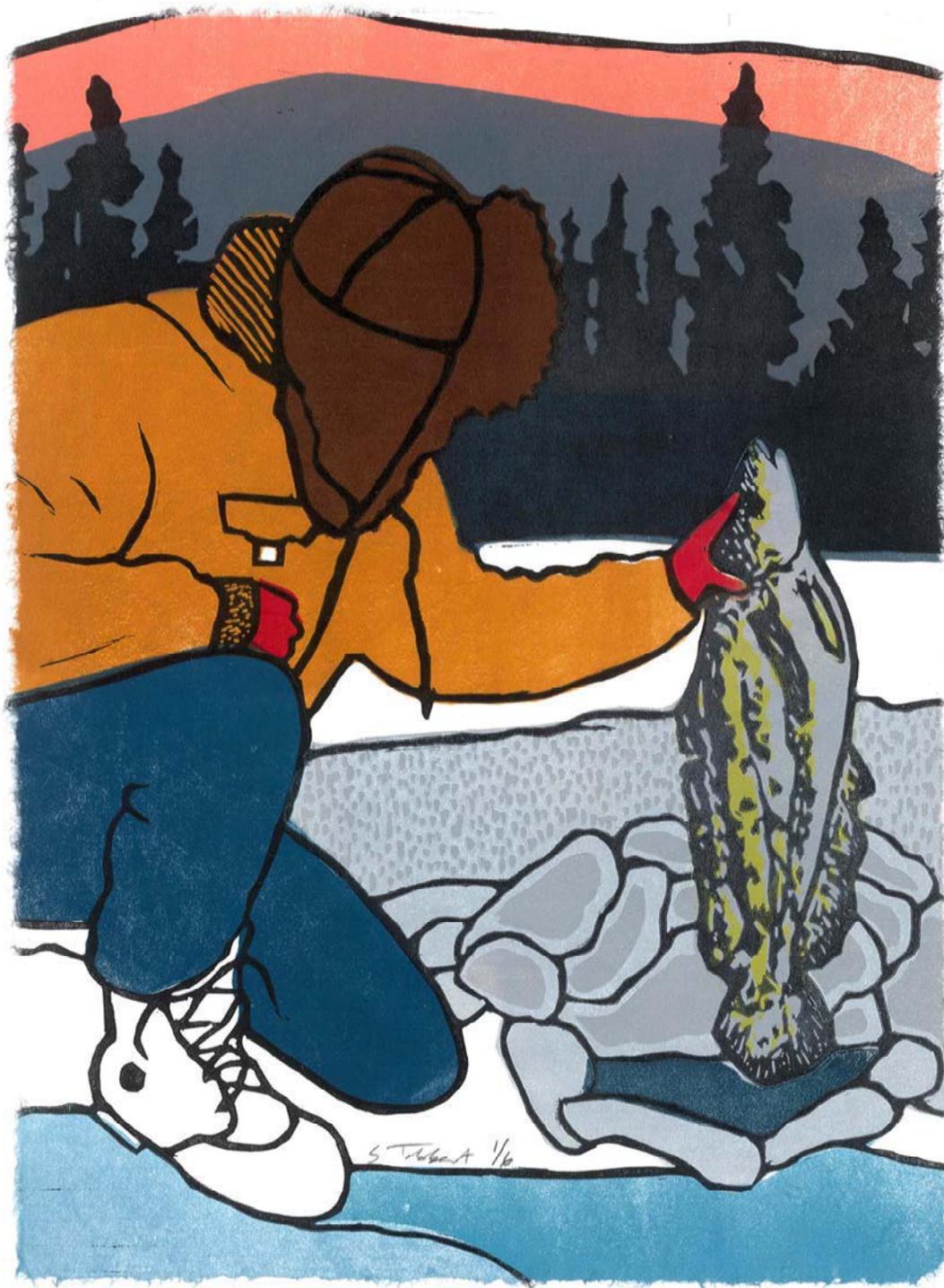




***Celebrating Professional  
Diversity in Alaska Fisheries***



***The 36th  
Meeting of  
the Alaska  
Chapter***

***November 3-  
5, 2009***

***Fairbanks  
Alaska***

## What is the American Fisheries Society?

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

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

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

### AFS Mission Statement

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



### The Alaska Chapter of AFS

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

**Visit the Alaska Chapter AFS Website at <http://www.fisheries.org/afs-ak/>**

Cover of Ice Fisherman with Burbot on the Tanana River by Sara Tabbert. Cover Assembled by Lisa Stuby

Sara Tabbert is an artist who currently resides in Fairbanks, Alaska. Her wood-block prints, wood cuts, glass mosaic pieces, and collaged prints made with Japanese paper were shown last year at a solo art exhibit at the Anchorage Museum. The Alaska House Art Gallery in Fairbanks has carried Tabbert's work for 10 years and features a full exhibit every two years. Sara has also exhibited her art in Juneau and will be working with Cullom Gallery in Seattle this winter. In her "free" time she loves to ski and skijor.

**Special thanks to those who worked so hard to make this  
conference happen**

**Alaska Chapter of the American Fisheries Society Executive Committee**

**Bert Lewis**, Past President  
**Toshihide “Hamachan” Hamazaki**, President  
**Lisa Stuby**, President Elect  
**Audra Brase**, Vice President  
**Karla Bush**, Secretary  
**Lee Ann Gardner**, Treasurer  
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**Local Arrangements**

**Lee Ann Gardner**, RWJ Consulting  
**Shelley Woods**, University of Alaska, Fairbanks  
AFS student-units (UAF, UAA, UAS)

**Communications and Publicity**

**Allen Bingham and Gretchen Bishop**; Alaska Department of Fish and Game

**Audio/Visual**

AFS Student Units (UAS, UAF, UAS)

**Plenary Keynote Speaker**

**Jennifer Nielsen**, USGS Alaska Science Center

**Plenary Speakers**

**Trent Sutton**, University of Alaska, Fairbanks  
**Bill Wilson**, North Pacific Fishery Management Council  
**Denny Lassuy**, North Slope Science Initiative  
**Fred DeCicco**, Retired AK Dept. Fish and Game  
**Jim Reynolds**, University of Alaska, Fairbanks (emeritus)  
**Mark Wipfli**, University of Alaska, Fairbanks

## **Banquet**

**Steve Brown and the Bailers Band**  
**AK Chapter AFS Awards presentation**

## **Session Chairs**

**Jeff Adams**, U.S. Fish and Wildlife Service  
**Milo Adkison**, University of Alaska, Fairbanks  
**Audra Brase**, Alaska Department of Fish and Game  
**Aaron Dupuis**, University of Alaska, Fairbanks  
**Dani Evenson**, Alaska Department of Fish and Game  
**Stewart Grant**, Alaska Department of Fish and Game  
**Toshihide “Hamachan” Hamazaki**, Alaska Department of Fish and Game  
**Jonathan Kamler**, U. S. Coast Guard, Juneau  
**Ann Knowlton**, University of Alaska, Fairbanks  
**R.D. Nelle**, U.S. Fish and Wildlife Service, Mid-Columbia River  
**Ray Reichl**, U. S. Coast Guard, Juneau  
**Cecil Rich**, Alaska Department of Fish and Game  
**James Savereide**, Alaska Department of Fish and Game  
**Bianca Streif**, U.S. Fish and Wildlife Service, Oregon Office  
**Lisa Stuby**, Alaska Department of Fish and Game  
**Trent Sutton**, University of Alaska, Fairbanks

## **Continuing Education Instructors**

**Fisheries Education Tips and Techniques**  
**Laurel Devaney**, U.S. Fish and Wildlife Service  
**Eric Anderson**, Alaska Department of Fish and Game

**Genetics Basics for Alaska Fishery Professionals**  
**Bill Templin and Chris Habicht**, Alaska Department of Fish and Game

**Power-based Standardization in Electrofishing**  
**Jim Reynolds**, University of Alaska, Fairbanks (emeritus)

**Cross-cultural Communication and Alaska Native Perspectives on Fishery Resources**

**Judy Daxootsu Ramos**, Realty and NAGPRA Director for the Yakutat Tlingit Tribe.  
**Elaine Abraham**, Tlingit elder and Chairperson of the Board of Commissioners of the Alaska Native Science Commission.

**THANK YOU to all of who Donated Silent Auction Items to Benefit the Alaska AFS Student Travel Fund**

## 2009 Annual Alaska Chapter AFS Conference

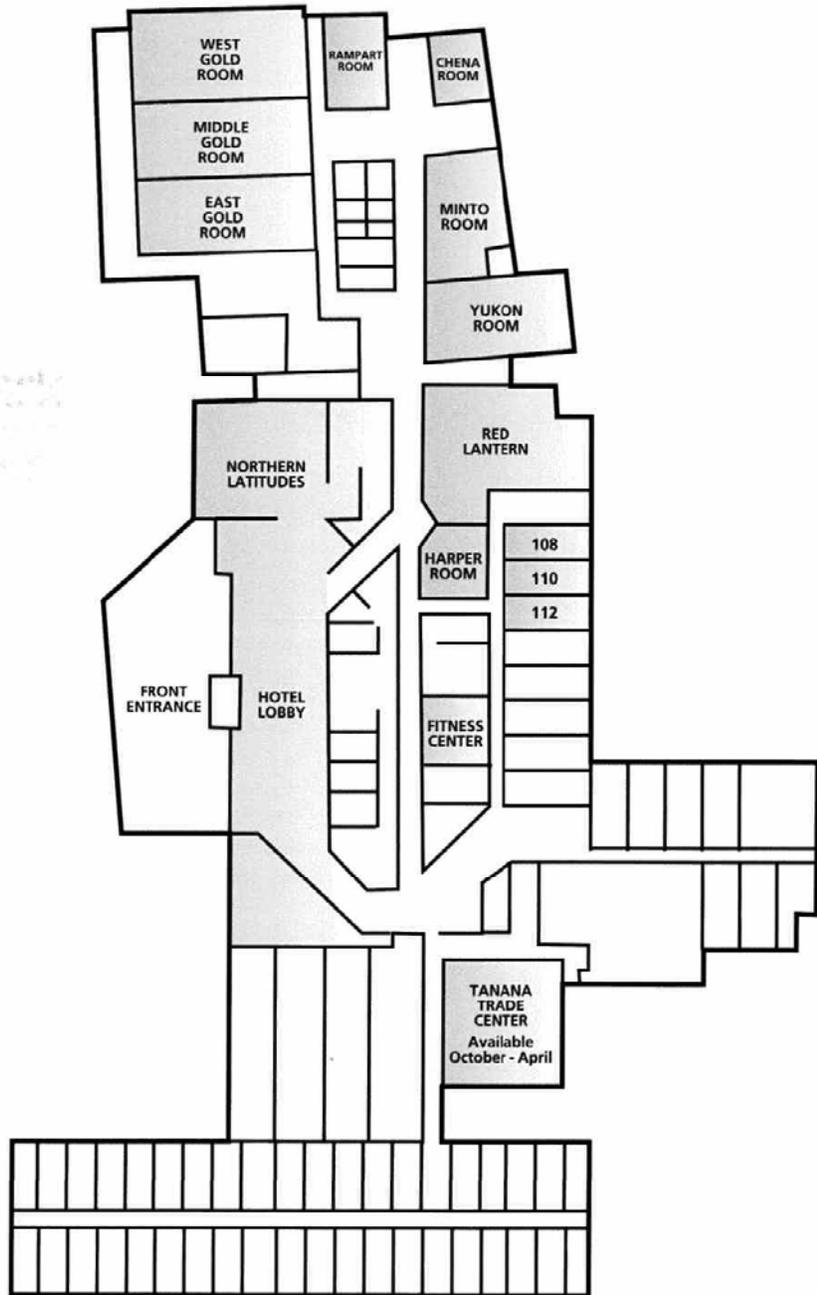
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**Schedule at a Glance for 2009 AK Chapter AFS Annual Meeting**

<b>Day/Date</b>	<b>Time Period</b>	<b>Minto Room</b>	<b>Yukon Room</b>	<b>Rampart Room</b>	<b>Lobby</b>
Sunday November 1	Morning				
	Afternoon	Fisheries Education Tips and Techniques <b>(Cancelled)</b>	Productive Meetings <b>(Cancelled)</b>		
Monday November 2	Morning	Genetics Basics for Alaska Fishery Professionals	Power-based standardization in electrofishing		
	Afternoon	Cross-cultural communication and Alaska Native Perspectives			Registration
	Evening	<b>Opening Reception (Northern Latitudes). 5:30 PM to 7:30 PM</b>			
Tuesday November 3	Morning	<b>Plenary Session (Gold Room)</b>			Registration
	Lunch	<b>Luncheon buffet (Northern Latitudes); Student-mentor luncheon (Rampart Room)</b>			
	Early Afternoon	Pacific Lampreys	Allocation among fisheries users	Poster session 4:45 – 5:30, Poster Presentations	
	Late Afternoon	Habitat Restoration	Evolution of Fish Diversity		
	Evening	<b>Opening Social at Silver Gulch Brewery; meet in hotel lobby at 5:30 PM for transportation.</b>			
Wednesday November 4	Morning	Size Trends	Contributed Papers	Poster session	Registration
	Late Morning	Quantitative Methods			
	Lunch	<b>Luncheon buffet (Northern Latitudes) and Past Presidents Meeting (Harper Board Room)</b>			
	Afternoon	Genetics & Management of Fish	Fish Distributions	Poster session	
	Late Afternoon		AK Coastal Waters		
	Early Evening	<b>AFS Chapter Business Meeting Yukon Room, 5:00 - -6:30 PM</b>			
	Evening	<b>Pre-Banquet concert 6:00 – 7:00 PM, Banquet Buffet 7:00 – 10:00 PM, Gold Room</b>			
Thursday November 5	Morning	Management of Whitefish	Fisheries Enforcement (TBA)	Poster session	Registration
	Afternoon	<b>Awards and Adjournment (Yukon Room), 11:45 AM to 12:15 PM</b>			

# Fairbanks Westmark

## ROOM LAYOUTS



## **2009 Alaska Chapter AFS Conference Agenda**

### **SUNDAY, NOVEMBER 1 - CONTINUING EDUCATION**

**The two Sunday Continuing Education Courses: “How to have more productive meetings” and “Fisheries education tips and techniques” have been CANCELLED due to the low numbers of registrants.**

### **MONDAY, NOVEMBER 2 - CONTINUING EDUCATION**

**8:00 AM - noon**

**Minto Room – Genetics basics for Alaska fishery professionals**

*Bill Templin and Chris Habicht, Instructors*

**8:00 AM – noon**

**Yukon Room – Power-based standardization in electrofishing**

*Jim Reynolds, Instructor*

**1:00 – 5:00 PM**

**Minto Room – Cross-cultural communication and Alaska Native perspectives on fishery resources**

*Judy Daxootsu Ramos and Elaine Abraham, Instructors*

**5:30 PM to 7:30 PM**

**Northern Latitudes - Opening Reception**

**TUESDAY, NOVEMBER 3**

**8:00 AM – 6:00 PM**

**Westmark Lobby – Conference Registration**

**Gold Room – Plenary Session**

**8:15 – 8:30 AM**

Welcome – *Toshihide “Hamachan” Hamazaki*

Opening Remarks and Introduction of Keynote Speaker – *Lisa Stuby*

**8:30 AM – 9:30 AM**

**Plenary Keynote Speaker**

Diversity in Alaska's Fisheries - Did you choose the fish or did the fish choose you?

*Jennifer Nielsen*

**9:30 – 10:00 AM**

Charting a New Course for Fisheries Education in Alaska

*Trent Sutton*

**10:00 – 10:15 AM – Break**

**10:15 – 11:15 AM**

Arctic Fisheries: the Science, Planning, and Management Challenges Ahead

*Bill Wilson and Denny Lassuy*

**11:15 – noon**

A Tribute to Nick Hughes

*Fred DeCicco, Jim Reynolds, and Mark Wipfli*

**Noon – 1:20 PM**

**Northern Latitudes - Lunch Buffet**

**Noon – 1:20 PM**

**Rampart Room - Student-Mentor Luncheon**

**Poster Session – Ongoing in Rampart Room for November 3-5<sup>th</sup>.**  
**Poster Presentations 4:45 – 5:30 PM on November 3rd**  
***Cecil Rich, Chair***

Minto Flats Northern Pike Radiotelemetry: seasonal movements, assessment of mark-recapture experiment assumptions, and environmental factors effecting fish movements  
*Matthew Albert, F. Joseph Margraf, and Matthew Evenson*

The ecology of juvenile Chinook salmon in the Chena River, interior Alaska  
*Elizabeth C. Green, Megan T. Perry, Jason R. Neuswanger, Emily R. Benson, Laura Gutierrez, Mark S. Wipfli, Nicholas F. Hughes, and Matthew J. Evenson*

The Coastal Cutthroat Trout Database Project  
*Roger Harding, K.E. Griswold, Stephen Phillips, Tara Smith, Michael Banach, Van Hare, David Lentz, David Jepsen, Jon Anderson, Ron Ptolemy, Roger Harding, Grant Kirby, Patrick Connolly, Michael Hudson, Bianca Streif, and Gordon Reeves*

Who is the man behind the Wally Noerenberg Award for Fisheries Excellence  
*Bill Hauser and Ted Otis*

Selection for different armored phenotypes in the threespine stickleback (*Gasterosteus aculeatus*) in Wallace Lake, Alaska  
*Emily A. Lescak, Richard R. Bernhardt, Michael A. Bell, and Frank A. von Hippel*

The influence of lake habitat on stocked rainbow trout success in interior Alaska lakes  
*Kelly Mansfield, Amanda Rosenberger, Trent Sutton, and Cal Skaugstad*

Ecological effects of introduced European bird cherry on salmonid food webs in Anchorage streams  
*David A. Roon, Mark S. Wipfli, and Tricia L. Wurtz*

Vertical distribution of larval walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), and *Atheresthes* spp. in the eastern Bering Sea  
*T. I. Smart, E. C. Siddon, J. T. Duffy-Anderson, and N. Hillgruber*

Considering Pacific Lamprey When Implementing Instream Activities  
*Bianca Streif*

Nushagak Bay: Monitoring for Ecosystem Health: Nushagak Bay Biodiversity Project  
*Todd Radenbaugh and Sarah Wingert*

**TUESDAY, NOVEMBER 3 (CONTINUED)**

**Minto Room – Concurrent Session #1**

**Pacific Lampreys**

*R.D. Nelle and Bianca Streif, Chairs*

**1:20 – 1:40 PM**

Considering Pacific Lamprey When Implementing Instream Activities

*Bianca Streif*

**1:40 – 2:00 PM**

USFWS Pacific Lamprey Conservation Initiative-Past, Present, and Future

*R.D. Nelle*

**2:00 – 2:20 PM:**

Lamprey Use in the Yukon River, Alaska

*Caroline Brown*

**2:20 – 2:40 PM:**

Adult Pacific Lamprey Passage at Winchester Dam, and the Subsequent Distribution and Habitat Selection in North Umpqua River Basin, Oregon

*Ralph Tatsuo Lampman, Carl Schreck, Sam Moyers, and Fabian Carr*

**2:40 – 3:00 PM - BREAK**

**Minto Room – Concurrent Session #1**

**Habitat Restoration in Interior Alaska**

*Jeff Adams, Chair*

**3:00 – 3:20 PM**

The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program in Interior Alaska

*Mitch Osborne*

**3:20 – 3:40 PM**

Upper Chena River Bank Erosion and Fish Habitat Projects

*Christopher H. Roach P.E.*

**3:40 – 4:00 PM**

Developing a Riparian Plan for the Fairbanks North Star Borough

*Robert J. Henszey and Joni Scharfenberg*

**4:00 PM – 4:20 PM**

Including Youth in Habitat Restoration Projects

*Laurel Devaney*

**4:20 PM – 4:40 PM**

Creating Green Space for Student Learning

*Kim Kelly*

**Yukon Room – Concurrent Session #2**

**Allocation among Fisheries Users: “How to Divide up Alaska’s Fish Pie?”**

*Audra Brase, Chair*

**1:20 – 1:40 PM**

A Brief History of Allocation Issues in the Togiak Herring and Bristol Bay Salmon Fisheries

*Tim Sands*

**1:40 – 2:00 PM**

Balancing Biological Sustainability with the Economic Needs of Alaska’s Sockeye Salmon Fisheries

*Erin M. Steiner, Keith R. Criddle, and Milo D. Adkison*

**2:00 – 2:20 PM**

Rockfish Management in Southeast Alaska

*Brian Marston*

**2:20 – 2:40 PM**

An Alaskan Fisheries Odyssey: An Entertaining Look at the Evolution of Dual Subsistence Management

*James Savereide*

**2:40- 3:00 PM - BREAK**

**Yukon Room - Concurrent Session #2**

**Evolution of Fish Diversity**

*Lisa Stuby, Chair*

**3:00 – 3:10 PM**

Introduction to Evolution of Fish Diversity

*Lisa Stuby*

**3:10 – 3:20 PM**

Introduction to Ice Ages in Alaska

*Patricia Heiser*

**3:20 – 3:40 PM**

Dynamic Landscapes Dynamic Fish: How Geologic Processes and Landscape Evolution Can Be Drivers for Change in Fish Populations

*Patricia Heiser*

**3:40 PM – 4:00 PM**

Did the Ice Ages Promote or Retard Marine Speciation in the North Pacific?

*Stewart Grant*

**4:00 PM – 4:20 PM**

Recent ecological divergence despite migration in sockeye salmon (*Oncorhynchus nerka*)

*Scott A. Pavey, Jennifer L. Nielsen, and Troy R. Hamon*

**4:20 PM – 4:40 PM**

Understanding Alaska's evolving fish diversity: a question of scales

*J. Andrés López and Tuuli Mäkinen*

**4:40 PM – 5:00 PM**

Deep population structure and low genetic variability of lake trout in the Togiak National Wildlife Refuge

*Penny Crane, Pat Walsh, Cara Lewis, and John Wenburg*

**4:45 – 5:30 PM**

**Poster Presentations, Rampart Room**

**Opening Social at Silver Gulch Brewery; meet in hotel lobby at 5:30 PM for transportation.**

**WEDNESDAY, NOVEMBER 4**

**Minto Room – Concurrent Session #1  
Size Trends of Alaskan Salmon Stocks  
*Dani Evenson, Chair***

**8:00 – 8:20 AM**

Hawaiian goatfish life history and implications for conservation and management  
*Heather A. Leba*

**8:20 – 8:40 AM**

Influence of environmental parameters on age and size at maturity of sockeye salmon from Newhalen River, Alaska  
*Elizabeth Benolkin and Carol Ann Woody*

**8:40 – 9:00 AM**

Yukon River Chinook Salmon - Sex, Size, Politics and Lies  
*Chris Stark*

**9:00 – 9:20 AM**

Examination of Yukon Chinook Salmon commercial catch size trend: Is there an evidence for declining?  
*Toshihide “Hamachan” Hamazaki*

**9:20 – 9:40 AM**

Catch Comparisons of Three Gillnet Mesh Sizes from the Lower Yukon  
*Kathrine G. Howard*

**9:40 – 10:00 AM - BREAK**

**10:00 – 10:20 AM**

Selective fishing as a potential factor contributing to declining size and productivity of Yukon River Chinook salmon  
*Jeffrey J. Hard*

**10:20 – 10:40 AM**

Reproductive Constraints among Yukon River Chinook Salmon Revealed by Genetics and a Generalized Mixture Model  
*Jeffrey F. Bromaghin, Danielle F. Evenson, and Thomas H. McLain*

**Minto Room – Concurrent Session #1  
Quantitative Methods in Alaskan Fisheries Research and Management  
*Milo Adkison, Chair***

**10:40 – 11:00 AM**

Estimation of Total Abundance and Migratory Timing of Adult Salmon using  
Distribution and Partial Abundance Data

*Jeffrey F. Bromaghin, Kenneth S. Gates, and Douglas E. Palmer*

**11:00 – 11:20 AM**

Estimating survival of yelloweye and quillback rockfish released with a deep water  
release mechanism with Markov Chain Monte Carlo.

*Samuel Hochhalter and Daniel Reed*

**11:20 – 11:40 AM**

Bayesian Run Reconstruction from the Ground Up

*Steve Fleischman.*

**11:40 – noon**

Application of Ecological Simulation Modeling to Combine Fish Science and Fisheries  
Science

*Toshihide “Hamachan” Hamazaki*

**Noon – 12:20 PM**

Improved 3-D analysis for underwater video, with applications to wild juvenile Chinook  
salmon foraging behavior

*Jason R. Neuswanger Nicholas F. Hughes Mark S. Wipfli and Lon H. Kelly*

**Yukon Room – Concurrent Session #2**

**Contributed Papers**

*Toshihide “Hamachan” Hamazaki and James Savereide, Chairs*

**8:00 – 8:20 AM**

Eruption of Redoubt Volcano and Impacts to Aquatic Habitats in 2009

*Christian E. Zimmerman and Christopher F. Waythomas*

**8:20 – 8:40 AM**

Feeding intensity, diet, and survival in relation to body size of juvenile pink salmon

*Michael J. Malick, Lewis J. Haldorson, and John J. Piccolo*

**8:40 – 9:00 AM**

The optimal stability ‘window’ hypothesis: A possible link between water column  
stability and Gulf of Alaska pink salmon survival

*Sara E. Miller, Milo Adkison, and Lewis Haldorson*

**9:00 – 9:20 AM**

Environmental variation and whole stream metabolism in the Chena River, interior  
Alaska

*Emily R. Benson, Mark S. Wipfli, and Nicholas F. Hughes*

**9:20 – 9:40 AM**

Patterns of prey abundance for juvenile Chinook salmon in the Chena River, interior Alaska

*Laura Gutierrez, Mark S. Wipfli, Nicholas F. Hughes, and Elizabeth C. Green*

**9:40 – 10:00 AM - Break**

**10:00 – 10:20 PM**

The relationship between spawning salmon abundance and the fitness of stream-dwelling fishes, Kenai Peninsula, Alaska

*Daniel J. Rinella, Mark S. Wipfli, Craig Stricker, and Ron Heintz*

**10:20 – 10:40 AM**

Growth responses of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) to food abundance and water temperature in the Chena River, interior Alaska.

*Megan T. Perry, Nicholas F. Hughes, Mark S. Wipfli, Jason R. Neuswanger, and Matthew J. Evenson*

**10:40 – 11:00 AM**

Migration timing, abundance, and egg-to-smolt survival of juvenile chum salmon in Clear Creek and Kwethluk River, Alaska

*Sean E. Burrell, Christian E. Zimmerman, James E. Finn, Carl F. Kretsinger, and Daniel Gilikin*

**11:00 – 11:20 AM**

Otolith Chemistry Analyses Indicate that Water Sr:Ca is the Primary Factor Influencing Otolith Sr:Ca for Freshwater and Diadromous Fish but not for Marine Fish

*Randy J. Brown, Kenneth P. Severin*

**11:20 – 11:40 AM**

Ecotypic Variation in Kuskokwim Sockeye Salmon: AYK SSI Project Update

*Megan McPhee*

**11:40 – Noon**

A review of the species status of the Angayukaksurak charr *Salvelinus anaktuvukensis* of Northern Alaska: perspectives from molecular and morphological data.

*Scott D. Ayers, Amanda E. Rosenberger, and Eric (Rick) B. Taylor*

**NOON – 1:20 PM – LUNCH – Northern Latitudes**

**NOON – 1:20 PM Past President's Lunch – Harper Boardroom**

**Minto Room – Concurrent Session #1**

**Genetics and the Management of Fishery Resources in Alaska**

*Stewart Grant, Chair*

**1:20 – 1:40 PM**

Genetic stock structure of giant Pacific octopus, *Enteroctopus dofleini*, in Alaska

*P. Barry, S. Tamone, D.A. Tallmon*

**1:40 – 2:00 PM**

Genetic variability among populations of Alaska blackfish (*Dallia pectoralis*): How does it fit in the big picture?

*Matthew A. Campbell, J. Andres Lopez*

**2:00 – 2:20 PM**

Characterization of 15 single nucleotide polymorphisms in Alaska red king crab

*Wei Cheng, Jeffrey R. Guyon, William S. Grant, Zac Grauvogel, Christopher A. Sasaki, and William D. Templin*

**2:20 – 2:40 PM**

Migration timing of sockeye salmon (*Oncorhynchus nerka*) smolt in the Chignik Watershed, Alaska: mixed stock analysis using single nucleotide polymorphisms

*Lisa Creelman, Lorenz Hauser, Lisa Seeb, and Mark Witteveen*

**2:40 – 3:00 PM**

Form and function of sockeye life history

*Scott A. Pavey, Jennifer L. Nielsen, Troy R. Hamon, and Felix Breden*

**3:00 – 3:20 PM – BREAK**

**3:20 – 3:40 PM**

Inseason Genetic Stock Identification of Chinook Salmon in Yukon River Test Fisheries

*Nick DeCovich and William Templin*

**3:40 – 4:00 PM**

Comparative landscape genetic analysis of co-occurring salmon species in the AYK region

*Jeffrey B. Olsen, Terry D. Beacham, Penelope A. Crane, Blair G. Flannery, Lisa W. Seeb, William D. Templin, and John K. Wenburg*

**4:00 – 4:20 PM**

Patterns of stock composition in the Port Moller Test Fishery in 2006 – 2008

*Tyler Dann, Chris Habicht, Heather Hoyt, Andy Barclay, Tim Baker, and Jim Seeb*

**4:20 – 4:40 PM**

A 40-year retrospective of catch compositions of sockeye salmon (*Oncorhynchus nerka*) in Bristol Bay

*Matt Smith, Lowell Fair, Chris Habicht, Lisa Seeb, and Jim Seeb*

**4:40 – 5:00 PM**

Identification of hybrid whitefish

*Sara M. Turner, Kristin Amstrup, and Jennifer Nielsen*

**Yukon Room – Concurrent Session #2**

**Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

*Jonathan Kamler, Chair*

**1:20 – 1:40 PM**

Study of the Nome River Salmon Habitat Using PRISM, PALSAR, and TerraSAR-X data.

*Rick Guritz, Daniel Miller, and Kelly Burnett*

**1:40 – 2:00 PM**

Spatial and Temporal Analyses of Bering Sea Groundfish Harvest and Fleet Effort

*Jonathan Kamler and Steve Lewis*

**2:00 – 2:20 PM**

Demersal Fishes in the Chukchi Sea

*Brenda L. Norcross and Brenda A. Holladay*

**2:20 – 3:00 PM**

Environmental Data Integration and Delivery – Some Free Shortcuts for ArcGIS, Matlab & R

*Cara Wilson, Roy Mendelsohn, Dave Foley, and Eoin Howlett*

**3:00 – 3:20 PM - BREAK**

**Yukon Room – Concurrent Session #2**

**Alaskan Coastal Waters: Biology, Ecology, and Ecosystem Services**

*Ann Knowlton, Chair*

**3:20 – 3:40 PM**

The Use of Thermal Marking in Alaska and the North Pacific Ocean: It's Application to Management of Pacific Salmon

*Beverly Agler*

**3:40 – 4:00 PM**

Large-scale Patterns in Nearshore Marine Fish Assemblages

*A. Darcie Neff, Scott W. Johnson, and John F. Thedinga*

**4:00 PM – 4:20 PM**

Edge effects and patch size dynamics of Alaskan kelp forest fish populations

*Terril Efird and Brenda Konar*

**5:00 PM – 6:30 PM – AK CHAPTER BUSINESS MEETING - YUKON ROOM**

**6:00 PM – 7:00 PM – Pre-Banquet concert by Steve Brown and the Bailers**

**7:00 PM – 10:00 PM – BANQUET BUFFET– Westmark Gold Room**

## **THURSDAY, NOVEMBER 5**

### **Minto Room – Concurrent Session #1**

#### **Management of whitefishes in Alaska: “What do we know and where do we start?”**

*Trent Sutton and Aaron Dupuis, Chairs*

#### **9:00 – 9:20 AM**

Biological, Chemical, and CPUE Evidence of Annual Spawning Migrations of Anadromous Coregonid Fishes in the Yukon River

*Randy J. Brown, David W. Daum, Bill Carter, and Stan Zuray*

#### **9:20 – 9:40 AM**

Lower Yukon River commercial whitefish fishery, a challenge for managers

*Larry DuBois*

#### **9:40 – 10:00 AM**

Spawning Movements of humpback whitefish and least cisco in the Chatanika River

*Aaron Dupuis and Trent Sutton*

#### **10:00 – 10:20 PM**

Identification and characterization of inconnu spawning habitat in the Sulukna River, Alaska

*Jonathon Gerken, F. Joseph Margraf, and Randy Brown*

#### **10:20 – 10:40 AM - BREAK**

#### **10:40 – 11:00 AM**

DNA barcoding of eight North American coregonine species

*Ora L. Schlei, Alexis Crête-Lafrenière, Andrew R. Whiteley, Randy J. Brown, Jeffrey B. Olsen, Louis Bernatchez, and John K. Wenburg*

#### **11:00 – 11:20 AM**

Differences in growth patterns across cohorts in an anadromous Arctic fish, Arctic cisco (*Coregonus autumnalis*)

*Vanessa R. von Biela, Christian E. Zimmerman, and Lawrence L. Moulton*

#### **11:20 – 11:40 AM**

Management of a Primal Fishery: Chatanika River Whitefish

*Audra Brase*

### **Yukon Room – Concurrent Session #2**

#### **Fisheries Enforcement and Fish Sustainability**

*Ray Reichl, Chair: SESSION TBA*

#### **11:45 Am to 12:15 PM - Awards and Adjournment, Yukon Room**

## Session - Plenary

### **Diversity in Alaska's Fisheries - Did you choose the fish or did the fish choose you?**

**Jennifer L. Nielsen**

*USGS Alaska Science Center  
4210 University Drive, Anchorage, AK 99508  
[jennifer\\_nielsen@usgs.gov](mailto:jennifer_nielsen@usgs.gov); 907-786-7062*

Diversity is not defined exclusively by race or gender. It extends to age, ethnicity, sexual orientation, culture, ancestry, physical ability, educational pedigree, and creativity. A verbal commitment to diversity is common to society and the workplace in today's world, but how different aspects of our culture manifest that commitment varies significantly. In science this is especially true, and despite significant changes over the last 50 years, fisheries science still has a reputation for stereotypes, lagging behind other disciplines in creating a diverse profile. Throughout my own career, the implicit nature of fisheries science and strong differences in participation and performance have been mutually reinforcing. The question is really: "Who gets to do fisheries science in the next century?" Will an increased diversity of identity, perspectives, and cognitive ability hurt or help fisheries? How have the American Fisheries Society and the Alaska Chapter of AFS measured up to the need for increased variety of experiences, perspectives and scholarly interests among the membership? In preparing this talk I took a closer look at people engaged in fisheries in Alaska and various efforts by Alaskans to reach some sort of biological egalitarianism. I found a not-too-surprising quotient of diversity of various types dispensing fisheries 'wisdom' in Alaska. This talk plans to discuss and celebrate that Alaskan diversity and suggest additional ways we might refute the stereotypical fisheries-norm.

## **Session - Plenary**

### **Charting a New Course for Fisheries Education in Alaska**

**Trent M. Sutton**

*University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
905 Koyokuk Drive, Fairbanks, Alaska 99775*

Alaska's fisheries resources are entering a time of rapid change, and the fisheries program offered by the University of Alaska Fairbanks (UAF) through the School of Fisheries and Ocean Sciences (SFOS) must respond to meet this challenge. The UAF SFOS will educate and train undergraduate and graduate students who can support the sustainability of Alaska's marine and freshwater resources and who can fill positions needed to maintain the state's vital fishing and seafood industries. The undergraduate and graduate programs in SFOS, located in both Fairbanks and Juneau, have been revitalized to meet this goal through the restructuring of the Bachelor of Science in Fisheries Science curriculum and the creation of both a Bachelor of Arts in Fisheries and Minor in Fisheries degree program; discussions are ongoing regarding the revision of the Master's of Science in Fisheries curriculum. Ongoing steps in the process of revitalizing the undergraduate and graduate programs in fisheries include: (1) evaluation and revision of existing curricula; (2) expansion and engagement of tenure-track faculty; (3) student recruitment and retention; and (4) development and renovation of physical facilities and infrastructure. A particular emphasis has been placed on restructuring the undergraduate program, which now: (1) has an experiential learning requirement; (2) offers a broad range of interdisciplinary classes; (3) is widely available to students throughout Alaska; and (4) has a focus on developing partnerships with government agencies, the fishing and seafood industry, and other fisheries groups. This invigorated and more encompassing focus in both the undergraduate and graduate degree programs at UAF will not only better prepare students for traditional agency research and management positions, but will also train students for fisheries careers in the areas of business administration, policy and social sciences, or rural development.

## Session - Plenary

### Arctic Fisheries: the Science, Planning, and Management Challenges Ahead

**Bill Wilson<sup>1</sup>, and Denny Lassuy<sup>2</sup>**

*1: North Pacific Fishery Management Council  
605 West 4th Avenue, Suite 306  
Anchorage, AK 99501-2252*

*Ph: 907-271-2809 Fax: 907-271-2817*

*[Bill.wilson@noaa.gov](mailto:Bill.wilson@noaa.gov); [www.fakr.noaa.gov/npfmc](http://www.fakr.noaa.gov/npfmc)*

*2: North Slope Science Initiative  
222 West 7<sup>th</sup> Avenue, #13, Anchorage, AK 99513*

*Ph: 907-271-4121 Fax: 907-271-4596*

*[Denny\\_Lassuy@fws.gov](mailto:Denny_Lassuy@fws.gov); [www.northslope.org](http://www.northslope.org)*

Fisheries challenges and opportunities in the Arctic are changing rapidly in the face of climate change. Diminishing ice, new shipping and energy development pressures, international claims on Arctic waters, and the potential for dramatic changes in Arctic ecosystems all have implications for Arctic fish and fisheries. This presentation will update Alaska fisheries professionals on the latest developments in fishery planning and international discussions about the future of Arctic fisheries. In anticipation of future climate change, the North Pacific Fishery Management Council adopted a management plan for the fishery resources in the U.S. Arctic Management Area. This new Arctic Fishery Management Plan (FMP) was approved by the Secretary of Commerce in August 2009, and will become law later this year. No significant fisheries exist in the U.S. Arctic Management Area, but the warming of the Arctic and seasonal shrinkage of the sea ice may increase opportunities for fishing. The new Arctic FMP: (1) closes the Arctic to commercial fishing so that unregulated fishing does not occur until information improves sufficiently so that fishing can be conducted sustainably and with due concern to other ecosystem components; (2) establishes fishery management authorities in the Arctic and provides a vehicle for addressing future management issues; and (3) implements an ecosystem-based management policy that recognizes the resources of the U.S. Arctic and the potential for fishery development that might affect those resources, particularly in the face of a changing climate. The significant gaps in our knowledge of how the U.S. can sustain Arctic fisheries and ecosystems certainly include biological data gaps, but also include a great many uncertainties about the management authorities and options for transboundary stocks (including important subsistence species), international management structures, indeed even the broad context of Arctic governance in the coming age of an increasingly accessible Arctic. This presentation will provide a summary of findings from the upcoming International Arctic Fisheries Symposium (October 2009, see: <http://www.nprb.org/iafs2009/>) where many of these important emerging Arctic concerns were discussed.

## **Session – Pacific Lampreys**

### **Considering Pacific Lamprey When Implementing Instream Activities**

**Bianca Streif**

*U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office, 2600 SE 98th Ave.  
Suite 100, Portland, Oregon 97266: phone (503) 231-6978; email:  
bianca\_streif@fws.gov*

Efforts to minimize negative effects during instream activities generally do not consider the life history characteristics of non-game fish species, specifically lamprey. While there is still much to be learned about Pacific lamprey distribution, abundance, and status, the need for conservation of lampreys is evident. Historically, Pacific lampreys were probably distributed wherever salmon and steelhead occurred. However, recent data indicate that distribution of the Pacific lamprey has been reduced or eliminated in many river drainages.

Projects that alter passage, change flow hydraulics, alter stream substrates, and decrease habitat complexity can negatively affect lampreys. Of particular importance during construction activities are areas where ammocoetes inhabit areas of low velocity and live in the substrate as filter feeders for 2 to 7 years. Since several generations and age classes of ammocoetes congregate in high densities forming colonies, a single dewatering event may have a significant effect on a lamprey population. Methods to reduce effects to ammocoetes during construction are just beginning to be developed. Most measures will also benefit other fish species by providing for (1) diversity of habitats and stream structure, (2) complex velocity distributions, and (3) modifications to the duration and timing of instream actions.

## Session – Pacific Lampreys

### USFWS Pacific Lamprey Conservation Initiative-Past, Present, and Future

**Author: R.D. Nelle**

*U.S. Fish and Wildlife Service, Mid-Columbia River Fishery Resource Office 7501  
Icicle Road, Leavenworth, Washington, 98826: Phone (509) 548-2981: e-mail:  
[rd\\_nelle@fws.gov](mailto:rd_nelle@fws.gov)*

**Abstract:** The Pacific Lamprey Conservation Initiative is an effort led by the U.S. Fish and Wildlife Service (FWS) to facilitate communication and coordination relative to the conservation of Pacific lampreys throughout their range. Information on Pacific lamprey distribution and abundance is limited; however, it is thought that both distribution and numbers have declined over their historic range. The need to conserve this species is a high priority for the USFWS considering its benefit to the overall ecosystem and its importance as a tribal food resource.

The goal of the initiative is to develop a Pacific Lamprey Conservation Plan that will lead to restored Pacific lamprey populations and improvement of their habitat across their entire distribution. This plan will compile the present knowledge on Pacific lamprey and provide guidance and strategies to conserve and restore Pacific Lamprey populations rangewide.

## Session – Pacific Lampreys

### Lamprey Use in the Yukon River, Alaska

**Caroline Brown**

*Alaska Department of Fish & Game, Division of Subsistence  
1300 College Road  
Fairbanks, Alaska 99701  
[caroline.brown@alaska.gov](mailto:caroline.brown@alaska.gov)*

Very little is reported in the scientific literature about the ecology or harvest and use of Arctic lamprey in Alaska. However, residents of the lower reaches of the Yukon River maintain a rich body of knowledge about certain aspects of lamprey, or “eels” as they are commonly referred to locally. Many of these observations can yield important insights for the continued biological study of fish life history and also offer important considerations for the management of the species. This talk will explore some of the details of lamprey life history, harvest, and use as known and practiced by the Yukon River residents and their implications for biological research and management.

## Session – Pacific Lampreys

### Adult Pacific Lamprey Passage at Winchester Dam, and the Subsequent Distribution and Habitat Selection in North Umpqua River Basin, Oregon

Ralph Tatsuo Lampman<sup>1</sup>, Carl Schreck<sup>2</sup>, Sam Moyers<sup>3</sup>, and Fabian Carr<sup>3</sup>

**1:** Oregon Cooperative Fish & Wildlife Research Unit  
Oregon State University - Department of Fisheries & Wildlife  
Corvallis, Oregon 97331  
[ralph.lampman@oregonstate.edu](mailto:ralph.lampman@oregonstate.edu); 971-227-0862 (cell)

**2:** Oregon Cooperative Fish & Wildlife Research Unit, USGS  
Oregon State University, Corvallis, Oregon  
[carl.schreck@oregonstate.edu](mailto:carl.schreck@oregonstate.edu); 541-737-1961

**3:** Oregon Department of Fish & Wildlife  
Roseburg Regional Office  
Roseburg, Oregon  
Email: [samuel.w.moyers@state.or.us](mailto:samuel.w.moyers@state.or.us); [fabian.m.carr@state.or.us](mailto:fabian.m.carr@state.or.us)  
541-440-3353

Our goal is to understand the physiological effects of dams and other hydrological barriers on adult Pacific lamprey, as well as habitat use and selection and autecology of the species in relation to their upstream migration. Adult Pacific lamprey counts at Winchester Dam (Winchester, OR) have dramatically decreased from 46,785 in 1966 to only 34 fish in 2001 and the counts in recent years continue to be substantially depressed. There is strong evidence that at least some of the Pacific lamprey are using alternate routes to pass the dam besides the fish ladder. By tracking the Pacific lamprey starting below the Winchester Dam using radio telemetry, we monitored their dam passage routes. A better understanding of their passage routes can also help attain a much more accurate population estimate for adult Pacific lamprey that spawn above the Winchester Dam in the North Umpqua River Basin. To our surprise, the vast majority of the tagged Pacific lamprey stayed below the dam even after the peak of their initial, spring-summer migration phase; we do not know if they will again migrate during final maturation this coming spring. The majority of the tagged lamprey moved upstream to reach the dam, but only one of them migrated past the dam. An unexpected opportunity, which arose as a result of the dam repair/dewatering project in the summer of 2009, enabled us to examine the unique location of these lamprey that were holding below the dam. Because the majority of the tagged lamprey stayed in the lower reaches of the river, our habitat analysis was able to examine their selection of summer holding habitat most likely unique to larger river systems, using deep, swift, well-covered habitat.

**Student**

## **Session – Habitat Restoration in Interior Alaska**

### **The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program in Interior Alaska**

**Mitch Osborne**

*U.S. Fish and Wildlife Service  
Fairbanks Fish and Wildlife Field Office  
101 12<sup>th</sup> Ave, Room 110, Fairbanks, AK 99701  
(907) 456-0209; [mitch\\_osborne@fws.gov](mailto:mitch_osborne@fws.gov)*

The Partners for Fish and Wildlife Program (Partners Program), established by the U.S. Fish and Wildlife Service in 1987, is a watershed and ecosystem approach to conservation that involves collaborating with private landowners to re-establish degraded habitats and protect a range of environments, including uplands, wetlands and riparian corridors. Presently, the Partners Program has been involved nationwide in more than 41,000 cooperative habitat restoration initiatives with private landowners, including the restoration of more than 800,000 acres of wetlands. Within the Interior of Alaska, the Partners Program has coordinated the efforts of approximately 50 private landowners to restore wildlife habitat on private property. Well over 100 miles of streambank habitat have been improved, 18 fish passage barriers have been remedied, and several thousand acres of forest, wetland, and tundra habitat have been restored. Numerous landowners, local citizens, and staff from various agencies have developed an awareness and appreciation for the Partners Program, ensuring its future role in habitat restoration in the Interior of Alaska.

## **Session – Habitat Restoration in Interior Alaska**

### **Upper Chena River Bank Erosion and Fish Habitat Projects**

**Christopher H. Roach P.E.**

*Christopher H. Roach P.E., Consulting Engineer  
3121 E. 112<sup>th</sup> Ave., Anchorage, AK 99516  
(907) 677-0645; [chroach@alaska.net](mailto:chroach@alaska.net)*

Erosion on the upper Chena River was threatening the integrity of habitats associated with the river's riparian corridor. Throughout the Chena River watershed many sites had riverbank protection projects done by local landowners with little to no input from regulatory/service agencies or professionals in the field of bank erosion protection or fisheries. Starting in 2005 an effort was begun to develop environmentally effective means of bank erosion protection that was affordable and which maintained or improved existing fish habitat. In total, four sites were addressed along the Upper Chena River within about 5 miles from Chena Hot Springs. The selected methods included combinations of root-wads, vane structures, and various forms of re-vegetation. The sites have been subjected to several high flow and flood events with excellent performance. In addition, overhead-cover, holding water, and channel diversity have been increased for fish habitat improvement. These methods have also been used successfully at Rika's Roadhouse on the Tanana River. The success of these projects may be a basis for putting forward these methods in the future as an alternative to more conventional means of bank erosion protection.

## **Session – Habitat Restoration in Interior Alaska**

### **Developing a Riparian Plan for the Fairbanks North Star Borough**

**Robert J. Henszey and Joni Scharfenberg**

*Tanana Valley Watershed Association*

*P.O. Box 84104*

*Fairbanks, AK 99708*

[tvwatershed@gmail.com](mailto:tvwatershed@gmail.com)

This condensed presentation will show river processes eroding streamside property, costs associated with fighting erosion, and the value of riparian areas for fish and wildlife habitat. The presentation is part of the public participation effort by the Fairbanks North Star Borough and the Tanana Valley Watershed Association while formulating a riparian plan for the Borough. Within the Fairbanks North Star Borough there are over 9,000 miles of mostly unspoiled and free flowing waterways that have outstanding fisheries, wildlife, recreation, home site and economic opportunities. Some processes that help to maintain these healthy waterways, however, such as overbank flooding and channel migration across the floodplain, can pose problems for business and property owners. Riparian areas provide a natural, no cost alternative to expensive riprap and other constructed bank protection measures to help minimize these problems. Unfortunately, improper riparian vegetation management and other activities can easily damage this important link between land and water that provides some of the most productive wildlife habitat in Alaska. The Borough recognizes this potential problem, and is partnering with the TVWA to develop a riparian plan for the Borough. Steps in the plan's development include educating Borough residents about the potential problems in riparian areas and soliciting their suggestions for solutions, compiling and publishing a review of the science to see how others have addressed similar problems, soliciting public comments on a draft plan based on earlier public comments and the scientific review, and finally submitting the plan to the Borough Assembly for potential adoption.

## **Session – Habitat Restoration in Interior Alaska**

### **Including Youth in Habitat Restoration Projects**

**Laurel Devaney**

*U.S. Fish and Wildlife Service  
Fairbanks Fish and Wildlife Field Office  
101 12<sup>th</sup> Ave, Room 110, Fairbanks, AK 99701  
(907) 456-0558; [laurel\\_devaney@fws.gov](mailto:laurel_devaney@fws.gov)*

Wetland habitat protection and restoration programs will never be truly successful until community members understand how urban development and the actions of individuals can degrade wetland habitats for fish and wildlife. Including area high school age students in habitat restoration projects is cost effective, but also helps youth become stewards of their local wetland resources and develops a commitment to maintain them. This presentation will briefly describe a Youth Habitat Conservation Corps program located in Fairbanks including the structure of the program and activities taught. In addition, the presentation will discuss recruiting and selecting students, developing school and community partnerships, and seeking funding, along with some common “do’s and don’ts” to consider.

## Session – Habitat Restoration in Interior Alaska

### Creating Green Space for Student Learning

**Kim Kelly**

*Special Education/ELP Teacher*

*Two Rivers School*

*Fairbanks North Star Borough School District*

*520 Fifth Avenue, Fairbanks, Alaska 99701*

[kkelly@northstar.k12.ak.us](mailto:kkelly@northstar.k12.ak.us)

Two Rivers School is in the process of creating a Learning Landscape for its K-8 students. Students and the local community will have the opportunity to learn about the ecological and socio-economic values of boreal ecosystems through interactive and critical thinking activities, targeted educational materials, and restoration activities as they restore upland and wetland habitats on school property as part of a School Yard Habitat Project. Two Rivers students will also participate and observe the restoration process, and educational materials will be provided to the students in the form of field manuals, binoculars, and curricular materials. As part of the ornithology curriculum, students will be participating in Cornell University's bird monitoring program by recording bird population changes throughout the duration of the Learning Landscape project. Also, classroom teachers will be constructing nesting boxes to attract bird populations to the Learning Landscape. This project will help students from Two Rivers learn the importance of habitat restoration in Alaska. The project is part of a larger effort initiated by the U.S. Fish and Wildlife Service's (FWS) Partners for Fish and Wildlife Program. Two Rivers School, FWS Fairbanks Fish and Wildlife Field Office, Fairbanks Soil & Conservation Service, the Fairbanks North Star Borough School District, the Fairbanks North Star Borough, and Chandalar Ranch will partner together in this effort.

## **Session – Allocation among Fisheries Users: “How to Divide up Alaska’s Fish Pie?”**

### **A Brief History of Allocation Issues in the Togiak Herring and Bristol Bay Salmon Fisheries**

**Tim Sands**

*Alaska Department of Fish & Game - Commercial Fisheries Division*

*P.O. Box 230 Dillingham, AK 99576-0230*

*[tim.sands@alaska.gov](mailto:tim.sands@alaska.gov); 907-842-5227*

The Bristol Bay commercial salmon fishery has been prosecuted since the late 1800's. The primary species of interest is sockeye salmon (*Oncorhynchus nerka*) but other salmon species are also caught. Subsistence salmon harvest also occurs in Bristol Bay with both sockeye and Chinook salmon (*O. tshawytscha*) being harvested. In the last few decades, sport fishing effort has also increased, targeting primarily Chinook and sockeye, but to some extent all salmon. Despite these different uses, allocation issues occur largely between commercial gear groups and areas, rather than between user groups. In Bristol Bay, specific management plans have been developed to allocate potential harvest between set and drift gillnet gear groups. Historically, the South Peninsula fishery harvest was based on a percentage of the Bristol Bay forecast as well. The Togiak Herring fishery harvests Pacific herring (*Clupea harangus pallasii*) near the village of Togiak, in Southwest Alaska. As with salmon, the herring resource is fully allocated, and the primary allocation issues occur between commercial users, especially gillnet and purse seine gear types. The allocation history has steadily evolved since the late 1970's to the current plan but there are more proposals to change allocation again this year.

## Session – Allocation among Fisheries Users: “How to Divide up Alaska’s Fish Pie?”

### Balancing Biological Sustainability with the Economic Needs of Alaska’s Sockeye Salmon Fisheries

Erin M. Steiner<sup>1</sup>, Keith R. Criddle<sup>2</sup> and Milo D. Adkison<sup>3</sup>

*1: NOAA Fisheries Service - Office of Science and Technology  
1315 East West Highway Silver Spring, MD 20910  
[Erin.Steiner@noaa.gov](mailto:Erin.Steiner@noaa.gov); (301) 713-2367 x 160*

*2: University of Alaska Fairbanks  
School of Fisheries and Ocean Sciences  
17101 Pt. Lena Loop Rd Juneau, AK 99801  
[kcriddle@sfos.uaf.edu](mailto:kcriddle@sfos.uaf.edu); (907) 796-5449*

*3: University of Alaska Fairbanks  
School of Fisheries and Ocean Sciences  
235 O'Neill Fairbanks, AK 99775  
[milo.adkison@uaf.edu](mailto:milo.adkison@uaf.edu); (907) 474-1811*

The total revenue of the Bristol Bay, Alaska sockeye salmon *Oncorhynchus nerka* fishery has continued to decline resulting from increases in production of farmed Chilean rainbow trout *O. mykiss* and coho salmon *O. kisutch*. There may be some opportunity to regain value to the fishery by altering management strategies. We simulated three management strategies for sockeye salmon: a fixed escapement range strategy, a fixed harvest strategy and a fixed harvest rate strategy. Yields from these simulations were then combined with a forecast of farmed Chilean trout and salmon production and a model of international trade flows for Alaskan sockeye and Chilean coho salmon and rainbow trout to generate forecasts of ex-vessel price and total revenue for 2010. Results demonstrate a switch to an inelastic market environment and reveal the need to modify current management strategies to improve the economic health of the fishery.

## **Session – Allocation among Fisheries Users: “How to Divide up Alaska’s Fish Pie?”**

### **Rockfish Management in Southeast Alaska**

**Brian Marston**

*Alaska Department of Fish & Game - Sport Fish Division*  
*P.O. Box 49 Yakutat, AK 99689*  
[brian.marston@alaska.gov](mailto:brian.marston@alaska.gov); 907-784-3222

Rockfish (*Sebastes spp*) fishery management in SE Alaska is a complex allocation regiment based on fish biology and utilization history by a diverse group of sport, subsistence, and commercial users. In SE Alaska sustainability of exploited rockfish populations is achieved by estimating the total allowable mortality a population can endure, subsequently leaving adequate spawner biomass through time that maintains population viability. Guideline harvest levels (GHL's) are allocated within delineated areas for each fishery that limit total mortality to prescribed levels, and regulations are crafted to achieve these GHL's. Fisheries are monitored in-season and regulations can be altered so that GHL's are not exceeded. Fishery regulations are also altered across seasons if GHL's have not been met. Overall allocations are set and reviewed with public input by the Alaska Board of Fisheries every 3 years, while management to achieve allocations is administered by the Alaska Department of Fish and Game. Research assessments are undertaken by the Alaska Department of Fish and Game, and several federal agencies. Fishery markets and fishery popularity can change quickly and alter the dynamics between user groups, or changing marine conditions can alter fish populations directly. Allocation conflicts are inevitable due to changes to fishery or fish population realities. Sport and commercial fisheries based on species of *Sebastes* creates multi-million dollar industries, and the regulatory environments of all marine fisheries of SE Alaska are impacted by management of this group. SE Alaskan rockfish management has attempted to evolve with new and better information in order to sustain and equitably allocate the limited *Sebastes* resource.

## **Session – Allocation among Fisheries Users: “How to Divide up Alaska’s Fish Pie?”**

### **An Alaskan Fisheries Odyssey: An Entertaining Look at the Evolution of Dual Subsistence Management**

**James Saveriede**

*Alaska Department of Fish & Game – Sport Fish Division  
1300 College Rd Fairbanks, AK 99701  
[james.saveriede@alaska.gov](mailto:james.saveriede@alaska.gov); 907-459-7252*

Once upon a time in a land far, far away a group of nomadic people established a rich culture based on a traditional subsistence lifestyle. The land encompassed all types of terrain and natural resources which provided these Native people with everything they needed to survive and prosper. They lived this way for 10,000 years and their traditions were passed down from one generation to the next. Odysseus (native fishers) grew up in this culture and thrived on the salmon from his native land. As time passed, a group of explorers named Poseidon (commercial and sport fishers) came from a different culture to his homeland searching for fur and gold. Zeus (federal government) was the founding entity of this new world culture and he declared that Athena (state government) would watch over and protect this land and its resources. Athena authored a written document that stated all resources throughout this land called Alaska will be shared equally among its people, which pleased Odysseus and Poseidon. Unfortunately, time eroded the relationship between Odysseus and Poseidon and Odysseus felt that his subsistence lifestyle had been threatened. Odysseus pleaded with Athena to help him maintain the subsistence way of life by giving his people more precedence in waters adjacent to Zeus’ land. In the end, Athena felt this was unfair and decided to deny his request. This upset Odysseus so he beseeched his case to Zeus. A controversial trial took place and the subsistence priority was established in waters adjacent to and flowing through Federal lands.

## Session – Evolution of Fish Diversity

### **Dynamic Landscapes Dynamic Fish: How Geologic Processes and Landscape Evolution Can Be Drivers for Change in Fish Populations**

**Patricia Heiser**

*University of Alaska Geography Program  
School of Natural Resources and Agricultural Sciences  
PO Box 755840  
Fairbanks, AK 99775-5840  
Ph (907)474-7061: [ffpah@uaf.edu](mailto:ffpah@uaf.edu)*

Landscapes change on geologic timescales of thousands to millions of years, but can also change on decadal to centennial timescales. Our understanding of genetic and behavioral variation in fish species can be informed by an understanding of the timing and nature of landscape change. From the uplift of mountain ranges driving speciation of Pacific salmon species, to the isolation of communities from glacial activity, to changing vegetation and nutrient cycles over the last several decades, landscape and climate have been important influences on fish populations.

By looking at spatial patterns of fish populations in the light of geologic processes and geographic change, we stand to gain a better understanding of how fish populations have responded to changes in the past and how they may respond in the future. This presentation is an overview of previous work on salmon and other fish speciation as a result of geologic and geographic change. Perspectives on the different temporal, spatial, scales of landscape change will be applied to past and present fisheries studies.

## Session – Evolution of Fish Diversity

### **Did the Ice Ages Promote or Retard Marine Speciation in the North Pacific?**

**Stewart Grant**

*Alaska Department of Fish & Game, Gene Conservation Laboratory,  
333 Raspberry Road, Anchorage, AK 99518  
william.grant @alaska.gov*

Marine waters around the rim of the North Pacific were repeatedly influenced by terrestrial glaciations since the beginning of the Quaternary 2.6 million years ago. These episodes of glacial cooling led to lowered sea levels, to greatly modified shorelines, and to declines in ocean productivity. Climatic deteriorations produced shifts in species' abundances and distributions, driving some populations to extinction, but geographically isolating others. Surveys of genetic variability in several marine species in the North Pacific show genetic suture zones that apparently reflect secondary contact after isolation in ice-age refugia. Other species appear to have survived in warm refugia on only one side of the North Pacific. Nearly all open-ocean species with planktonic larvae that have been studied show genetic signatures of rapid population growth or geographic expansion, as evidenced by departures from drift-migration equilibrium, by unimodal mtDNA sequence mismatch distributions, or by rapid growth in Bayesian skyline plots. Ice-age cycles have contributed to diversity among populations in some species, but not in others. Speciations in most groups appear to predate the Quaternary and were due to isolations across the North Pacific in the Pliocene and Miocene or to dispersals from the Atlantic through the Arctic in the Pliocene following the opening of Bering Strait.

## Session – Evolution of Fish Diversity

### Recent ecological divergence despite migration in sockeye salmon (*Oncorhynchus nerka*)

**Authors: Scott A. Pavey<sup>1,2</sup>, Jennifer L. Nielsen<sup>3</sup>, Troy R. Hamon<sup>4</sup>**

**1:** National Park Service, Katmai National Park, PO Box 7, King Salmon, AK 99613, USA; Phone: 907-246-2144; email: scott\_pavey@nps.gov

**2:** Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC V5A 1S6, CANADA

**3:** US Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, AK, 99508, USA; Phone: 907-786-7062; email: jlnielsen@usgs.gov

**4:** National Park Service, Katmai National Park, PO Box 7, King Salmon, AK 99613, USA; Phone: 907-246-2144; email: troy\_hamon@nps.gov

Ecological divergence may result when populations experience different selection regimes, but there is considerable discussion about the role of migration at the beginning stages of divergence before reproductive isolating mechanisms have evolved. However, detection of past migration is difficult in current populations and tools to differentiate genetic similarities due to migration versus recent common ancestry are only recently available. Using past volcanic eruption times as a framework, we combine morphological analyses of traits important to reproduction with a coalescent-based genetic analysis of two proximate sockeye salmon (*Oncorhynchus nerka*) populations. We find that this is the most recent (~500 years, 100 generations) natural ecological divergence recorded in a fish species, and report that this divergence is occurring despite migration. While studies of fish divergence following the retreat of glaciers (10,000-15,000 years ago) have contributed extensively to our understanding of speciation, the Aniakchak system of sockeye salmon provides a rare example of the initial stages of ecological divergence following natural colonization. Our results show that even in the face of continued migration, populations may diverge in the absence of a physical barrier.

## Session – Evolution of Fish Diversity

### Understanding Alaska's evolving fish diversity: a question of scales

**J. Andrés López<sup>1</sup> and Tuuli Makinen<sup>2</sup>**

*1: University of Alaska Fairbanks, Museum of the North  
907 Yukon Drive, Fairbanks, AK 99775  
907 474 7828; jalopez2@alaska.edu*

*2: School of Fisheries and Ocean Sciences  
207B O'Neill Building, Fairbanks, AK 99775-7220  
907 474 1570*

The marine and freshwater fish fauna of Alaska includes representatives of fish lineages that span the history of non-tetrapod craniate evolution from lampreys to flatfish. The presence of this diverse assemblage in and around Alaska and the varied adaptations to Arctic environments its constituents must display form rich ground on which to develop an improved understanding of biological evolution at the macro- and microevolutionary scales. Large-scale studies of phylogeny are contributing new and more robust hypotheses of the timing of divergence and sequence of relationships among the major components of the Alaskan fish fauna, particularly for freshwater groups. As an example, I review recent examinations of salmonid, esociform and osmerid phylogenetic relationships. Efforts of this type along with incremental improvements in phylogenetic inference should continue to yield refinements to theories on the macroevolutionary processes that shaped broad-scale patterns of fish diversity. These dynamics, although of general interest in biology, are only distantly connected to the mechanisms of speciation and adaptation, two aspects of evolution with significant implications for natural resource management. Discovering and characterizing these mechanisms is among the most challenging and important pursuits in biology. The continual development of tools to explore genotype-phenotype links offers great promise in this context. I review significant recent developments on the study of speciation, adaptation and ecological divergence and highlight promising avenues for their application to the study of fish diversification in Alaska. Due in large part to the dramatic effects of recent glacial cycling on Beringian aquatic habitats and their faunas, the study of Alaska's fishes may yield new insights on how the interactions between history and ecology affect the evolution of biological diversity.

## Session – Evolution of Fish Diversity

### Deep population structure and low genetic variability of lake trout in the Togiak National Wildlife Refuge

Penny Crane<sup>1</sup>, Pat Walsh<sup>2</sup>, Cara Lewis<sup>1</sup>, and John Wenburg<sup>1</sup>

*1: U.S. Fish and Wildlife Service, Conservation Genetics Laboratory, Anchorage AK 99503, [penelope\\_crane@fws.gov](mailto:penelope_crane@fws.gov); [cara\\_lewis@fws.gov](mailto:cara_lewis@fws.gov); [john\\_wenburg@fws.gov](mailto:john_wenburg@fws.gov)*

*2: U.S. Fish and Wildlife Service, Togiak National Wildlife Refuge, Dillingham, AK 99576, [patrick\\_walsh@fws.gov](mailto:patrick_walsh@fws.gov)*

Lake trout *Salvelinus namaycush* is a slow-growing, late-maturing, cold-water adapted species whose native distribution is confined to glaciated regions of North America. Lake trout inhabiting small lakes may be at greater risk for extirpation from stressors such as overexploitation and climate change due to smaller effective population sizes. In this study, lake trout were sampled from 15 lakes in six watersheds on or near Togiak National Wildlife Refuge from 2004-2007, and assayed for genetic variation at 14 microsatellite loci to investigate the effect of glacial history on spatial structure and within-population genetic variation. Populations were structured by drainage, suggesting a single founding source in each drainage. An exception occurred in the Nushagak River watershed, where evidence was detected for stream capture between the Kwethluk and upper Nushagak drainages. Among-population variation, as measured by  $F_{ST}$ , was 0.35; pairwise  $F_{ST}$  within drainages ranged from 0.05-0.47, indicative of very low gene flow, even within drainages, though individual-based analysis detected movement of lake trout among lakes within the Kanektok and Goodnews drainages. Lake surface area was positively associated with gene diversity and allele richness, and negatively associated with relatedness, indicating that smaller lakes in the Refuge harbor, less genetic diversity and may have more limited adaptive potential.

## Session – Size Trends of Alaskan Salmon Stocks

### Hawaiian goatfish life history and implications for conservation and management

Heather A. Leba

*Alaska Department of Fish and Game, Commercial Fisheries Division  
333 Raspberry Road, Anchorage, AK 99518  
907-720-1417; heather.leba@alaska.gov*

Goatfishes (family Mullidae) are an important component of Hawaii's commercial and recreational fisheries and have significant cultural importance to the Hawaiian people. However, the fishery is largely unregulated, is active year-round, and only commercial harvest is recorded. To provide life history information for the development of sound management practices, the spawning seasonality, fecundity and size and age at reproductive maturity was investigated for the three most heavily targeted Hawaiian goatfishes, *Mulloidichthys vanicolensis*, *M. flavolineatus* and *Parupeneus porphyreus*. Fishes were sampled monthly from August 2006 to December 2008. Weight, length and sex data were recorded and otoliths were removed for ageing. Batch fecundity was assessed and gonadosomatic indices were estimated to elucidate spawning seasonality. The size at which 50% of females were mature ( $L_{50}$ ) was 17.5 cm FL for *M. vanicolensis* and 18.25 cm FL for *M. flavolineatus*. On average, females of both *M. vanicolensis* and *M. flavolineatus* were significantly longer and heavier than males, however, the opposite was found for *P. porphyreus*. All three species studied exhibited a protracted spawning season that began in early spring, peaked mid-summer and declined into the autumn months. There was an exponential relationship between instantaneous batch fecundity and fork length (FL) for both *M. vanicolensis* and *M. flavolineatus*; *P. porphyreus* was the least fecund species, *M. flavolineatus* the most. This study elucidated critical life history information necessary to improve management strategies and regulate goatfish harvest. Overlapping and protracted spawning seasons may complicate management efforts. Restricted fishing, limiting both number and size of fish harvested, during peak spawning is recommended. The continued targeting of the largest, most fecund individuals while simultaneously harvesting juveniles, may severely compromise the long term sustainability of these populations.

## Session – Size Trends of Alaskan Salmon Stocks

### **Influence of environmental parameters on age and size at maturity of sockeye salmon from Newhalen River, Alaska**

**Elizabeth Benolkin<sup>1</sup> and Carol Ann Woody<sup>2</sup>**

*1: U.S. Geological Survey, Alaska Science Center  
4210 University Drive, Anchorage, AK 99508  
ebenolkin@usgs.gov*

*2: Fisheries Research and Consulting,  
601 Chevigny Street, Anchorage, AK 99502,  
carolw@alaskalife.net.*

Sockeye salmon (*Oncorhynchus nerka*) originating from Lake Clark and the upper Newhalen River are an important commercial, ecological, and subsistence resource, and are an important component of the larger Kvichak River escapement. Average escapement to the Kvichak River declined sharply during 1996-2005, prompting the listing of the Kvichak originating salmon as a “stock of concern” in 2003. To determine if demographic changes occurred during this period, we investigated age and size at maturity, key life history traits of salmon. We examined trends in age and size at maturity of Lake Clark and upper Newhalen River sockeye salmon from two time periods (brood years 1976-1980 and 1997-2001) and tested relationships between size at maturity and environmental variables including the Aleutian Low pressure system, the Pacific Decadal Oscillation, sea surface temperatures, and coastal upwelling. Age composition and size at maturity of Newhalen River sockeye salmon differed between time periods; the proportion of older marine age 3 fish was greater in recent brood years, while fish size at maturity was significantly smaller during 1997-2001 compared to 1976-1980. Broad-scale environmental indices (Aleutian Low and Pacific Decadal Oscillation) were not correlated with sockeye salmon length in either sex or in any age group. Sea surface temperatures were negatively correlated with fish length, and coastal upwelling was positively correlated with fish length. Changes in sea surface temperatures and coastal upwelling may be related to changes in food availability for salmon, leading to differential growth. Our study may provide managers with a better understanding of how environmental processes affect size at maturity of sockeye salmon originating from Lake Clark and the upper Newhalen River.

**Student**

## **Session – Size Trends of Alaskan Salmon Stocks**

### **Yukon River Chinook Salmon - Sex, Size, Politics and Lies**

**Chris Stark**

*Research Professional II*

*University of Alaska Fairbanks, School of Fisheries and Ocean Sciences*

*905 N. Koyukuk Drive, 245 O'Neill Building*

*Fairbanks, Alaska 99775-7220*

There has long been concern in the Yukon River drainage that larger Chinook salmon have become less abundant, and that the average size and yield has declined. The goal here is to present the summary information and discuss the relevant issues. A review of available harvest and escapement ASL and weight data (1970-2004) and agency reports concerning Yukon River Chinook salmon fisheries and escapement monitoring programs suggests the following. Escapement goals have generally been met or exceeded. The average weight of commercially harvested fish has decreased about 20% in both the lower and upper portions of the Yukon River in the U.S., and the average fecundity has declined 25%. The proportion of larger fish has declined since the 1970s in the majority of monitored spawning streams. The female proportion of the escapement has declined in upriver stocks more recently. While it is likely that both the dominant gear (8+ inch mesh gill net) used to harvest Yukon Chinook salmon and changes in the ocean environment have contributed to fish size declines, the relative contribution of these factors is unknown. The effects of intercept fisheries and competition between wild stocks and hatchery releases in the Bering Sea are less understood but of equal interest.

## Session – Size Trends of Alaskan Salmon Stocks

### **Examination of Yukon Chinook Salmon Commercial Catch Size Trend: Is there an Evidence for Declining?**

*Toshihide “Hamachan” Hamazaki*  
*Alaska Department of Fish and Game, Commercial Fisheries Division,*  
*333 Raspberry Road, Anchorage, AK 99518*  
*907-267-2158; toshihide.hamazaki@alaska.gov*

Declining size of Yukon River Chinook salmon is one of the major concerns among the public. However, it is difficult to empirically evaluate the size trend because many of the available data sets are short and incomplete, and the trend is not always linear. These could lead to inaccurate assessments of the trends. Here, I examined size trends using the District 1 commercial catch age, sex, and length data (1964-2007) from large mesh (unrestricted) fisheries, the longest and the most complete data available in the Yukon River. The size trends were analyzed using a general linear model (GLM) and a non-linear general additive model (GAM). The GLM showed 1) a significant decline of average length of age-1.4 and age-1.5 fish, 2) a significant decline of the proportion of large ( $\geq 900\text{mm}$ ) fish, and 3) significant but slight decline of the proportion of age-1.5 fish. In contrast, proportion of females increased, though the increase was small. On the other hand, the GAM showed that the majority of the above declining trends occurred from 1970 to the mid 1990s and then stabilized since through 2007. Furthermore, the average length of age-1.4 and age-1.5 fish and proportion of large fish increased from 1964 to 1970 before the declining trends started. In fact, average length of age-1.4 and age-1.5 fish during the 2003-2007 period is similar to those during the 1964-1968 period. These show that the Yukon River Chinook Salmon size characteristics returned to those of 1960s.

## Session – Size Trends of Alaskan Salmon Stocks

### Catch Comparisons of Three Gillnet Mesh Sizes from the Lower Yukon

**Kathrine G. Howard**

*Alaska Department of Fish and Game, Division of Commercial Fisheries*  
333 Raspberry Rd, Anchorage, AK 99518  
[kathrine.howard@alaska.gov](mailto:kathrine.howard@alaska.gov)

This study conducted a test fishery in District Y-1 near Emmonak to investigate catch composition of 7", 7 ½", and 8" stretch-mesh drift gillnets. Age, sex, length, weight and girth (ASLWG) characteristics of Chinook salmon caught, and the species composition of the catch were examined. Comparisons among mesh sizes and with data from Lower Yukon commercial and other test fisheries are included. Overall patterns indicate that larger mesh sizes catch a greater proportion of older fish, more Chinook relative to chum, a greater proportion of females, and more larger fish in respect to length, weight and girth. This study provides important insight for management strategies and regulations concerning mesh size restrictions for the Yukon River, as well as improving our understanding of potential impacts of size-selective fishing.

## Session – Size Trends of Alaskan Salmon Stocks

### **Selective fishing as a potential factor contributing to declining size and productivity of Yukon River Chinook salmon**

**Jeffrey J. Hard**

*Conservation Biology Division, Northwest Fisheries Science Center,  
National Marine Fisheries Service, Seattle, WA 98112  
[jeff.hard@noaa.gov](mailto:jeff.hard@noaa.gov)*

There is a growing body of evidence that human practices such as hunting and fishing can change the characteristics of animals in ways that affect their productivity. Such practices, when sufficiently selective, may lead to “unnatural” selection that can erode the very characteristics favored by natural selection in the wild. The Yukon River gillnet fishery may be the only major fishery in the world that targets Chinook salmon with large-mesh gear, and concern over the potential consequences of removing large fish through fishing is increasingly being expressed among fishery professionals and in public meetings. Many published reports are attributing observed changes in fish age, sex, and size composition to selective fishing. Unfortunately, most of these reports have involved retrospective analyses of phenotypic trends and have been unable to ascertain whether changes in harvested populations are due to evolution, rather than phenotypic plasticity or environmental variation. We used a stochastic, individual-based model to investigate the potential long-term effects of large-mesh gillnet fisheries on Yukon River Chinook salmon. We evaluated potential changes to productivity and age, sex, and size structure of the population caused by the selective removal of large fish. We also explored the resiliency of the population to alternative harvest strategies.

Significantly, evolution brought about by selective fishing might greatly increase the time required for exploited populations to recover once fishing is curtailed because fishing often creates strong selection, whereas curtailing fishing often results in less intense selection in the opposing direction. Taking into account these selective effects on viability is a major challenge for harvest managers, but harvest management must begin to address them, implement rigorous monitoring programs to detect selection, and identify harvest practices that minimize impacts on sustainability.

## Session – Size Trends of Alaskan Salmon Stocks

### Reproductive Constraints among Yukon River Chinook Salmon Revealed by Genetics and a Generalized Mixture Model

Jeffrey F. Bromaghin<sup>1\*</sup>, Danielle F. Evenson<sup>2</sup>, and Thomas H. McLain<sup>3</sup>

*1: U. S. Fish and Wildlife Service, Fisheries and Ecological Services  
1011 E. Tudor Road, Anchorage, Alaska 99507*

*2: Alaska Department of Fish and Game, Division of Commercial Fisheries  
333 Raspberry Road, Anchorage, Alaska 99518*

*3: U. S. Fish and Wildlife Service (retired), Fairbanks Fish and Wildlife Field Office  
101 12th Ave., Room 110, Fairbanks, Alaska 99701*

\* Current address: U. S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508; 907-786-7086; [jbromaghin@usgs.gov](mailto:jbromaghin@usgs.gov)

Fecundity is a vital population characteristic directly linked to the productivity of fish populations. Recent observations of Yukon River Chinook salmon suggest that fecundity differs among sub-basins and has declined by approximately 20% over 16 years in the Tanana River sub-basin. Yukon River Chinook salmon have been harvested in large-mesh gillnet fisheries for decades, and a decline in fecundity was considered a potential evolutionary response to size-selective exploitation. The implications for conservation and fisheries management led us to initiate a drainage-wide investigation of fecundity. Matched observations of fecundity, morphological variables, and genotypes were collected from a mixed-population sample of adults captured in test fisheries in the vicinity of Emmonak, Alaska near the Yukon River terminus in 2008. Complete data were obtained from 403 individual females. The conditional maximum likelihood mixture model, commonly used to estimate the composition of multi-population mixtures, was generalized to permit estimation of population-specific fecundity parameters without assigning individuals to a putative population of origin. A decline in fecundity was not confirmed. However, differences in estimated fecundity within sub-basins provide insights into constraints on reproductive investment imposed by long migrations and warrant consideration in fisheries management and conservation. The generalized mixture model extends the utility of genetic markers to new applications and can easily be adapted to study a variety of population characteristics.

## **Session – Quantitative Methods in Alaskan Fisheries Research and Management**

### **Estimation of Total Abundance and Migratory Timing of Adult Salmon using Distribution and Partial Abundance Data**

**Jeffrey F. Bromaghin<sup>1</sup>, Kenneth S. Gates<sup>2</sup>, and Douglas E. Palmer<sup>3</sup>**

*1: U. S. Geological Survey, Alaska Science Center  
4210 University Drive, Anchorage, AK 99508  
907-786-7086; [jbromaghin@usgs.gov](mailto:jbromaghin@usgs.gov)*

*2: U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office  
43655 Kalifornsky Beach Road, Soldotna, Alaska, 99669  
907-260-0126; [kenneth\\_gates@fws.gov](mailto:kenneth_gates@fws.gov)*

*3: U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office  
43655 Kalifornsky Beach Road, Soldotna, Alaska, 99669  
907-260-0127; [douglas\\_palmer@fws.gov](mailto:douglas_palmer@fws.gov)*

Many Pacific salmon fisheries are actively managed to meet escapement goal objectives. In fisheries where the demand for surplus production is high, a comprehensive assessment program is needed to achieve the opposing objectives of allowing adequate escapement and fully exploiting the available surplus. Knowledge of abundance is a critical element of such assessment programs. Abundance may be predicted by pre-season forecasts, indexed using catch-per-unit-effort (CPUE), or estimated using methods such as hydroacoustics or mark-recapture. Mark-recapture experiments have become common in recent years, particularly within large river systems. Fish are typically captured and marked in the lower river while migrating in mixed aggregations of multiple populations. In many cases, recapture data are obtained from escapement monitoring projects located near spawning areas, which provide large sample sizes and information on population-specific mark rates. When recapture data are obtained from more than one population, unequal mark rates may reflect heterogeneous capture probabilities, which violates an assumption of many mark-recapture models. A typical analytical strategy is to test the hypothesis that mark rates are homogenous and combine all recapture data if the test is not significant. This approach has two potential disadvantages. First, mark rates are often low and a test of homogeneity may lack sufficient power to detect meaningful differences among populations. Second, population-specific mark rates may provide information on capture probabilities that is not exploited during abundance estimation. We present a temporally stratified mark-recapture model that permits capture probabilities and migratory timing through the lower river capture area to vary among strata. Escapement abundance information from a subset of all populations and telemetry distribution data are jointly used to estimate the abundance and migratory timing of all populations upriver of the capture site. The technique is illustrated with data from Kasilof River coho salmon obtained in 2008.

## Session – Quantitative Methods in Alaskan Fisheries Research and Management

### Estimating survival of yelloweye and quillback rockfish released with a deep water release mechanism with Markov Chain Monte Carlo.

Samuel Hochhalter<sup>1</sup> and Daniel Reed<sup>2</sup>

1: Alaska Department of Fish and Game, Division of Sport Fish  
PO Box 669, Cordova, AK 99574  
(907) 424-3213; samuel.hochhalter@alaska.gov

2: Alaska Department of Fish and Game, Division of Sport Fish  
PO Box 1148, Nome, AK 99762  
(907) 443-5167; daniel.reed@alaska.gov

Discard mortality rates of demersal rockfish *Sebastes sp.* are thought to be high as even when caught at relatively shallow depths of 30 m individuals may sustain fatal injuries due to barotrauma (i.e., damage to tissue caused by expansion of gas in the gas bladder that occurs because of reduced atmospheric pressure as fish are brought to the surface). Cage experiments indicate that rockfish that are returned to depth quickly after capture results in relatively high short-term survival probabilities across several species of rockfish. However, estimates of survival derived from studies that 1) are conducted in wild settings where individuals are exposed to natural sources of mortality, 2) use devices available to the angling public (e.g., deep water release mechanisms; DRM), and 3) encompass longer time frames are needed to better understand the efficacy of DRM in the management of demersal rockfish. We addressed this need by conducting a mark-recapture experiment on two commercially and recreationally important species of demersal rockfish that were released with a DRM, yelloweye *Sebastes ruberrimus* and quillback *Sebastes maliger*. Survival estimates were measured across five, 16-day intervals. An objective Bayesian analysis that used Markov Chain Monte Carlo simulation was performed in Program MARK to generate posterior distributions of survival probabilities. The average modal survival probability for yelloweye was 0.98. A lack of recaptures for quillback precluded estimation of survival. These results indicate that the use of DRM dramatically improves discard survival of yelloweye rockfish.

## **Session – Quantitative Methods in Alaskan Fisheries Research and Management**

### **Bayesian Run Reconstruction from the Ground Up**

**Steve Fleischman**

*Alaska Department of Fish and Game, Sport Fish Division  
333 Raspberry Road, Anchorage, AK 99518  
[steve.fleischman@alaska.gov](mailto:steve.fleischman@alaska.gov)*

Over the decades, fisheries management agencies have accumulated multiple time series of stock assessment data that represent the investment of many millions of dollars and hundreds of person-years of effort. It can be a difficult challenge to extract maximal utility from these data, especially when they are spatially and/or temporally incomplete, or are subject to differing levels of measurement error. This talk demonstrates simple methodology for synthesizing incomplete, imprecise data in a coherent fashion. The resulting estimates are spatially and temporally complete, and have assessments of uncertainty that accurately reflect the strengths and weaknesses of the data. Real-data examples, from simple to complex, are worked from Alaska salmon stocks.

## **Session – Quantitative Methods in Alaskan Fisheries Research and Management**

### **Application of Ecological Simulation Modeling to Combine Fish Science and Fisheries Science**

**Toshihide “Hamachan” Hamazaki**

*Alaska Department of Fish and Game, Commercial Fisheries Division,  
333 Raspberry Road, Anchorage, AK 99518  
907-267-2158; toshihide.hamazaki@alaska.gov*

Advancement of research in fish ecology reveals many ecological factors that affect productivity of fish population. However, it is difficult to quantify how those factors would influence fishery management. Simultaneously, fishery science acknowledges that more fish ecology data are needed to improve precision in fishery management. However, it is difficult to identify which data should be collected. Those questions can be explored using an ecological simulation modeling technique. As a case study, I demonstrate how Chinook salmon life-history simulation model can be used to examine 1) effects of *Ichthyophonus* mortality on fisheries, and 2) inclusion of spawning habitat quality, oceanic change, and abundance of out-migrant juveniles on improvement of the spawner-recruit model.

## **Session – Quantitative Methods in Alaskan Fisheries Research and Management**

### **Improved 3-D analysis for underwater video, with applications to wild juvenile Chinook salmon foraging behavior**

**Jason R. Neuswanger<sup>1</sup>, Nicholas F. Hughes<sup>2</sup>, Mark S. Wipfli<sup>3</sup>, and Lon H. Kelly<sup>4</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775; 907-474-6740*

*2: Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*3: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*4: Bureau of Land Management, Fairbanks, Alaska 99709-3899*

The study of fish behavior has often been limited by the difficulty of precisely measuring behavior in the field without altering it. Paired video cameras, after a simple calibration, can help solve this problem by unobtrusively measuring precise 3-D time series fish positions and morphometrics. However, this method has rarely been used in fisheries science, largely because of costly and cumbersome underwater video equipment, mathematical methods that restricted field capabilities, and a lack of simple analysis software. We sought to eliminate these limitations and apply the improved technology to a study of the foraging behavior and size structure of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in the fifth-order Chena River near Fairbanks, Alaska. We designed two waterproof camera systems, differing in mobility and resolution, which proved effective for filming juvenile salmon across a wide variety of habitats. Video analysis was streamlined by creating two freely available software tools that provide simple graphical interfaces and use algebraic techniques that minimize assumptions about subject orientation and position. Measurement errors down to 1% allowed fine-scale analysis of foraging behavior, including prey capture maneuvers and feeding territories, as well as unobtrusive remote measurement of fish lengths. More generally, the ability to quantify and visualize positions in three dimensions unlocks much of the vast information contained in high-resolution video of natural fish behavior. The precision and usability of this method put 3-D video analysis within reach of mainstream laboratory and field biologists who need established tools with a reasonable learning curve.

**Student**

## Session – Contributed Papers

### **Eruption of Redoubt Volcano and impacts to aquatic habitats in 2009**

**Christian E. Zimmerman and Christopher F. Waythomas**

*USGS Alaska Science Center  
4210 University Dr., Anchorage, AK 99508*

In late March – early April 2009, the eruption of Redoubt Volcano, located in the Cook Inlet Region of Southcentral Alaska, resulted in numerous ashfall events and subsequent impacts to aquatic habitats within the Drift River watershed. At least two large and several smaller lahars (volcanic mudflows) down the north flank of the volcano resulted in significant sediment inputs to the entire Drift River. Whereas most documented aggrading river systems in Alaska, and elsewhere, are fed by inputs of sediment from active glaciers or human disturbance (e.g., logging, mining) and driven by seasonal snowmelt flooding or large rainstorms, the Drift River system is periodically driven by extraordinarily large volcanically-generated lahars and floods (with peak discharges up to the magnitude of the flood of record for the Mississippi River). Following a similar eruption in 1989-90, in June of 1995, USGS and cooperators examined impacts of lahars on the macroinvertebrate community in the Drift River. Macroinvertebrate populations along the Drift River, if diminished by the 1989-90 eruption (this could not be shown because no baseline data existed), had recovered to levels observed in similar river settings (all glacially influenced) on the west side of Cook Inlet within 5 years. We revisited the sites sampled in 1995 to assess macroinvertebrate communities within months of the 2009 lahar events. Within the Drift River sites, macroinvertebrate communities were unaffected upstream of the volcano and no macroinvertebrates were collected in sites downstream of the volcano. Using the Alaska Department of Fish and Game Fish Distribution Database, we also revisited 25 sites within the Drift River and surrounding streams where fish (salmon and char) had been documented in 2002. Many of these sites were significantly impacted by lahar deposits (up to 2 m of deposition in some sites) and no fish were present. Using previously collected data as a baseline and satellite imagery, we discuss the impacts of lahars on aquatic communities and potential evolution of aquatic habitats and biotic communities following the 2009 eruption.

## Session – Contributed Papers

### **Feeding Intensity, Diet, and Survival in relation to Body Size of Juvenile Pink Salmon**

**Michael J. Malick, Lewis J. Haldorson, and John J. Piccolo**

*University of Alaska Fairbanks, Juneau Center,  
School of Fisheries and Ocean Sciences, Juneau, AK 99801  
mjmalick@alaska.edu*

Variations in body size and growth rates in a cohort of juvenile fish can lead to differences in the feeding ecology of different sized conspecifics, thus, increasing differential survival in the cohort. Consequently, identifying the relationships between body size, feeding ecology, and survival is important in understanding mortality of juvenile fishes during the early marine life phase. We used feeding intensity, diet composition, and growth rate data collected from juvenile pink salmon (*Oncorhynchus gorbuscha*) to investigate how feeding ecology differs between large and small conspecifics and how the growth rates of large and small individuals influences overall marine survivorship. The sampling occurred from 1997-2004 and encompassed three marine habitats in the northern Gulf of Alaska. Feeding intensity did not significantly differ between large and small individuals across all habitats. Diet composition varied more among years and habitats than between large and small individuals. Within a year and habitat the diet composition of large and small conspecifics differed more in offshore waters than the near shore habitats with larger pink salmon eating more fish and less large copepods than smaller conspecifics. Growth positively related to marine survival in all habitats. The growth of fish sampled in offshore habitats related stronger to survival than the growth of fish in the near shore habitats. Within the offshore waters, the growth rates of larger individuals better explained marine survival than the growth of smaller conspecifics. These results suggest that diet composition does differ between small and large conspecifics on small temporal and spatial scales, which may allow larger individuals to exploit bigger and more energy rich prey, resulting in increased survival of larger fish.

## Session – Contributed Papers

### **The optimal stability ‘window’ hypothesis: A possible link between water column stability and Gulf of Alaska pink salmon survival**

**Sara E. Miller, Milo Adkison, and Lewis Haldorson**

*University of Alaska, Fairbanks, Juneau Center,  
School of Fishery and Ocean Sciences, Juneau, AK 99801  
semiller@alaska.edu*

Gargett hypothesized that salmon survival is likely to be favored in the light-limited Gulf of Alaska (GOA) during strong phases of the Aleutian Low Pressures system through in-phase changes in freshwater input and water column stability. Using summer juvenile pink salmon (*Oncorhynchus gorbuscha*) samples from the coastal GOA, Gargett’s hypothesis was tested in two parts. The first hypothesis tested was that pink salmon condition and growth should have a positive relationship with water column stability. Contrary to expectation, stability was not significant in explaining variability in fish condition or growth in a model that included all hatchery and wild fish; however, year effects were significant. In a separate analysis of only the fish originating from the Armin F. Koernig hatchery, stability did exhibit a positive relationship with growth rate in the Alaska Coastal Current watermass. The second hypothesis tested was that pink salmon survival should be positively related to fish condition and growth. Survival was positively related to condition and growth. Only one of these relationships (for an effect of condition in the Alaska Coastal Current watermass) was statistically significant.

**Student**

## Session – Contributed Papers

### **Environmental Variation and Whole Stream Metabolism in the Chena River, Interior Alaska**

**Emily R. Benson<sup>1</sup>, Mark S. Wipfli<sup>2</sup>, and Nicholas F. Hughes<sup>3</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775; 907-474-1949; erbenson@alaska.edu*

*2: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775; 907-474-6654; mark.wipfli@uaf.edu*

*3: Institute of Arctic Biology  
University of Alaska Fairbanks, Fairbanks, Alaska 99775*

The influence of many environmental variables on stream metabolism is not well understood, particularly in subarctic ecosystems. Environmental variables influence the carbon dynamics in streams and hence the productivity of stream food webs. The existence of trophic relationships between primary producers, primary consumers, and upper level consumers such as fish suggests that changes in these environmental variables could influence stream organisms at multiple trophic levels, and ultimately fish production. The objective of this study was to investigate how selected environmental variables – stream flow, light intensity, and nutrient concentrations – relate to whole stream metabolism in the Chena River of interior Alaska. We estimated whole stream metabolism rates (gross primary production and ecosystem respiration) using the single-station, open channel method in two study reaches during the summers of 2008 and 2009. We also measured several parameters of environmental variation over the same time period. Preliminary results suggest production to respiration ratios were positively related to light, production rates were negatively related to stream flow, and metabolism rates were not correlated with stream nutrient concentrations. These findings contribute to a more complete understanding of juvenile Chinook salmon ecology and population dynamics by providing insight into how basal food resources relate to environmental variation, ultimately affecting salmon and potentially other upper level consumers.

**Student**

## Session – Contributed Papers

### **Patterns of prey abundance for juvenile Chinook salmon in the Chena River, interior Alaska**

**Laura Gutierrez<sup>1</sup>, Mark S. Wipfli<sup>2</sup>, Nicholas F. Hughes<sup>3</sup>, and Elizabeth C. Green<sup>1</sup>**

*1: University of Alaska Fairbanks Alaska Cooperative Fish and Wildlife Research Unit,  
Department of Biology and Wildlife, Fairbanks, AK  
[lgutierrez@alaska.edu](mailto:lgutierrez@alaska.edu)*

*2: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit,  
Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK*

*3: Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK*

Aquatic and terrestrial invertebrates are often an important food source for juvenile salmonids. Seasonal inputs of terrestrial prey into streams and their abundance relative to aquatic-born prey are not well described, particularly in subarctic streams important for Chinook salmon production. The objectives of this study-in-progress are to determine through time and in response to stream flow: 1) the seasonal influx of terrestrial invertebrates into the Chena River, central Alaska, 2) the proportion of aquatic and terrestrial prey in the drift, and 3) the predation on aquatic- and terrestrial-born prey by juvenile Chinook salmon. We deployed surface pan traps to collect terrestrial invertebrate inputs into the river, collected drifting invertebrates via subsurface drift nets, and sampled juvenile Chinook salmon diets in two stream reaches within a 100-km section of river. Juvenile Chinook salmon predominantly preyed upon chironomid midges, chloroperlid stoneflies, heptageniid mayflies, and various terrestrial invertebrates. Predation upon terrestrial prey increased in late summer. Understanding the spatial and temporal dynamics of terrestrial invertebrate infall into streams is important for determining their role in aquatic food webs and in the production of juvenile Chinook salmon.

**Student**

## Session – Contributed Papers

### **The relationship between spawning salmon abundance and the fitness of stream-dwelling fishes, Kenai Peninsula, Alaska**

**Daniel J. Rinella<sup>1</sup>, Mark S. Wipfli<sup>2</sup>, Craig Stricker<sup>3</sup>, and Ron Heintz<sup>4</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Dept of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK 99775; & Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK 99501*

*2: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK 99775*

*3: U.S. Geological Survey Stable Isotope Laboratory, Denver Federal Center, Denver, CO 80225*

*4: National Marine Fisheries Service, Auke Bay Laboratory, Juneau, AK 99801*

Understanding the dose-response relationship between salmon spawner abundance and the ecological benefits of marine-derived nutrients (MDN) is an important step in the development of salmon escapement goals that account for MDN supplies in stream ecosystems. Identifying spawner levels above which stream-dwelling fish cease to gain physiological benefits may be a direct and appropriate measure of the capacity of fish populations to utilize MDN. Juvenile coho salmon and Dolly Varden were collected during spring and fall from 11 streams on the Kenai Peninsula, south-central Alaska, that varied widely in salmon spawner densities (0.1 to 4.8 kg/m<sup>2</sup>). From these samples we measured RNA-DNA ratios (an index of recent growth rates) and energy density (kJ/g dry mass) as fitness measures, and nitrogen stable isotopes ( $\delta^{15}\text{N}$ ) as a low-cost proxy for fitness. Akaike Information Criterion ( $\text{AIC}_c$ ) was used to determine whether linear (i.e., no saturation) or logarithmic (i.e., saturation) models best approximated the relationship between spawner abundance and dependent variables. RNA-DNA ratios and energy density indicated a saturation response where values increased rapidly with spawner abundance up to approximately 1 kg/m<sup>2</sup> and then leveled off (except for Dolly Varden during fall, which were not successfully sampled at sites with high spawner abundance). Coho sampled during fall showed the strongest evidence for MDN saturation effects on RNA-DNA ratios ( $w_i = 0.64$ ,  $r^2 = 0.61$ ) and energy density ( $w_i = 0.87$ ,  $r^2 = 0.77$ ). Delta  $^{15}\text{N}$  showed little or no evidence of a saturation response, indicating that stable isotopes may not necessarily serve as reliable proxies for fitness responses in fish. Saturation points like those identified in this study may indicate a target spawner density that would balance salmon harvest with the ecological benefits of MDN in stream ecosystems.

**Student**

## Session – Contributed Papers

### **Growth responses of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) to food abundance and water temperature in the Chena River, interior Alaska.**

**Megan T. Perry<sup>1</sup>, Nicholas F. Hughes<sup>2</sup>, Mark S. Wipfli<sup>3</sup>, Jason R. Neuswanger<sup>1</sup>, and Matthew J. Evenson<sup>4</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775; 907-474-6740*

*2: Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*3: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*4: Alaska Department of Fish and Game Sport Fish Division, 1300 College Road, Fairbanks, Alaska 99701*

Chinook salmon (*Oncorhynchus tshawytscha*) population size often seems to be regulated by density-dependent factors during the first summer in fresh water, when environmental fluctuations appear to influence competition for food and space. The objectives of this work-in-progress are to determine the influence of water temperature and food intake on the growth and local abundance of juvenile Chinook salmon. We measured the effects of food supplementation on juvenile Chinook salmon in two 15-km reaches within a 50-km section of the Chena River, interior Alaska. Each study reach contained two control and two food-supplemented sites. Fish length was measured in situ using stereo videogrammetry, and fish abundance was estimated via mark-recapture techniques. Growth modeling is presently being used to compare spatial and temporal patterns of juvenile salmonid growth. During summer 2009, larger juveniles were observed at locations further downstream, where temperatures averaged 2°C warmer, and food additions had no significant effect on fish size, possibly suggesting that juvenile Chinook salmon were not food-limited during the course of this study. These results will help predict the effects of temperature and food abundance on Chinook salmon productivity and recruitment in the Chena and other Yukon River drainages.

**Student**

## Session – Contributed Papers

### **Migration timing, abundance, and egg-to-smolt survival of juvenile chum salmon in Clear Creek and Kwethluk River, Alaska**

**Sean E. Burrell<sup>1</sup>, Christian E. Zimmerman<sup>1</sup>, James E. Finn<sup>1</sup>, Carl F. Kretsinger<sup>2</sup>, and Daniel Gilikin<sup>3</sup>**

*1: U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508*

*2: Bureau of Land Management, Fairbanks District Office, Fairbanks, Alaska*

*3: U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska*

Chum salmon (*Oncorhynchus keta*) are distributed throughout Alaska and are one of the most abundant salmon species returning to the Yukon and Kuskokwim Rivers. Declines in chum salmon returns, in the late 1990s and early 2000s, resulted in unprecedented restrictions to subsistence and commercial fisheries and highlighted the need for more baseline data on chum salmon from this region. A better understanding of freshwater habitat productivity and survival of juvenile chum salmon would aid natural resource managers in decisions concerning future land-use authorizations, and improve their capability to forecast returns. We used inclined-plane traps and mark-recapture methods to monitor juvenile chum salmon seaward migration, estimate abundance, and determine egg-to-smolt survival at two study sites. Clear Creek in the Yukon River watershed was studied from 2002 – 2005 and Kwethluk River in the Kuskokwim River watershed was studied from 2007 – 2008. Migration began at both sites shortly after ice-out (early-May) and continued through late-May/early-June at Clear Creek, and into mid-June on the Kwethluk River. Abundance of migrating juvenile chum salmon peaked between mid- to late-May at both locations, ranging from 0.5 to 3.0 million in Clear Creek and 2.0 to 2.9 million in the Kwethluk River. Survival was higher in Clear Creek than in the Kwethluk River (range = 10.5 – 20.5% vs. 4.6 – 5.2%, respectively). Our studies are two of only a few to estimate freshwater abundance of wild juvenile chum salmon in Alaska, and provide the first estimates of smolt abundance and egg-to-smolt survival within the Yukon or Kuskokwim Rivers. Combined with future analyses (after fish return as adults), these data will enable us to partition survival between freshwater (egg-to-smolt) and marine phases, an important first step in evaluating the factors controlling salmon returns.

## Session – Contributed Papers

### **Otolith Chemistry Analyses Indicate that Water Sr:Ca is the Primary Factor Influencing Otolith Sr:Ca for Freshwater and Diadromous Fish but not for Marine Fish**

**Randy J. Brown<sup>1</sup> and Kenneth P. Severin<sup>2</sup>**

*1: U.S. Fish and Wildlife Service, 101 12th Ave., Room 110, Fairbanks, Alaska, 99701,  
Phone: (907) 456-0295  
randy\_j\_brown@fws.gov*

*2: University of Alaska Fairbanks, Department of Geology and Geophysics,  
Box 755780, Fairbanks, Alaska, 99775-5780  
(907) 474-5820*

Water chemistry is thought to be the primary factor influencing fish otolith chemistry. Experimental results with freshwater and diadromous fish have been consistent with this paradigm, but with marine fish they have often been ambiguous or contradictory. A review of water chemistry data indicated that Sr:Ca (mmol:mol) levels were higher in marine water than in most freshwater systems and that Sr:Ca variability was lower in marine water than in most freshwater systems. We therefore hypothesized that lifetime otolith Sr:Ca profiles of freshwater fish would exhibit low levels of Sr:Ca with moderate variability, of diadromous fish would exhibit highly variable Sr:Ca levels, and of marine fish would exhibit high levels of Sr:Ca with low variability. Otolith Sr:Ca profiles from 72 species in 35 families of freshwater, diadromous, and marine fish revealed that freshwater fish had low levels of Sr:Ca and lower variability than expected relative to marine fish, diadromous fish had Sr:Ca levels and variability that were consistent with expectations, and marine fish had high maximum Sr:Ca levels, as expected, and high Sr:Ca variability, similar in magnitude to diadromous fish, which was not expected. These findings indicate that water Sr:Ca is the primary factor influencing otolith Sr:Ca variation for freshwater and diadromous fish but not for marine fish.

## Session – Contributed Papers

### **Ecotypic Variation in Kuskokwim Sockeye Salmon: AYK SSI Project Update**

**Megan McPhee**

*Flathead Lake Biological Station  
32125 Bio Station Lane, Polson, MT 59860  
[megan.mcphee@umontana.edu](mailto:megan.mcphee@umontana.edu); (406) 214-1724*

Year-to-year variation in salmon run size causes difficulty for managers and fishermen trying to anticipate salmon returns and associated expenditures/income in the next fishing season. Recent evidence from the successful Bristol Bay sockeye salmon fishery has shown that “biocomplexity” contributes to regional run stability via the portfolio effect, where life history variability across local spawning populations leads to stability at the regional level. Because sockeye salmon are becoming increasingly important to fisheries in the Kuskokwim River, our study seeks to determine whether the biocomplexity that contributes to run stability in the Bristol Bay region is also present in Kuskokwim sockeye runs. To this end we are quantifying diversity in life-history, morphological, and genetic traits across spawning aggregations in two areas, the Holitna River and Telaquana Lake (Stony River drainage), and comparing our results to those from Bristol Bay populations. This talk will provide a synopsis of field efforts and results of preliminary analyses.

## Session – Contributed Papers

### **A review of the species status of the Angayukaksurak charr *Salvelinus anaktuvukensis* of Northern Alaska: perspectives from molecular and morphological data.**

**Scott D. Ayers<sup>1</sup>, Amanda E. Rosenberger<sup>2</sup>, and Eric (Rick) B. Taylor<sup>3</sup>**

*1: University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
P.O. Box 757220, Fairbanks, AK 99775  
scottdayers@gmail.com*

*2: University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
P.O. Box 757220, Fairbanks, AK 99775  
rosenberger@sfos.uaf.edu*

*3: University of British Columbia, Dept. of Zoology,  
6270 University Blvd., Vancouver, BC, CANADA, V6T 1Z4  
etaylor@zoology.ubc.ca*

In a region known for its complex and dynamic past, the Arctic is a unique place to examine drivers of diversity in life history strategies, particularly in species that colonize new or disturbed habitats. Of particular interest is how diversity in life history can contribute to speciation or endemism, as may be the case for the putative Angayukaksurak charr (*Salvelinus anaktuvukensis*). The goal of this project is to determine the species status *S. anaktuvukensis*; the only described freshwater fish endemic to Alaska. We examined the morphology (meristics and geometric morphometrics) and genetics (microsatellite and mitochondrial DNA) of Angayukaksurak charr and its closest relative, the Dolly Varden (*Salvelinus malma*) of northern Alaska. Meristic characters divided the specimens into three groups that corresponded to river drainage, primarily based on orbit width and anal fin ray count. Geometric morphometric analysis divided the specimens into two forms along nominal species lines based on body depth and minor shape differences that could, however, also be attributed to differences between anadromous and resident life history forms. Sequences from a 550bp section of the mitochondrial d-loop failed to segregate the putative Angayukaksurak charr into a single separate lineage, rather placing specimens into two previously resolved lineages (Arctic and Bering). In addition, differentiation between species was not evident based on analysis of microsatellite loci. We conclude that the Angayukaksurak charr of northern Alaska is a resident life history form (and junior synonym) of the Dolly Varden.

**Student**

## Session – Genetics and the Management of Fishery Resources in Alaska

### Genetic stock structure of giant Pacific octopus, *Enteroctopus dofleini*, in Alaska

P. Barry<sup>1</sup>, S. Tamone<sup>1,2</sup>, D.A. Tallmon<sup>1,2</sup>

*1: Univeristy of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
905 N. Koyukuk Drive, 245 O'Neill Building  
Fairbanks, Alaska 99775-7220  
[p.barry@uaf.edu](mailto:p.barry@uaf.edu)*

*2: University of Alaska Southeast, Department of Biology  
Point Lena Loop Rd. Juneau, Alaska 99801*

Mitochondrial DNA sequences from giant Pacific octopus, *Enteroctopus dofleini*, populations revealed an enigmatic pattern of phylogenetic structure. Due to renewed interest in a directed fishery for octopus, we investigated genetic variation within and between populations of *E. dofleini* throughout the Gulf of Alaska using the cytochrome oxidase I and II subunits (COI and COII) of the mtDNA genome. We sequenced 581 base pairs of two mtDNA loci for 137 octopuses from four locations: Southeast (SE), Glacier Bay (GB), Prince William Sound (PWS), and Kachemak Bay (KB). We observed five haplotypes, with two haplotypes that differed by 15 mutations (2.9% sequence divergence) accounting for over 97% of the sequences observed. Sequence divergence between haplotypes ranged from 0.2% to 3.1%. The majority of individuals sampled from GB and KB shared haplotype 1, while individuals from PWS and SE shared haplotype 3. Pairwise  $F_{ST}$  values and exact tests for population differentiation show strong divergence of GB from both PWS and SE, as well as of KB from both PWS and SE. No differentiation was observed between GB and KB or between PWS and SE. The presence of two highly divergent mtDNA lineages, overlapping in some locations, may reflect overlapping distributions of two of the three recognized subspecies of *E. dofleini*.

**Student**

## Session – Genetics and the Management of Fishery Resources in Alaska

### Genetic variability among populations of Alaska blackfish (*Dallia pectoralis*): How does it fit in the big picture?

Matthew A. Campbell and J. Andres Lopez

University of Alaska Fairbanks, Dept. of Biology and Wildlife,  
Fairbanks, Alaska 99775,  
[macampbell2@alaska.edu](mailto:macampbell2@alaska.edu)

Low diversity of species and low within-species genetic diversity are among the defining features of faunas in high temperate land masses when contrasted to tropical and subtropical assemblages. This reduced biological diversity is the combined product of biological and historical environmental factors. The determining biological factors are tied to the strong selection pressures expected to be prevalent in high temperate and arctic environments. Glacial cycling with its resulting extinctions, local extirpations, confinements to refugia, establishment of dispersal barriers and the subsequent rapid range expansion following glacial retreat stands as the most important historical determinant of the diversity distribution pattern in the freshwaters of northern North America. Partly as a result of that geologic history, freshwater fishes in Beringia show high dispersal abilities and very large ranges (eg. *Esox lucius*, *Lota lota*, *Oncorhynchus* sp.). The genus *Dallia* (Esocidae), with a distribution restricted to Beringia, is an exception to that rule. Up to three species are currently recognized in the genus using diagnostic morphological characters. *Dallia pectoralis* occurs across Western Alaska, Central Alaska in the Yukon River drainage, and on the North Slope, as well as extreme Eastern Russia (Chukotka Peninsula). *Dallia admirabilis* is described from the Amguema River basin and *D. delicatissima* is reported to occur on the northern Chukotka Peninsula. In Alaska, a Colville River population of *Dallia* has a constant diploid number of  $2n = 74$ , while chromosome number in fish from the Yukon River varies within individuals from  $2n = 70$  to  $2n = 82$ , with the population having a diploid number of  $2n = 76$  or  $78$ . The diagnostic morphological characters proposed to differentiate Russian populations of *Dallia* at the species level have not proven informative when applied to the karyotypically distinct populations in Alaska. In this study we provide a baseline perspective on the extent of genetic variability in Alaskan populations of *Dallia* and the implied relationships between Central, Western, and Northern Alaskan populations.

Student

## Session – Genetics and the Management of Fishery Resources in Alaska

### Characterization of 15 single nucleotide polymorphisms in Alaska red king crab

Wei Cheng<sup>1</sup>, Jeffrey R. Guyon<sup>2</sup>, William S. Grant<sup>1</sup>, Zac Grauvogel<sup>1</sup>, Christopher A. Sasaki<sup>3</sup>, and William D. Templin<sup>1</sup>

*1: Alaska Department of Fish and Game, Gene Conservation Laboratory, Anchorage AK 99518, [wei.cheng@alaska.gov](mailto:wei.cheng@alaska.gov); [william.grant@alaska.gov](mailto:william.grant@alaska.gov); [zac.grauvogel@alaska.gov](mailto:zac.grauvogel@alaska.gov); [bill.templin@alaska.gov](mailto:bill.templin@alaska.gov)*

*2: Auke Bay Laboratories, NOAA Fisheries, Juneau, Alaska, 99801, [Jeff.Guyon@noaa.gov](mailto:Jeff.Guyon@noaa.gov)*

*3: Clemson University Genomics Institute, Clemson, South Carolina 29634, [csaski@genome.clemson.edu](mailto:csaski@genome.clemson.edu)*

Fifteen single nucleotide polymorphism (SNP) assays have been developed for red king crab (*Paralithodes camtschaticus*), which is the base for an important commercial fishery in Alaska. The SNPs were discovered by constructing a red king crab genomic DNA library, sequencing a portion of 1339 random clones, amplifying the homologous region from a collection of crab DNA isolated from disparate locations, and comparing the resulting sequences. *Taqman* assays were designed for 39 putative SNPs and 15 were shown to be specific. These 15 SNPs were canvassed from four widely separated populations in the North Pacific and Bering Sea and a substantial amount of differentiation was detected among the grouped samples. Minor allele frequency differences ( $\Delta q$ ) among samples ranged from 0.02 to 0.29, resulting in  $F_{ST}$  values ranging from 0.00 to 0.18 among SNPs and in an overall  $F_{ST} = 0.045$ .

## **Session – Genetics and the Management of Fishery Resources in Alaska**

### **Migration timing of sockeye salmon (*Oncorhynchus nerka*) smolt in the Chignik Watershed, Alaska: mixed stock analysis using single nucleotide polymorphisms**

**Lisa Creelman<sup>1</sup>, Lorenz Hauser<sup>1</sup>, Lisa Seeb<sup>1</sup>, Mark Witteveen<sup>2</sup>**

*1: University of Washington, School of Aquatic and Fishery Sciences,  
Seattle, WA 98195*

[lisakc@u.washington.edu](mailto:lisakc@u.washington.edu), [lhauser@u.washington.edu](mailto:lhauser@u.washington.edu), [lseeb@u.washington.edu](mailto:lseeb@u.washington.edu)

*2: Department of Fish and Game, Commercial Fisheries Division  
211 Mission Road, Kodiak, AK 99615*

[mark.witteveen@alaska.gov](mailto:mark.witteveen@alaska.gov)

The Chignik River watershed, on the Alaska Peninsula, supports a highly productive population of sockeye salmon. The watershed consists of two lakes, Black Lake and Chignik Lake, which each support genetically distinct sockeye salmon populations. Recent shallowing of Black Lake, may cause juvenile sockeye salmon, which have historically overwintered in Black Lake, to migrate downstream to Chignik Lake. Increased intra-specific competition between these distinct populations in Chignik Lake may influence size, age, and timing of smoltification and subsequent seaward migration. The objective of our study is to assess differences in migration timing between populations, by estimating mixture proportions in samples of out-migrating smolts from 2006-2008 using a single nucleotide polymorphisms (SNPs) baseline. Results show that migration trends in 2006 and 2008 for Black and Chignik lake subpopulations were similar, while in 2007 migration trends were nearly opposite. These results suggest that migration timing is driven by environmental variation and intra-specific competition in both Black and Chignik lakes. Recent reduction in the volume of Black Lake may have amplified the influence of environmental fluctuations and reduced rearing habitat available to juvenile sockeye salmon in the Chignik River watershed.

**Student**

## Session – Genetics and the Management of Fishery Resources in Alaska

### Form and function of sockeye life history

Scott A. Pavey<sup>1,2</sup>, Jennifer L. Nielsen<sup>3</sup>, Troy R. Hamon<sup>1</sup>, Felix Breden<sup>2</sup>

*1: Katmai National Park  
PO Box 7, King Salmon, AK 99613  
[scott\\_pavey@nps.gov](mailto:scott_pavey@nps.gov); [troy\\_hamon@nps.gov](mailto:troy_hamon@nps.gov)*

*2: Simon Fraser University, Department of Biological Science  
8888 University Drive, Burnaby, BC V5A 1S6, CANADA  
[breden@sfu.ca](mailto:breden@sfu.ca)*

*3: US Geological Survey, Alaska Science Center  
4210 University Drive, Anchorage, AK, 99508  
907-786-7062; [jlnielsen@usgs.gov](mailto:jlnielsen@usgs.gov)*

Anadromous sockeye salmon (*Oncorhynchus nerka*) exhibit great diversity in life history strategy. Juveniles rear and adults spawn in different habitats. In this study, we sampled juvenile that reared in river and lake habitats. Due to the ecological differences, fish behavior also differed. Riverine rearing juveniles stay out of the current, defend territories, are subject to high predation, and eat relatively large food particles floating downstream; so burst swimming is favored. Lake rearing juveniles feed in schools on small zooplankton, are not territorial and subject to low predation, so constant swimming is favored. We compare body shape and gene expression of muscle in these two populations. Lake rearing sockeye have a more streamlined body shape compared to the deep robust shape of river rearing sockeye. We found 77 genes that were differentially expressed in muscle tissue. Preliminary analysis suggests putative genes up-regulated in lake rearing sockeye are associated with aerobic respiration, vascularization and slow twitch muscle contraction regulation whereas groups up-regulated in river rearing sockeye are associated with anaerobic respiration and growth.

## **Session – Genetics and the Management of Fishery Resources in Alaska**

### **Inseason Genetic Stock Identification of Chinook Salmon in Yukon River Test Fisheries**

**Nick DeCovich, William Templin**

*Alaska Dept. of Fish and Game, Gene Conservation Laboratory  
333 Raspberry Road, Anchorage AK 99518  
[nick.decovich@alaska.gov](mailto:nick.decovich@alaska.gov); [bill.templin@alaska.gov](mailto:bill.templin@alaska.gov)*

This study evaluated the feasibility of in-season mixed stock analysis of Chinook salmon (*Oncorhynchus tshawytscha*) harvested in test fisheries of the Lower Yukon River in 2008 and 2009. In 2008, 900 fish representing three major pulses in the fishery were analyzed. We estimated stock composition in each pulse, including at least three broad-scale reporting regions. The proportion of Canadian-origin Chinook salmon in each pulse ranged from a high of 53% during the first pulse to a low of 43% during the second pulse. In 2009, it was difficult to detect pulses in the Lower Yukon Test Fishery (LYTF), and 1221 fish from the LYTF and Pilot Station Test Fishery, representing four strata, were analyzed. The estimated proportion of Canadian-origin Chinook salmon in each stratum ranged from a high of 70% in the first stratum to a low of 43% in the fourth stratum. In each year, the low overall run strength combined with in-season genetic information on the Canadian-bound proportion of the run highlighted concerns regarding the run's capacity to meet the escapement goal at the Canadian border and subsistence harvests. Subsequently, fishery managers implemented reductions in the subsistence fishery and delayed the summer chum salmon commercial fishery.

## Session – Genetics and the Management of Fishery Resources in Alaska

### Comparative landscape genetic analysis of co-occurring salmon species in the AYK region

Jeffrey B. Olsen<sup>1</sup>, Terry D. Beacham<sup>2</sup>, Penelope A. Crane<sup>1</sup>, Blair G. Flannery<sup>1</sup>,  
Lisa W. Seeb<sup>3</sup>, William D. Templin<sup>4</sup>, John K. Wenburg<sup>1</sup>

*1: Conservation Genetics Laboratory, U.S. Fish and Wildlife Service  
Anchorage AK, 99503*

*[Jeffrey\\_Olsen@fws.gov](mailto:Jeffrey_Olsen@fws.gov), [penelope\\_crane@fws.gov](mailto:penelope_crane@fws.gov), [blair\\_flannery@fws.gov](mailto:blair_flannery@fws.gov),  
[john\\_wenburg@fws.gov](mailto:john_wenburg@fws.gov)*

*2: Molecular Genetics Laboratory, Department of Fisheries and Oceans Canada,  
Pacific Biological Station, Nanaimo B.C., Canada V9T 6N7*

*[BeachamT@pac.dfo-mpo.gc.ca](mailto:BeachamT@pac.dfo-mpo.gc.ca)*

*3: Lisa W. Seeb, School of Aquatic and Fisheries Sciences, University of Washington,  
Seattle WA., 98105, [lseeb@u.washington.edu](mailto:lseeb@u.washington.edu)*

*4: Alaska Department of Fish and Game, Gene Conservation Laboratory  
Anchorage, Alaska, USA 99518*

*[bill.templin@alaska.gov](mailto:bill.templin@alaska.gov)*

In this study, we used landscape genetic analyses to compare and contrast habitat features influencing population structure of Chinook, chum, and coho salmon in the Yukon and Kuskokwim Rivers and Norton Sound. We tested the hypothesis that the three watersheds are the primary determinant of hierarchical population structure. An analysis of molecular variance for spatially defined samples revealed a single large coastal group and one or more inland groups for each species. These results suggested that hierarchical population structure occurs primarily along a latitudinal axis, which is dominated by the Yukon River, rather than the much shorter longitudinal axis that defines the relative position of the three watersheds. We also tested the hypothesis that the same habitat features influenced the population structure of each species. At the region-wide scale our analyses indicated that no single habitat variable was strongly correlated to population structure. However, the variable mean annual precipitation was common among all species and one of two (chum and coho) or three (Chinook) variables that, in combination, may partially explain the population structure of each species.

## **Session – Genetics and the Management of Fishery Resources in Alaska**

### **Patterns of stock composition in the Port Moller Test Fishery in 2006 – 2008**

**Tyler Dann<sup>1</sup>, Chris Habicht<sup>1</sup>, Heather Hoyt<sup>1</sup>, Andy Barclay<sup>1</sup>, Tim Baker<sup>1</sup>, Jim Seeb<sup>2</sup>**

*1: Alaska Department of Fish and Game, Commercial Fisheries Division  
Anchorage, AK. 99518*

*[tyler.dann@alaska.gov](mailto:tyler.dann@alaska.gov), [chris.habicht@alaska.gov](mailto:chris.habicht@alaska.gov), [heather.hoyt@alaska.gov](mailto:heather.hoyt@alaska.gov),  
[andy.barclay@alaska.gov](mailto:andy.barclay@alaska.gov), [tim.baker@alaska.gov](mailto:tim.baker@alaska.gov)*

*2: University of Washington, School of Aquatic and Fishery Sciences  
Seattle, WA 98195*

*[jseeb@u.washington.edu](mailto:jseeb@u.washington.edu)*

The Port Moller Test Fishery is currently a cooperative program between Alaska Department of Fish and Game, University of Washington, Bristol Bay Science and Research Institute and area processors to provide in-season run strength information for sockeye salmon returning to Bristol Bay drainages. Starting in 1968, age composition data were used to infer stock composition from this fishery; however, this method lacked power to discriminate among all the drainages with useful accuracy. Recently, genetic stock identification (GSI) methods were developed to determine the stock composition (to drainage) of mixtures for sockeye salmon returning to Bristol Bay. We used these GSI methods to analyze mixtures from the Port Moller Test Fishery in-season during 2006-2008 to assess relative run strength to help shape fisheries openings. Here we compare stock compositions, and associated CPUE, to inshore returns to better understand spatial (distance from shore) and temporal (early-mid-late season) influences on stock composition.

## Session – Genetics and the Management of Fishery Resources in Alaska

### A 40-year retrospective of catch compositions of sockeye salmon (*Oncorhynchus nerka*) in Bristol Bay

Matt Smith<sup>1</sup>, Lowell Fair<sup>2</sup>, Chris Habicht<sup>2</sup>, Lisa Seeb<sup>1</sup>, Jim Seeb<sup>1</sup>

*1: University of Washington, School of Aquatic & Fishery Sciences,  
Seattle, WA 98195*

[smithm8@u.washington.edu](mailto:smithm8@u.washington.edu), [lseeb@u.washington.edu](mailto:lseeb@u.washington.edu), [jseeb@u.washington.edu](mailto:jseeb@u.washington.edu)

*2: Alaska Department of Fish and Game, Commercial Fisheries Division  
Anchorage, AK 99518*

[lowell.fair@alaska.gov](mailto:lowell.fair@alaska.gov), [chris.habicht@alaska.gov](mailto:chris.habicht@alaska.gov)

We are currently using archived sockeye salmon scales to provide historical catch composition in the fishing districts of Bristol Bay. The Bristol Bay Management Area supports the largest commercial sockeye salmon fishery in the world, with harvests ranging from 5–45 million fish annually and a recent 10-year average of about 21 million fish. The fishery is divided into five discrete fishing districts (Egegik, Naknek-Kvichak, Nushagak, Togiak, and Ugashik) designed to target populations destined for major drainages. The take of some fish from out-of-district is inevitable. However, the magnitude of this take is uncertain. We used genetic stock identification with 45 single nucleotide polymorphism (SNP) markers to report a time series of stock compositions in the Egegik, Naknek-Kvichak, and Nushagak districts from 1964-2005. These districts have the greatest potential for significant allocation errors in existing brood tables, potentially eroding the effectiveness of MSY management. Historical catch composition estimates will result in greater accuracy in brood tables which will allow for improved pre-season forecasting, in-season forecasting, and escapement goals, ultimately providing for a more sustainable and economically viable fishery that will benefit local communities and the fishing industry.

**Student**

## Session – Genetics and the Management of Fishery Resources in Alaska

### Identification of hybrid whitefish

Sara M. Turner<sup>1</sup>, Kristin Amstrup<sup>2</sup>, and Jennifer Nielsen<sup>1</sup>

*1: USGS Alaska Science Center  
4210 University Dr., Anchorage, AK 99508  
[saraturner@usgs.gov](mailto:saraturner@usgs.gov); [jlnielsen@usgs.gov](mailto:jlnielsen@usgs.gov)*

*2: Independent Contractor  
[kamsrtup@usgs.gov](mailto:kamsrtup@usgs.gov),*

Arctic cisco (*Coregonus autumnalis*), an anadromous whitefish, are an important subsistence resource for the village of Nuiqsut, Alaska. In an attempt to determine the population of origin for Arctic cisco collected from the Colville River we have sequenced a 594bp region of the mitochondrial gene ATPaseVI. Thus far, 19 unique haplotypes have been identified in samples collected from both the Colville and Mackenzie rivers. Four fish collected have highly divergent sequences compared to other Arctic cisco collected. Previous work has suggested that three of these samples align exactly with the Yukon River Bering cisco. The fourth haplotype differs from both Bering and Arctic cisco haplotypes. This suggests a past hybridization event or misidentification of samples collected in the field. Here we present new data collected from other whitefish species in order to determine if hybridization may have occurred with species other than the Yukon River Bering cisco.

# **Session – Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

## **Study of the Nome River Salmon Habitat Using PRISM, PALSAR, and TerraSAR-X data.**

**Rick Guritz<sup>1</sup>, Daniel Miller<sup>2</sup>, and Kelly Burnett<sup>3</sup>**

*1: Alaska Satellite Facility (ASF), Geophysical Institute  
University of Alaska Fairbanks, 903 Koyukuk Dr., Fairbanks, Alaska 99775-7320*

*2: Earth Systems Institute  
3040 NW 57th St., Seattle. Washington 98107*

*3: U.S. Forest Service, Pacific Northwest Research Station,  
3200 SW Jefferson Way, Corvallis, Oregon 97331*

Given current limitations of accurate geospatial data for the State of Alaska, ALOS PRISM and PALSAR data provide many unique characteristics that are important to scientific research. Habitat quantity and quality are key drivers of salmon abundance and distribution in freshwater. Advancing limited knowledge about how these drivers affect salmon in the Arctic-Yukon-Kuskokwim (AYK) system is the overarching goal of this project. Research efforts to date have included the processing and evaluation of ALOS PRISM and PALSAR data for 1) delineation of the stream network, and 2) generation of digital elevation data from which landscape and geomorphic structure can be evaluated specific to the watershed. Comparisons between existing data and ALOS-derived products will be presented. A number of commercial off-the-shelf software packages were used in the processing of this data, including GammaRS, ENVI, and PCI software. The presentation will include feedback on the use of these software tools and any observed limitations specific to ALOS data. The presentation will also compare the accuracies of existing and newly created DEMs for the study area. A second more challenging objective is the classification of river ice during the winter season using TerraSAR-X data. Ice is classified into three classes: open water, ice over water, and ice frozen to the bottom, for the purpose of characterizing potential over-winter salmon habitat in rivers. A time series of TerraSAR-X data was collected and is being processed to evaluate and monitor changes to the habitat during the winter season. Selection of TerraSAR-X data over ALOS PALSAR was primarily driven by the limited size of the Nome River which has a channel width that varies from 10 to 30 meters in its main stem. We will show some early results of this analysis.

# **Session – Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

## **Spatial and Temporal Analyses of Bering Sea Groundfish Harvest and Fleet Effort**

**Jonathan Kamler<sup>1</sup> and Steve Lewis<sup>2</sup>**

*1: Seventeenth Coast Guard District, Response & Enforcement Branch  
P.O. Box 25517, Juneau, AK 99801  
[jonathan.w.kamler@uscg.mil](mailto:jonathan.w.kamler@uscg.mil)  
907-463-2213*

*2: NOAA Alaska Region, Analytical Team  
P.O. Box 21608, Juneau, AK 99802  
[steve.lewis@noaa.gov](mailto:steve.lewis@noaa.gov)  
907-586-7858*

The NOAA Catch-In-Areas (CIA) database was developed by NOAA fisheries and has been used extensively by US Coast Guard fisheries enforcement to help understand the spatial and temporal nuances of both fleet behavior and fisheries harvest. The database provides insights on intra-annual fleet behavior, inter-annual trends over a variety of spatial resolutions, and inter-annual geostatistical analyses of both catch and fishing patterns. The database integrates a variety of data sources including Observer data and Vessel Monitoring System (VMS) data. VMS data is matched to Groundfish Catch Accounting System (CAS) and cross-referenced to observer records. The Groundfish CAS database serves as the central repository for all groundfish harvest data and uses NMFS Reporting Areas as the spatial unit, most of which are several hundred nautical miles across. The NMFS Reporting areas are initially subdivided by State Statistical Areas, which are approximately 30x30 nautical miles. The final CIA database subdivides the spatial units into an even finer grid. The CIA grids are approximately 7x7 kilometers and have been further subdivided by Steller Sea Lion management areas and state and federal waters boundaries. While the Bering Sea currently provides for the highest accuracy for the CIA database (and is the focus of the analyses presented here), the Gulf of Alaska also benefits highly from the VMS enabled dataset due to the lightly observed fleet. The CIA database has facilitated the documentation of a northward extension of both catch and effort along the continental shelf break of the Bering Sea. Finely detailed catch and effort patterns (not previously evident) such as migration, dispersal, density, and patchiness can be discerned using the CIA database. This information highlights challenges and helps identify options for scientists, managers, and enforcement in the Bering Sea.

# **Session – Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

## **Demersal Fishes in the Chukchi Sea**

**Brenda L. Norcross and Brenda A. Holladay**

*University of Alaska Fairbanks  
School of Fisheries and Ocean Sciences  
P.O. Box 757220, Fairbanks, AK 99775  
[norcross@ims.uaf.edu](mailto:norcross@ims.uaf.edu); 907-474-7990*

The rapid warming of the Arctic climate makes it imperative to establish a baseline of fish resources before expected changes occur. Baseline fish data in the Chukchi Sea are very limited; sampling has occurred approximately every 20 years. Prior to 2004 only 10 cruises were conducted. From 2004 through 2008 we conducted four cruises, with another four cruises being conducted in 2009. The cruises were all multidisciplinary; in addition to collecting fish with a bottom trawl, bottom temperature and salinity measurements were taken at each station. We used a statistical technique with which biologists are familiar, cluster analyses, to identify four bottom water masses in the Chukchi Sea. Statistical clusters distinguished among Chukchi water mass types as clearly as the standard physical oceanographic TS diagrams. Habitats occupied by small demersal fishes were characterized by sediment type, bottom salinity, and bottom temperature. The water mass and habitat characteristics with which demersal assemblages were associated create a baseline to measure anticipated effects of climate change that are expected to be most severe at high latitudes. Monitoring fish assemblages could be a tool for assessing the effects of climate change. Climate-induced changes in distributions of species would result in a restructuring of fish assemblages in the Chukchi Sea.

# **Session – Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

## **Environmental Data Integration and Delivery – Some Free Shortcuts for ArcGIS, Matlab & R**

**Cara Wilson<sup>1</sup>, Roy Mendelsohn<sup>1</sup>, Dave Foley<sup>1,2</sup> and Eoin Howlett<sup>3</sup>**

*1: NOAA/NMFS Southwest Fisheries Science Center, Environment Research Division  
1352 Lighthouse Avenue, Pacific Grove, CA 93950  
[cara.wilson@noaa.gov](mailto:cara.wilson@noaa.gov); 831-648-5337*

*2: Joint Institute for Marine and Atmospheric Research  
University of Hawai'i at Manoa  
1000 Pope Road, Marine Science Building 312, Honolulu, HI 96822*

*3: Applied Sciences Associates (ASA), Inc  
55 Village Square Drive, South Kingstown, RI 02879  
401 789-6224*

The continuity, global coverage, and high temporal and spatial resolution of satellite data make it an important tool for monitoring and characterizing marine ecosystems, but the scientific formats they are typically stored in, such as Grib, HDF and NetCDF, are not easily accessible by users unfamiliar with them. For example, importing satellite data in ArcGIS, a tool used by many fisheries scientists, has traditionally been a cumbersome process. To alleviate this difficulty, NOAA Fisheries (SWFSC/ERD) contracted ASA to build a new extension for ArcGIS that allows users to browse Thematic Real-time Environmental Distributed Data System (THREDDS) catalogs and connect directly to OPeNDAP servers to access large amounts of scientific data and ingest the data into ArcGIS. The resulting Environmental Data Connector (EDC) extension uses a Java-based browser and leverages existing components from the Unidata libraries so that users can filter large amounts of data in space and time. The data is then converted to raster or feature classes in ArcGIS and is available for standard GIS analysis and display. The raster and feature data are connected to ASA's TimeSlider™ extension so that the data may be animated and analyzed over time. Special customizations were made to the TimeSlider for this project to manage data with non-uniform time-steps; the scientific data is highly variable in time with some data, such as in-situ current and wind measurements, being measured every few minutes to climate data that may be measured in terms of decades. A new version is under development that will also allow access to sensor data served by IOOS SOS (Sensor Observation Service) protocol. In addition to the EDC, there are free routines available that allow client-side access of environmental data using Matlab and R (freeware). These “xtractomatic” routines access data served by THREDDS and perform extractions such as:

## **Session – Fisheries Distributions, Movements, Migration, and Management as Outgrowths of Oceanic Change: Well, Isn't That Spatial!**

### **Environmental Data Integration and Delivery – Some Free Shortcuts for ArcGIS, Matlab & R (Continued)**

1. extract a given dataset (SSH, SST, chlorophyll, etc) along the track of an animal or ship given input of time, and longitude and latitude
2. extract all available data in a 3-dimensional cube specified by limits of longitude, latitude and time.
3. Extract data within a region masked by a user-supplied polygon, for example a Marine Protected Area or an Exclusive Economic Zone.

These tools are freely available at:

<http://www.pfeg.noaa.gov/products/EDC/>

<http://coastwatch.pfel.noaa.gov/xtracto/>

## **Session – Alaskan Coastal Waters: Biology, Ecology, and Ecosystem Services**

### **The Use of Thermal Marking in Alaska and the North Pacific Ocean: It's Application to Management of Pacific Salmon**

**Beverly Agler**

*Alaska Department of Fish and Game, Mark, Tag, and Age Laboratory  
10107 Bentwood Place, Juneau, AK 99801  
907-465-3498; [bev.agler@alaska.gov](mailto:bev.agler@alaska.gov)*

The Alaska Department of Fish and Game has been using otolith thermal marking of hatchery-raised salmonids to distinguish stocks and assist with management of mixed-stock fisheries for 16 years. Thermal marked otoliths have also provided insight into the high seas distribution and movements of salmonids in the North Pacific Ocean and the Bering Sea. Analysis of thermal marked otoliths has replaced coded-wire tags in several instances. Alaska released approximately 1.23 billion thermal marked salmon (40% chum, 55% pink) in 2008, and the statewide ADFG Thermal Mark Lab in Juneau processes ~20,000-30,000 otoliths per year from returning adult salmon. Within Alaska, the statewide lab, as well as several other labs (ADFG Cordova and a few hatcheries) examines thermal marks to provide timely information for management of local fisheries and to assess effectiveness of hatchery processes. ADFG also works with the North Pacific Anadromous Fish Commission Working Group on Salmonid Marking to coordinate thermal marks throughout the North Pacific Ocean. The number of thermal marks Alaska applied to salmonids increased steadily until 2001. From 2001-present Alaska has marked 68-78 different mark groups each year. Digital images of otolith thermal mark patterns and release information for all NPAFC countries are available on the Internet. There are no “known” otoliths; consequently, thermal mark lab staff second read at least 50% of each year's samples to assess inter-reader accuracy. In this talk, I will show the ADFG and NPAFC internet sites and discuss the usefulness of thermal marks in managing Alaska's fisheries.

## **Session – Alaskan Coastal Waters: Biology, Ecology, and Ecosystem Services**

### **Large-scale Patterns in Nearshore Marine Fish Assemblages**

**Darcie Neff, Scott W. Johnson, and John F. Thedinga.**

*NOAA Fisheries, Alaska Fisheries Science Center, Auke Bay Laboratories  
17109 Point Lena Loop Rd., Juneau, AK 99801  
[darcie.neff@noaa.gov](mailto:darcie.neff@noaa.gov); (907) 789-6066*

Shallow, nearshore waters (<5 m deep, <20 m from shore) are an important component of Alaska's marine environment. Nearshore areas provide protection from predators, and nursery and spawning habitat for many commercially important and forage fish species. Nearshore areas are often ignored in fisheries surveys and are particularly vulnerable to human disturbance. During the last 10 years (1998-2008), more than 670,000 fish comprising over 100 species were captured by beach seine in four different habitat types (bedrock outcrops, eelgrass, kelp, and sand-gravel beaches) in four regions of Alaska (Arctic, Aleutian Islands, Prince William Sound (PWS), and southeastern Alaska). Analyses of fish distribution, relative abundance, species richness, and habitat use exhibited large-scale regional patterns. Pacific sand lance, for example, dominated catches in the Aleutian Islands, whereas capelin dominated catches in the Arctic. Relative abundance and species richness were higher in vegetated habitats (e.g., eelgrass) than in non-vegetated habitats (e.g., bedrock outcrops). Some species were closely associated with certain habitats; saffron cod were almost exclusively captured in eelgrass in PWS. Baseline information on distribution, relative abundance, and habitat use of nearshore fishes will help resource managers track long-term and large-scale changes in fish communities that may result from human disturbance or global climate change.

## **Session – Alaskan Coastal Waters: Biology, Ecology, and Ecosystem Services**

### **Edge effects and patch size dynamics of Alaskan kelp forest fish populations.**

**Terril Efird and Brenda Konar**

*University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
245 O'Neill Bldg.: PO Box 757220  
Fairbanks, Alaska 99775-7220*

Fish distribute based on habitat preference. Examples for this include pelagic vs. demersal and sandy bottom vs. rocky reef. Within broad scale habitats, a finer scale of habitat choices is present. Kelp forests offer fish microhabitats based on several aspects. These incorporate spatial factors, such as forest size and location within a forest; biotic factors, like kelp species composition and understory abundance; and abiotic factors, including rugosity, exposure, and bottom type. How these fine scale habitat features affect the associated fish assemblages in Alaska is poorly understood. This should be a topic of concern as Alaska's kelp forests serve as spawning/mating grounds, feeding grounds, predator avoidance and shelter from currents for many commercial, recreational, and subsistence harvested species. Furthermore, kelp forests are in a state of flux. Studies have shown that forests are shrinking, not returning to their previous extent, and undergoing shifts in forest forming algae. The objectives of this study were to investigate if fish abundance differed across a range of kelp forest sizes, and moreover, to determine if fish abundance differed between interior and edge microhabitats. To address these objectives diver-based visual 100 m<sup>2</sup> belt transects were performed at 10 sites in Kachemak Bay. Transects were run along the edge of the forest and within the interior of the forest. Sites were mapped with a GPS by circumnavigating the canopy kelp at low tide with a small boat. The results of these surveys show distinct patterns of relative abundances among 28 species of fish based on their observed microhabitats. Kelp forests included in this study ranged from 2,522 m<sup>2</sup> to 1.8 km<sup>2</sup>, representing the distribution of forest sizes in the region. Future management and conservation decisions should take these findings into consideration when addressing Alaska's dynamic kelp forests and how nearshore fish populations may respond.

**Student**

**Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”**

**Biological, Chemical, and CPUE Evidence of Annual Spawning Migrations of Anadromous Coregonid Fishes in the Yukon River**

**Randy J. Brown<sup>1</sup>, David W. Daum<sup>1</sup>, Bill Carter<sup>1</sup>, and Stan Zuray<sup>2</sup>**

*1: U.S. Fish and Wildlife Service, 101 12<sup>th</sup> Ave., Room 110, Fairbanks, Alaska 99701  
(907) 456-0295*

*2: Rapids Research Center  
P.O. Box 172, Tanana, Alaska 99777*

Coregonid fishes are found throughout the Yukon River drainage in northwest North America where they contribute to major food fisheries. Salmon species have dominated fish management and research efforts in the drainage since the 1920s. As a result, Coregonid species have been largely ignored. We studied five Coregonid species at a fish wheel sampling site 1,200 km from the sea. They were inconnu *Stenodus leucichthys*, broad whitefish *Coregonus nasus*, humpback whitefish *C. clupeaformis*, Bering cisco *C. laurettae*, and least cisco *C. sardinella*. Maturity indices indicated nearly all were mature fish preparing to spawn. Length and otolith-derived age data established species-specific minimum lengths and ages of maturity. Analyses of otolith strontium levels revealed that anadromy was common for all five species. Radio tags were implanted in subsamples of fish from several species to identify spawning destinations. Major spawning habitats were located in the Yukon Flats, an extensive braided region of the river 400 to 500 km upstream from the fish wheel sampling site. The video-equipped sampling fish wheel provided seven years of species-specific CPUE data revealing predictable, seasonal spawning migrations for all species except least cisco. Together, these data indicated that major spawning migrations of anadromous Coregonid species ranged as far as 1,700 km upstream.

**Session – Management of Whitefishes in Alaska: “What do we know  
and where do we start?”**

**Lower Yukon River commercial whitefish fishery, a challenge for managers**

**Larry DuBois**

*Alaska Dept. of Fish and Game, Commercial Fisheries Division  
333 Raspberry Road, anchorage, AK 99518  
[Larry.dubois@alaska.gov](mailto:Larry.dubois@alaska.gov)*

Recent commercial interest in Yukon River whitefish *Coregonus* spp. has garnered concern among biologists about its sustainability. Scant information exists about the biology, distribution, abundance, productivity, and harvest of these whitefish species, which is essential for sustainable management of the fishery. Since 2005, ADF&G has allowed a freshwater commercial fishery targeting whitefish in the lower Yukon River delta area with an annual harvest limit of 10,000 lbs. Species composition, age, sex, length, and maturity information has been collected from these harvests. This presentation will provide an overview of available data, challenges, and future directions of the ADF&G whitefish harvest and monitoring program.

## **Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”**

### **Spawning movements of humpback whitefish and least cisco in the Chatanika River**

**Aaron Dupuis and Trent Sutton**

*University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
905 Koyukuk Drive, Fairbanks, AK 99775  
907-474-5032; a.dupuis@sfos.uaf.edu*

Humpback whitefish *Coregonus pidschian* and least cisco *C. sardinella* in the Chatanika River support a popular fall spear fishery. Little is known about the current distribution of spawning areas and the seasonal migrations of these fish. The objectives of this study were to describe and identify the movements and spawning areas of humpback whitefish and least cisco in the Chatanika River-Minto Flats complex. Radio telemetry was used to monitor the spawning migrations and locate spawning areas. A total of 160 and 15 radio transmitters were surgically implanted into humpback whitefish and least cisco, respectively. Fish movements were monitored with weekly boat surveys, aerial tracking, and automated receiving stations. Telemetry data indicated that humpback whitefish leave their summer feeding areas in Minto Flats in the early summer and reach their spawning areas in the Chatanika River by late summer. Spawning appears to take place in late fall and is confined to a 30 km stretch of river between Any Creek and the Elliot Highway bridge. Recent data suggest the possibility that a component of the Minto Flats whitefish actually migrate out of Minto Flats to spawn in the Tanana River upstream of Nenana. These data increase our understanding of the dynamic behavior of these fish in this system.

**Student**

## **Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”**

### **Identification and characterization of inconnu spawning habitat in the Sulukna River, Alaska**

**Jonathon Gerken<sup>1</sup>, F. Joseph Margraf<sup>2</sup>, and Randy Brown<sup>3</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, POB 757020 Fairbanks, AK 99775. ph: (907) 474-7661, fax: (907) 474-7872 email: [fsjdg11@uaf.edu](mailto:fsjdg11@uaf.edu)*

*2: U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, Fairbanks, AK 99775-7020. ph: (907) 474-6044, fax: (907) 474-7872 email: [ffjfm1@uaf.edu](mailto:ffjfm1@uaf.edu)*

*3: Fairbanks Fish and Wildlife Field Office, US Fish and Wildlife Service, 101 12<sup>th</sup> Ave Rm. 110 Fairbanks, AK 99701. ph: (907) 456-0295, fax: (907) 455-1853 email: [randy\\_j\\_brown@fws.gov](mailto:randy_j_brown@fws.gov)*

Inconnu *Stenodus leucichthys* are present throughout much of the Yukon River drainage in Alaska, but only five spawning areas have been identified. Radio telemetry studies indicate that nearly all inconnu in the drainage originate in one of these five spawning areas. Spawning habitat requirements are therefore thought to be very specific; however, the physical qualities of these habitats have not been characterized. The Sulukna River is one of five identified inconnu spawning areas within the Yukon River drainage. A systematic sampling design was used in September and October of 2007-2008 to define Sulukna River spawning locations. Presence of inconnu was identified using hook/line sampling and spawning was verified by catching broadcast eggs in plankton nets. A range of habitat features were sampled at transects located every 1.8 rkm, these features included small-scale, large-scale, and chemical habitat variables. Logistic regression was used to develop a predictive model for occurrence of spawning inconnu. Project results indicate that spawning habitat is confined to a narrow reach, approximately 20 rkm and occurred significantly more often in sites characterized with substrate between 6 and 12 cm, width/depth ratio of between 14.96 - 35.56, and water conductivity 266 - 298  $\mu\text{S}/\text{cm}$ . Understanding of the physical qualities of inconnu spawning habitats have been greatly enhanced by this work, similar studies on other known spawning habitats would reveal whether they are common qualities to all inconnu spawning populations or unique to the Sulukna River.

**Student**

## Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”

### DNA barcoding of eight North American coregonine species

Ora L. Schlei<sup>1</sup>, Alexis Crête-Lafrenière<sup>2</sup>, Andrew R. Whiteley<sup>2</sup>, Randy J. Brown<sup>3</sup>, Jeffrey B. Olsen<sup>1</sup>, Louis Bernatchez<sup>2</sup>, and John K. Wenburg<sup>1</sup>

1: U.S. Fish & Wildlife Service, Conservation Genetics Lab MS 331, 1011 E. Tudor Road, Anchorage, Alaska 99503

[Jeffrey\\_olsen@fws.gov](mailto:Jeffrey_olsen@fws.gov), [john\\_wenburg@fws.gov](mailto:john_wenburg@fws.gov); [ora\\_schlei@fws.gov](mailto:ora_schlei@fws.gov)

2: Québec Océan, Département de Biologie, Pavillon Charles-Eugène Marchand, Université Laval, Québec, Canada G1K 4P7

[alexis.crete-lafreniere@giroq.ulaval.ca](mailto:alexis.crete-lafreniere@giroq.ulaval.ca), [Andrew.whiteley.1@ulaval.ca](mailto:Andrew.whiteley.1@ulaval.ca),  
[Louis.Bernatchez@bio.ulaval.ca](mailto:Louis.Bernatchez@bio.ulaval.ca)

3: U.S. Fish & Wildlife Service, Fairbanks Fish & Wildlife Field Office, 101 12<sup>th</sup> Ave., Room 222, Fairbanks, Alaska, 99701

[randy\\_j\\_brown@fws.gov](mailto:randy_j_brown@fws.gov)

Coregonine fishes have a circumpolar distribution in the arctic and subarctic Northern Hemisphere. This subfamily of Salmonidae consists of three genera: *Prosopium*, *Stenodus* and *Coregonus*, including over 30 species. Many species overlap spatially and are difficult to distinguish based on morphological characteristics, especially as larvae or juveniles. Here, we present a method for rapid and cost effective species identification for representatives of the three genera based on sequence variation at the mitochondrial cytochrome *c* oxidase subunit I gene (COI). We examined eight species common to North America with distributional overlap in Alaska. Mean pairwise sequence divergence for all eight species was 7.04% and ranged from 0.46% to 14.23%. This sequence variation was used to develop a genetic assay based on restriction fragment length polymorphism (RFLP). In a blind test, this assay provided correct species assignment for 48 of 49 individuals representing all eight species. The single incorrect assignment may reflect hybridization between two closely related species. This DNA barcode-based assay promises to aid fishery managers and researchers by providing a cost-effective alternative to large-scale sequence analysis for identification of North American coregonine fishes.

## **Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”**

### **Differences in growth patterns across cohorts in an anadromous Arctic fish, Arctic cisco (*Coregonus autumnalis*)**

**Vanessa R. von Biela<sup>1</sup>, Christian E. Zimmerman<sup>1</sup>, Lawrence L. Moulton<sup>2</sup>**

**1:** *U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508*

**2:** *MJM Research, 1012 Shoreland Drive, Lopez Island, Washington, 98261*

Arctic cisco (*Coregonus autumnalis*) are an anadromous whitefish that spawn in tributaries of the Mackenzie River, but range along the Beaufort Sea coast into Alaska. Arctic cisco feed during the summer in nearshore waters and overwinter in brackish river deltas of northern Alaska and Canada. In Alaska, juvenile Arctic cisco ages 5-8 are targeted by a subsistence fishery on the Colville River when migrating to overwintering grounds. We previously found that growth rates of young-of-the-year fish captured in the Colville River vary with lagged river discharge, a driver of nearshore production. To determine if similar growth variability occurs in older fish, we compared cohort specific growth curves for fish captured between 1986 and 2007 in the Colville subsistence fishery by fitting otolith radius-at-age measurements to the von Bertalanffy growth curve. To minimize capture age effects, only fish age 6 and 7 were used to build cohort specific growth curves. Growth rate varied over time with fish from the 1987, 1999 and 2000 cohorts growing more rapidly than fish from the 1986 and 1994 cohorts, and fish from the 1985 cohort growing slower than all cohorts examined. Differences in the growth rates among successive cohorts (1985, 1986 and 1987) indicated that growth trajectories can vary between temporally overlapping cohorts and highlights the importance of young-of-the-year growth on growth trajectory. No consistent long-term change in growth patterns was detected, although individuals from the two most recent cohorts were among the three fastest growing. A trade-off between growth rates and asymptotic size was also detected so that the cohorts growing most rapidly reached the smallest asymptotic sizes and would likely have been smaller at maturity. If growth rates continue to be elevated, adult size may also remain low, which could have broad affects on Arctic cisco productivity.

## **Session – Management of Whitefishes in Alaska: “What do we know and where do we start?”**

### **Management of a Primal Fishery: Chatanika River Whitefish**

**Audra Brase**

*Alaska Department of Fish & Game, Sport Fish Division  
1300 College Rd, Fairbanks, AK 99701  
907-459-7244; audra.braser@alaska.gov*

The Chatanika River has large migratory spawning populations of both humpback whitefish (*Coregonus pidschian*) and least cisco (*C. sardinella*). Prior to 1997 the river supported a very popular fall whitefish spear sport fishery. In 1992 a management plan was developed which specified maximum harvest rates at varying levels of abundance. Harvest rates increased and the whitefish population decreased resulting in restrictions and finally a closure of the spear fishery from 1998 to 2009. The sport fishery remains closed to spear fishing gear; however a personal use spear fishery was opened in 2007. A limited number of permits have been issued each year for the spear fishery resulting in an increased, but sustainable harvest of Chatanika River whitefish.

## Session – POSTER

### **Minto Flats Northern Pike Radiotelemetry: seasonal movements, assessment of mark-recapture experiment assumptions, and environmental factors effecting fish movements**

**Matthew Albert<sup>1</sup>, F. Joseph Margraf<sup>2</sup>, and Matthew Evenson<sup>3</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, Fairbanks, AK m.albert@sfos.uaf.edu*

*2: U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, Fairbanks, AK joe.margraf@uaf.edu*

*3: Alaska Department of Fish and Game, Sport Fish Division, Fairbanks, Ak matt.evenson@alaska.gov*

The Minto Flats northern pike *Esox lucius* population supports a major proportion of the recreational and subsistence fishing effort for northern pike in the Lower Tanana Management Area. Accurate population estimates are crucial for the proper management of these important fisheries. Northern pike movements in Minto Flats as they relate to specific assumptions made in mark-recapture experiments conducted in the Minto Lakes study area have yet to be examined using radiotelemetry techniques. One-hundred radio tags were deployed in 2007 into northern pike captured in the Minto Lakes study area. In 2008 and 2009, respectively, eighty and forty radio tags were deployed into aggregations of northern pike that were overwintering in the Chatanika River. Radio-tagged fish that returned to the Minto Lakes study area for the 2008 and 2009 open water seasons were tracked daily via boat during the traditional mark-recapture time period. Additional surveys were conducted through-out the rest of the two year study period. Environmental data collected include water temperature, water level, air temperature, barometric pressure, wind speed/direction, precipitation, and solar radiation intensity. This project seeks to 1) describe the seasonal movements of northern pike in Minto Flats at varying geographic and temporal scales; 2) using movements of radio-tagged northern pike evaluate the assumptions of population closure, mixing and probability of capture as they pertain to mark-recapture experiments conducted in the Minto Lakes study area; and 3) describe environmental factors that influence movements of radio-tagged northern pike within the Minto Lakes study area over temporal scales of 24 hours to 3 months. Expected outcomes of this research will be identifying specific time periods during the open water season that are best suited for a mark-recapture experiment, specific study design improvements, and identifying environmental factors that significantly affect northern pike movement.

**Student**

## Session – POSTER

### **The ecology of juvenile Chinook salmon in the Chena River, interior Alaska**

**Elizabeth C. Green<sup>1</sup>, Megan T. Perry<sup>1</sup>, Jason R. Neuswanger<sup>1</sup>, Emily R. Benson<sup>1</sup>,  
Laura Gutierrez<sup>1</sup>, Mark S. Wipfli<sup>2</sup>, Nicholas F. Hughes<sup>3</sup>, and Matthew J. Evenson<sup>4</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Institute of Arctic Biology,  
University of Alaska Fairbanks, Fairbanks, Alaska 99775; 907-474-6740*

*2: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit,  
Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*3: Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775*

*4: Alaska Department of Fish and Game Sport Fish Division, 1300 College Road,  
Fairbanks, Alaska 99701*

The inability of most stock-recruitment models to incorporate environmental processes limits their rigor and reliability. In the Chena River, within the Yukon River drainage of interior Alaska, Chinook salmon (*Oncorhynchus tshawytscha*) population size seems to be regulated by density-dependent mortality during the first summer, when environmental fluctuations exert complex influences on competition for food and space. The objectives of this work-in-progress are to determine how seasonal patterns of flow and temperature affect food production and the availability of safe, profitable foraging habitat, and to test whether these influences on food production and foraging affect fish growth and abundance. We monitored nutrient concentrations, biofilm chlorophyll-*a* concentrations, stream metabolism, and prey (aquatic and terrestrial invertebrate) availability. We are also advancing stereoscopic video techniques to unobtrusively measure fish growth and foraging parameters. These data will guide the design of a process-based salmon recruitment model. Respiration exceeded production in summer and fall, suggesting allochthonous energy sources largely drove basal trophic production. We documented very high seasonal and spatial variability in basal food resources, and a negative relationship between stream discharge and benthic macroinvertebrate abundance. We observed no significant effects of feeding trials on fish growth. Food consumption by juvenile Chinook salmon declined dramatically during and immediately after major floods. The eventual output from this study will aid biologists and managers in forecasting future returns and setting optimal salmon escapement goals.

**Student**

## Session – POSTER

### The Coastal Cutthroat Trout Database Project

**Roger Harding<sup>1</sup>, K.E. Griswold<sup>2</sup>, Stephen Phillips<sup>3</sup>, Tara Smith<sup>3</sup>, Michael Banach<sup>3</sup>, Van Hare<sup>3</sup>, David Lentz<sup>4</sup>, David Jepsen<sup>5</sup>, Jon Anderson<sup>6</sup>, Ron Ptolemy<sup>7</sup>, Roger Harding<sup>8</sup>, Grant Kirby<sup>9</sup>, Patrick Connolly<sup>10</sup>, Michael Hudson<sup>11</sup>, Bianca Streif<sup>11</sup>, Gordon Reeves<sup>12</sup>**

*1: Alaska Department of Fish and Game, Sport Fish Division  
802 3<sup>rd</sup> Street Douglas AK, 99824  
(907) 465-4311*

*2: Idaho State University, 3: Pacific States Marine Fisheries Commission, 4: California Department of Fish and Game, 5: Oregon Department of Fish and Wildlife, 6: Washington Department of Fish and Game, 7: British Columbia Ministry of the Environment, 8: Alaska Department of Fish and Game, 9: Northwest Indian Fisheries Commission, 10: US Geologic Survey, 11: US Fish and Wildlife Service, 12: US Forest Service*

The status of coastal cutthroat trout (CCT) throughout the subspecies distributional range is largely unknown. The information that is available for CCT is largely found in agency reports or unpublished data and often is ancillary to monitoring programs for other species. This creates difficulties for decision makers who are charged with setting management priorities. Addressing the complicated issue of managing CCT is a priority for state, federal, tribal, and NGO organizations. In 2006, a CCT Working Group consisting of representatives from these organizations began working together with a goal of “developing a consistent framework to help guide and prioritize conservation, management, research, and restoration of CCT throughout their native range”. To accomplish this goal the group has worked to identify priority data needs and develop novel approaches to gathering and sharing scientific information that is needed for management actions including the determination of the subspecies status. The CCT database project was initiated in 2008 by Pacific States Marine Fisheries Commission (PSMFC) to address these needs. Additional funding from the Western Native Trout Initiative (WNTI) will result in the following projects: 1) A searchable library housed within the StreamNet Library ([www.streamnet.org](http://www.streamnet.org), [www.fishlib.org](http://www.fishlib.org)) with documents pertaining to CCT scanned and available for immediate download; 2) gathering information relating to documented occurrence in a broad geographic area, and 3) an interactive web-based searchable database and map that initially captures documented occurrence in selected regions of Oregon and Washington. A GIS-based map depicting documented occurrence will be presented along with a summary of data types and reporting on our initial success in gathering scientific information on the subspecies. Information pertaining to CCT in Alaska, including presence/absence, density etc., is being sought to incorporate into this range-wide database.

## Session – POSTER

### Who is the man behind the Wally Noerenberg Award for Fisheries Excellence

**Bill Hauser<sup>1</sup> and Ted Otis<sup>2</sup>**

*1: ADF&G (ret.), FISH TALK  
3621 Hazen Circle, Anchorage, AK 99515  
[karelbill@gci.net](mailto:karelbill@gci.net); 907-349-7175*

*2: Alaska Department of Fish and Game  
3298 Douglas Place, Homer, AK 99603  
[ted.otis@alaska.gov](mailto:ted.otis@alaska.gov); (907) 235-1723*

The Wally Noerenberg Award (WNA) for Fishery Excellence, the highest honor bestowed by the Alaska Chapter of the American Fisheries Society (AFS), is awarded to individuals who have made great and outstanding contributions to Alaska fisheries. Contributions may include: scientific research; technological development; species and habitat management; innovations in harvesting, processing, or marketing; academics and fishery education; or involvement in national and international affairs affecting Alaska fisheries. Since its inception 28 years ago, only 14 individuals have received the WNA. Who was Wally Noerenberg and why is the Chapter's most prestigious award named after him? Come view the poster to find out.

## Session – POSTER

### **Selection for different armored phenotypes in the threespine stickleback (*Gasterosteus aculeatus*) in Wallace Lake, Alaska**

**Emily A. Lescak<sup>1</sup>, Richard R. Bernhardt<sup>1</sup>, Michael A. Bell<sup>2</sup>, Frank A. von Hippel<sup>1</sup>**

*1: University of Alaska Anchorage, Department of Biology  
3211 Providence Dr. Anchorage, AK 99508*

*2: Stony Brook University, Department of Ecology and Evolution  
Stony Brook, NY 11794*

Our aim is to use the threespine stickleback population from Wallace Lake, located in south-central Alaska, to understand mechanisms of selection for defensive armor, specifically the pelvic girdle and lateral plates, as well as potential trade-offs associated with the development and maintenance of these structures. This population is of interest because it has a seemingly stable bimodal distribution of pelvic scores, with peaks at highly reduced and fully-formed phenotypes (Bell and Ortí 1994). Individuals in this population may be facing two conflicting sources of predation pressure: vertebrate predators that select for the fully-armored phenotype and macroinvertebrates that may select for pelvic reduction. In addition, Wallace Lake has a low availability of dissolved ions, which favors armor reduction. Our study consists of 16 samples of stickleback collected seasonally between 2001 and 2008 and analyzed for a suite of morphological traits. Preliminary results reveal that the population maintains a bimodal distribution over time. Seasonal comparisons of pelvic score reveal that the fully-formed phenotype does not seem to make individuals more susceptible to predation by macroinvertebrates, nor does it seem to increase the risk of overwinter mortality. Individuals in samples collected after the introduction of pike did not have significantly higher pelvic score or number of lateral plates, but these individuals seemed to have more symmetrical defensive armor. Further analyses will explore whether the size of pelvic elements and spines increased in post-pike samples.

**Student**

## Session – POSTER

### **The influence of lake habitat on stocked rainbow trout success in interior Alaska lakes**

**Kelly Mansfield<sup>1,2</sup>, Amanda Rosenberger<sup>1</sup>, Trent Sutton<sup>1</sup>, and Cal Skaugstad<sup>2</sup>**

*1: University of Alaska, Fairbanks, School of Fisheries and Ocean Sciences  
P.O. Box 755220, Fairbanks, AK 99775*

*[kelly.mansfield@alaska.gov](mailto:kelly.mansfield@alaska.gov), [rosenberger@sfos.uaf.edu](mailto:rosenberger@sfos.uaf.edu), [tmsutton@alaska.edu](mailto:tmsutton@alaska.edu)*

*2: Alaska Department of Fish and Game, Sport Fish Division  
1300 College Road, Fairbanks, AK 99701*

*[cal.skaugstad@alaska.gov](mailto:cal.skaugstad@alaska.gov)*

Managers require a better understanding of what lake characteristics are associated with successful stocking of rainbow trout *Oncorhynchus mykiss* in the interior of Alaska. This project seeks to provide Alaska Department of Fish and Game managers with tools to address public inquiries and improve stocking allocation. The goal of this study is to predict rainbow trout stocking success as defined by achieving pre-set standards for mean length at age in interior Alaska lakes. Archived rainbow trout length data from 38 stocked lakes from the last 20 years were used to qualitatively classify lakes as successful for stocking rainbow trout fingerlings. Based on preliminary modeling, lake variables (e.g., lake depth, lake remoteness (less than five miles from a road by trail), shoreline development, and average stocking density) were identified as potentially important for rainbow trout growth (as measured by mean length at age). During June, August, and September of 2009, 18 lakes were sampled for rainbow trout and data collected on lake habitat variables, including lake depth, volume, surface area, shoreline development, lake elevation, remoteness, average stocking density. These data will be compared to archived data. Additional variables (e.g., temperature, pH, dissolved oxygen, conductivity, alkalinity, Secchi depth, chlorophyll-*a*, and presence of forage for  $\geq 3$  year fish) were also collected to establish if habitat variables not originally in the archived data can explain stocking success. An expected outcome from this project is a predictive model that can be used by researchers and managers to predict and evaluate lakes proposed for stocking to determine likelihood of success.

**Student**

## Session – POSTER

### **Ecological effects of introduced European bird cherry on salmonid food webs in Anchorage streams**

**David A. Roon<sup>1\*</sup>, Mark S. Wipfli<sup>2</sup>, and Tricia L. Wurtz<sup>3</sup>**

*1: Alaska Cooperative Fish and Wildlife Research Unit, Dept of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775  
[daroon@alaska.edu](mailto:daroon@alaska.edu); (907) 474 – 6051*

*2: U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska, Fairbanks, Institute of Arctic Biology Fairbanks, Alaska 99775. [mark.wipfli@uaf.edu](mailto:mark.wipfli@uaf.edu)*

*3: USDA Forest Service  
R10 S&PF, Forest Health Protection, Fairbanks, Alaska 99709  
[twurtz@fs.fed.us](mailto:twurtz@fs.fed.us)*

Introduced species are a concern worldwide as they can threaten and displace native species and disrupt ecological processes. European Bird Cherry (*Prunus padus* L.) (EBC) is an introduced, ornamental tree that is rapidly spreading and possibly displacing native vegetation in urban areas of Alaska, including the riparian vegetation along streams within the Municipality of Anchorage. Riparian vegetation plays a vital role in stream food webs by supporting terrestrial and aquatic invertebrate communities, which are the major food source for juvenile salmonids and other fish and animal species. The objectives of this study-in-progress are to: (1) map the current distribution of EBC along two Anchorage streams, Campbell and Chester Creeks, (2) determine whether in-stream leaf litter processing is affected by EBC litter inputs, (3) determine if EBC affects invertebrate abundance and the availability of these prey to stream salmonids, and (4) assess whether juvenile salmonid food intake is affected by EBC. Mapping efforts from the 2009 field season found EBC to be widely distributed on all major forks along Chester Creek. Invertebrate samples collected from the 2009 field season are currently being processed in the lab, but early results suggest that EBC supports different species of terrestrial prey, and that EBC leaf litter may decompose at different rates than native species. This study will provide information on how introduced plant species can affect native species and ecological processes in riparian habitats of Alaska. The findings of this study are expected to help guide management of EBC by city, state and federal agencies involved in managing urban watersheds.

**Student**

## Session – POSTER

### **Vertical distribution of larval walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), and *Atheresthes* spp. in the eastern Bering Sea**

**T. I. Smart<sup>1</sup>, E. C. Siddon<sup>2</sup>, J. T. Duffy-Anderson<sup>3</sup>, N. Hillgruber<sup>2</sup>**

*1: University of Washington, School of Aquatic and Fishery Sciences  
Seattle, WA 98195*

[Tracey.Smart@noaa.gov](mailto:Tracey.Smart@noaa.gov)

*2: University of Alaska Fairbanks, School of Fisheries and Ocean Sciences  
Juneau, AK*

[ecsiddon@alaska.edu](mailto:ecsiddon@alaska.edu)

*3: NOAA Fisheries, Alaska Fisheries Science Center  
Seattle, WA*

[Janet.Duffy-Anderson@NOAA.gov](mailto:Janet.Duffy-Anderson@NOAA.gov)

This project examines linkages between early spring spawning areas, spring distributions, and summer vertical distributions for three target species in the eastern Bering Sea (EBS): walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), and *Atheresthes* spp. (arrowtooth and Kamchatka flounder). Based on ichthyoplankton samples collected in early spring (February/March), mid-spring (May), and summer (June/July) (2008-2010) cruises, together with environmental data, we will better understand how climate-mediated changes in the direction, speed, or seasonality of currents directly impact larval drift trajectories, as well as the indirect effects on associated conditions along the transport route. Data from these cruises will be integrated with data collected in the NOAA EcoFOCI program since 1992 to enhance our understanding of distribution and dispersal patterns of the target species. Walleye pollock larvae of all sizes are widely distributed throughout the water column, but may initiate positive diel vertical migrations as they age. Historical catches of Pacific cod larvae have been low, but indicate ontogenetic vertical migrations with older larvae moving up in the water column. Preliminary analysis indicates that *Atheresthes* spp. larvae may undergo a reverse ontogenetic vertical migration (deeper in the water column) as they near metamorphosis. We will examine patterns between the target species and hydrography using GAM analyses, which will allow us to determine which environmental variables most affect distribution and abundance. We will also incorporate our findings into individual based models (Dispersal Model for Early Life Stages, DisMELS) to predict juvenile recruitment locations.

## Session – POSTER

### Considering Pacific Lamprey When Implementing Instream Activities

**Bianca Streif**

*U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office  
2600 SE 98th Ave. Suite 100, Portland, Oregon 97266  
(503) 231-6978; bianca\_streif@fws.gov*

Efforts to minimize negative effects during instream activities generally do not consider the life history characteristics of non-game fish species, specifically lamprey. While there is still much to be learned about Pacific lamprey distribution, abundance, and status, the need for conservation of lampreys is evident. Historically, Pacific lampreys were probably distributed wherever salmon and steelhead occurred. However, recent data indicate that distribution of the Pacific lamprey has been reduced or eliminated in many river drainages.

Projects that alter passage, change flow hydraulics, alter stream substrates, and decrease habitat complexity can negatively affect lampreys. Of particular importance during construction activities are areas where ammocoetes inhabit areas of low velocity and live in the substrate as filter feeders for 2 to 7 years. Since several generations and age classes of ammocoetes congregate in high densities forming colonies, a single dewatering event may have a significant effect on a lamprey population. Methods to reduce affects to ammocoetes during construction are just beginning to be developed. Most measures will also benefit other fish species by providing for (1) diversity of habitats and stream structure, (2) complex velocity distributions, and (3) modifications to the duration and timing of instream actions.

## Session – POSTER

### **Nushagak Bay: Monitoring for Ecosystem Health: Nushagak Bay Biodiversity Project**

**Todd Radenbaugh & Sarah Wingert**

*University of Alaska Fairbanks, Bristol Bay Campus  
Dillingham AK 99576*

*Phone: 907-842-8326 Fax: 907-842-5692; sawingert@alaska.edu*

Nushagak Bay is a large estuary covering over 50 km<sup>2</sup> in southwestern Alaska and includes the flow of the Nushagak, Wood, Snake, and Igushik Rivers. The estuary supports one of the world's largest sockeye salmon runs that Bristol Bay residents sustainably used for both subsistence gains and commercial profits. However, given the estuary's ecological and economic importance, few comprehensive benthic studies have been conducted. This study aims to document species to ecosystem level diversity and to investigate trophic energy flow in Nushagak Bay. Diversity is measured through species counts and total biomass, while habitat diversity is measured using an ecosystem approach. In addition, baseline physical data collected includes, water temperature, pH, DO, salinity, turbidity, tidal current flow, and benthic substrates.

Over 33 800 m<sup>2</sup> was sampled and we found that 16 species were distributed unevenly throughout the estuary. Species collected including teleost fishes, isopods, amphipods, and other crustaceans giving Nushagak Bay a Shannon Diversity (H') value of 1.54, ranking it below similar subarctic estuaries such as Ungava Bay, near Labrador (60 degrees °34'N, 67 degrees 35'W) (Stewart et al 1985) and Lower Herring Bay in Prince William Sound (60 degrees 30'N, 147 degrees 13'W) (Dean and Jewett 2001) ( Shannon Diversity values are H'=2.11 and H'=2.5, respectively). This difference is most likely due to low salinity (average 8 ppt) and soft muddy sediments found in much of Nushagak Bay. Continued sampling will provide insight into the benthic community structure of the bay. Research plans for winter 2009 includes bomb calorimetry and stable isotope analysis of samples collected, which will provide addition details about trophic structure and energy flow throughout the estuary.

**Alaska Chapter of the American Fisheries Society,  
The 36<sup>th</sup> Annual Business Meeting  
Agenda, November 4, 2009, Fairbanks Westmark Hotel**

1. Call to Order
2. Determination of a Quorum
3. Approval of Agenda
4. Approval of minutes from Alaska Chapter Business Meeting 2008
5. Reports
  - a. Treasurer's report Lee Ann Gardner
  - b. Committee reports
    - i. Awards Theresa Tanner
    - ii. Wally Noerenberg Award Ted Otis
    - iii. Cultural Diversity Sara Gilk
    - iv. Molly Ahlgren Scholarship Hal Geiger
    - v. Continuing Education Jan Conitz and Tammy Hoem
    - vi. Environmental Concerns Cecil Rich
    - vii. Electronic Communication Allen Bingham
    - viii. Fisheries Communication and Education Laurel Devaney
    - ix. Past Presidents Bert Lewis
    - x. Student Units Shelley Woods
    - xi. Membership Audra Brase
    - xii. Resolutions and Bylaws Bill Bechtol
6. Outgoing President's Address
7. New Business
  - a. Introduce resolution to establish an AK Chapter life membership category
8. Old Business
9. Open forum
10. Adjourn

# American Fisheries Society, Alaska Chapter The 35<sup>th</sup> Conference Business Meeting Notes

October 29, 2008  
Anchorage, Alaska

1. The meeting was called to **order at 4:30** by President Bert Lewis.
2. **Quorum established** - Members of Executive Committee present were President Bert Lewis, President Elect Hamachan Hamazaki, Vice President Lisa Stuby, Past President Jamal Moss, Treasurer Lee Ann Gardner, Secretary Karla Bush, and Student Sub-unit Representative Dona Eidam. Approximately 23 members were present.
3. **Approval of the Agenda** - The membership approved the agenda as revised and presented at the meeting.
4. **Approval of minutes** from November 16, 2007 business meeting – The minutes of the November 16, 2007 were approved pending some name spelling corrections.

## 5. Reports

- a. **Treasurer's Report** – Lee Ann Gardner presented the report for 2007-2008. Lee Ann provided a hard copy of her report for the membership prior to the meeting. Primary treasury-related efforts this past year focused on developing a spending plan for 2008, completing federal tax returns, and serving on/supporting the Chapter's Finance Committee and the Molly Ahlgren Scholarship Committee.

Currently, markets are down and our investment accounts took a bit of a hit. The Wally Noerenberg and Cultural Diversity funds fell below the \$15,000 principle. This year there was no Wally Noerenberg award and the chapter expended funds to cover the cost for the Cultural Diversity award.

Total assets for the Alaska Chapter now stand around \$192,000 although this figure will go down pending meeting expense payments. The meeting has been well attended this year with 254 regular attendees. Continuing education classes were a big success and accounted for 182 student days. So far the meeting has grossed \$65,000. All figures will be finalized by November 30 which is the end of our tax year.

Bill Hauser asked about proceeds from the Fishes of Alaska book and Lee Ann responded that in 2007 we made \$1,500 in royalties.

### b. Committee Reports –

- i. **Finance Committee** – Ray Hander presented the Finance Committee's report. The Chapter's UBS investment portfolio lost approximately \$34,000 since December 31, 2007 with individual account losses ranging from 18 to 24%. This does not include the UBS checking account that fluxes with Chapter spending needs. This loss is due to the ongoing market volatility. The Chapter's UBS portfolio is invested using a moderately conservative strategy with an investment horizon of 7 to 10 years as determined by the Finance Committee members in

consultation with the UBS investment representative. The Chapter's strategy is for long-term growth and we will have to weather the volatility of the market.

The Finance Committee has met quarterly with the Chapter's UBS representative, Todd Fletcher, to receive portfolio status updates and conduct maintenance of accounts as needed to conduct Chapter business. Lee Ann Gardner is in frequent contact with UBS as she conducts day-to-day Chapter business and informs finance committee members with information on an as-needed basis.

Recently, Todd Fletcher left UBS and is now the Senior Vice President for investment accounts at Wedbush Morgan Securities (WMS) here in Anchorage. He was frustrated with UBS and their investment and management practices. One frustration that we shared with Todd was that UBS upper management was unwilling to reduce or remove the \$150 annual fee per account (\$750 annually) for the Chapter as a 501 c3 non profit organization. The Committee is studying the potential for moving our portfolio to WMS. We have reviewed their corporate information and know that they provide a wide array of services and investment vehicles similar to other investment businesses but are not a firm that works with mortgage-backed securities and other investments that have been major contributors to the current market situation.

- ii. **Awards** – Cheryl Anderson presented that the Awards Committee report. The Awards Committee is responsible for selecting the Meritorious Service Award, Alaska Chapter Service Award, Almost Darwin Award, and the best student paper and poster presented at the annual Chapter Meetings. The four member committee did not receive any nominations for the Meritorious Service Award or the Almost Darwin Award. The Alaska Chapter Service Award was presented to Lee Ann Gardner.

Twelve members volunteered to judge and select the best student paper and poster at this year's annual meeting. Kristen Dunlap won the award for best paper and Lisa South received an award for best poster.

Cheryl will be stepping down as chair of the Awards Committee after the annual meeting. Theresa Tanner has graciously volunteered to take over chairperson duties.

- iii. **Wally Noerenberg Award Committee** – Ted Otis presented the Wally Noerenberg Award report. The committee did not receive any nominations this year or last. The deadline is at the end of July which is during the field season. Ted discussed an option to shift the deadline to after the fall meeting as this would give ample time to consider and select an award recipient.

An alternative was suggested to move the deadline to the spring before the field season and Ted thought that better participation could be achieved if we advertised at the annual meeting and the deadline was post-meeting. Eric Wagner was asked if other chapters face the same problems with receiving nominations for awards and he commented that there is a lot of diversity in the awards and not all receive annual nominations.

Bert Lewis suggested that we move the deadline to the fall before the meeting and Cheryl thought that it might not give the committee enough time to complete the nomination/selection process. Bert suggested that the Awards Committee make a recommendation to the Executive Committee and he would investigate if changing the date required amending the bylaws.

- iv. Cultural Diversity Committee Report**– Lisa Stuby gave a report on the activities of the Cultural Diversity Committee. Shelley Woods was chosen as the 2008 award recipient. Shelley was born and raised in Dillingham with a strong family history of resource use and appreciation for those resources. She is currently an undergraduate student in fisheries at UAF and is serving as the Secretary/Treasurer of the student subunit of AFS. She hopes to do graduate work with an emphasis on salmon management policies. Shelly is also involved in the Alaskan Native Science and Engineering Program and the American Indian Students of Engineering and Science.

After over five years of serving on this committee, Jerry Berg and Lisa Stuby will be stepping down after the 2008 meeting as committee chairs and are currently looking for replacements for 2009 and beyond.

- v. Molly Ahlgren Scholarship Report** – Hal Geiger presented the committee report. The Molly Ahlgren Scholarship committee recommended Shelly Woods to be the third recipient of the Chapter’s most prestigious scholarship award.

The Scholarship Committee would like the Chapter to know that the scholarship fund is far behind our original projections. Currently there is approximately \$39,000 in the fund. The guiding principles for the scholarship calls for the scholarship awards to come from the interest earned from the fund when the fund exceeds \$100,000. This year’s interest from the fund’s principle is below what was expected when the Chapter first made plans for this scholarship. There will be no award next year (2009), unless the Executive Committee chooses to make a financial offering from the Chapter’s other funds. Additionally, the Committee would like to take this opportunity to suggest that the Chapter members consider an additional individual contribution to the scholarship fund.

- vi. Continuing Education Committee Report** – Bert Lewis gave the report and complemented Hamachan for organizing the classes this year. The offerings were both diverse and very well attended.

- vii. Environmental Concerns Committee Report** – Bert Lewis updated the Chapter on the Environmental Concerns Committee. The Chapter received many requests for letters of advocacy this past year, several of which did not meet our advocacy protocol. We do expect something to come up with the Pebble Mine in the coming year.

- viii. Electronic Communications Report** – Allen Bingham reported on the status activities of the Electronic Communications Committee. The main purpose of this committee is to maintain and keep current the Alaska Chapter web site and the Chapter’s email distribution list.

During the past few years the web site has essentially just been “maintained” (i.e., no new improvements). The web site was successfully used to conduct on-line e-balloting for the elections in the past, but due to changes in the server hosting our site we are conducting e-balloting entirely through email this year, and e-balloting is expected to be used in one form or another into the future. Each newsletter that has been put out during this past year has been made available on our web site in Adobe Acrobat (pdf) format; and information about training courses and meetings of not only the Chapter but also the Parent Society and the Western Division have been posted. New last year and continued this year was the conversion of the newsletter distribution system from mail/addressed based system to a mostly email-based system.

The Student Subunit web site is maintained as a portion of our site, and has continued to be maintained by the Electronics Communications Committee. Their web site address is: <http://www.fisheries.org/units/afs-ak/student>

The committee continued to maintain an email distribution list for most Chapter members with email addresses in the Chapter's membership database. In 2006 the parent Society re-implemented support for our Chapter's list server, and all Chapter members with an email address (who have chosen to participate) can be members of that list. During this past year (2008), the server that the parent Society hosts the email distribution system changed to address some SPAM issues, and there were a few growing pains related to that conversion, but it is currently functioning smoothly. Currently, the subscription list for this list server is about 3 months out-of-date, and will be updated in the next few months. Chapter members that are subscribed can post email to the list at the following address (they need to post from the email address that they are subscribed to the list): [akchap@lists.fisheries.org](mailto:akchap@lists.fisheries.org)

The committee is interested in hearing what members would like to see on our web site. The web site address is: <http://www.fisheries.org/units/afs-ak> and the e-mail address for sending comment about and contributions to the web site is: [allen.bingham@alaska.gov](mailto:allen.bingham@alaska.gov)

- ix. Fisheries Communication and Education** – Laurel Devany was not at this year's meeting and no report was provided.
- x. Past Presidents Committee report** – Jamal Moss presented the committee report. We were successful in recruiting 2 new officers for next year that will serve the chapter well. They are Audra Brase from ADF&G for Vice President and Cindy Tribuzio from the NOAA Fisheries for Assistant Treasurer. The Executive Committee had a productive discussion with the Past Presidents at the Past President's luncheon regarding the most effective way to proceed with a salmon straying workshop while maintaining the support of hatcheries and hatchery supporters. More details regarding this effort will be released in upcoming newsletters.
- xi. Student Sub-units** – Dona Eidam updated the Chapter on student activities. Thirty-seven students attended this year's meeting and 25 of the students

volunteered helping with various aspects of the meeting. The mentor luncheon was well attended with eight mentors and approximately 18 students.

Student sub-unit updates rotate between the campuses for each Chapter newsletter. The Juneau sub-unit held its 12th annual student symposium this year. The Fairbanks sub-unit has a blog on the Chapter's website updating members on their activities. They also support an annual high school science symposium and provide an award for the best aquatic presentation. The Anchorage subunit at UAA is currently inactive as 90% of the subunit graduated in the spring. Dona is hoping that the spring semester will bring new interest. Last spring the subunit held a series of talks on the Pebble Mine project that were well attended.

Allen Bingham asked if UAA will have a BA in fisheries like UAF and Dona replied that the University is implementing a program in Fisheries Economics with Professor Gunnar Knapp.

**xii. Membership Committee Report – No report**

**xiii. Resolutions and Bylaws Committee report – No report**

- 6. Western Division Report** –Eric Wagner updated the Chapter on activities in the Western Division (WD). The Division is accepting nominations for awards and recruiting for a new Secretary/Treasurer and Vice President. Scott Bonar the new Division President is working on a new program with aquatic education and he's looking for people to serve on that committee. If anyone would like contribute to the WD newsletter 'Tributary', he would be happy to pass that along.

The Portland meeting had 1,100 attendees and Eric thanked the Chapter for providing some financial support. The 2009 meeting will be May 4-8 in Albuquerque, New Mexico.

The Division is continuing to work on the native fishes database. The Graduate Student who is currently working on the project is fishing up and will be presenting the results in Arizona at a WD retreat.

- 7. Outgoing Presidents Address** – Bert Lewis gave a short address to the membership. He encouraged members to participate in Chapter events and committees. Bert said it was a pleasure and an honor to work with everyone and then passed the gavel to Hamachan.

- 8. New Business** – Hamachan Hamazaki took the gavel as chair of meeting.

**Assistant Treasurer Position** – This is a newly created position that will overlap with the past Treasurer's term for a year so that the incoming Treasurer can learn the system before taking over. Lee Ann mentioned that this is a learning/apprentice position as the Chapter has sizeable assets right now and it would be too intimidating for someone to step right in. The assistant could learn the system then formally run for Treasurer.

Bert spoke to the fact that this was something the Executive Committee acted on and Bill Bechtol brought up that if it's an official position it may need to be updated in the bylaws.

Tim Joyce agreed that there's a need for an Assistant Treasurer. Since his time as Treasurer the Chapter's assets have grown and there was a need to hire a bookkeeper and have investments managed by UBS. If the Assistant Treasurer was not on the Executive Committee, then there's no need to change the bylaws.

Ray Hander also supported the new position and Bert said that Cindy Tribuzio has offered to run. Ray suggested that she should meet face to face with Lee Ann at least once this year for some training.

Julie Nielsen said there's value of having an assistant and a slower transition to power. She thought there needed to be some clarification in procedures on how the transition from assistant to Treasurer would work. Tim asked if this would require a simple written procedure or should it be outlined in the bylaws. Lee Ann pointed out that this was a compromise since Cindy was not sure if she was ready to be Treasurer. Allen Bingham thought that it could be possible after a year or two of acting as assistant, a person may not want to be the Treasurer. He offered that creating a formal Executive Committee position would make it easier to retain someone.

Hal Geiger suggested referring the problem to the Executive Committee or someone should make a specific motion. Bert made a motion to table the issue and the motion was seconded. Motion passed with no opposition.

Ray cited that some legality may be involved regarding passwords to accounts so the best option may be to make something official through a change in the bylaws.

- 9. Old Business** – Allen Bingham brought up that at the last meeting a concern was brought up about the need to examine if ad hoc committees are functioning as standing committees. Jamal mentioned that there have not yet been any recommendations about which ad hoc committees should become standing committees.
- 10. Open forum** – Jamal Moss presented Bert Lewis with a plaque for his service as Chapter President this past year. Allen Bingham thanked all the committee chairs for their service and Ray Handler offered a special thanks to Trish deMontfort and Lee Ann for their efforts at this year's meeting.
- 11. Adjourn** - A motion to adjourn was made and seconded. Motion was passed by unanimous consent. The meeting adjourned at 6 pm.