Partnering with Change, 21st Century Aquatic Ecology in Alaska

The 32nd Meeting of the Alaska Chapter
November 13-16, 2006
Fairbanks, Alaska

2006 Annual Alaska Chapter AFS Conference

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

Alaska Chapter of the American Fisheries Society

Executive Committee

Hal Geiger, Past Pr esident
Scott Maclean, President
Jamal Moss, President Elect
Bert Lewis, Vice President
Steve Zemke, Secretary
Lee Ann Gardner, Treasurer

Local Arrangements

Lisa Stuby, Alaska Department of Fish and Game
Ray Hander, U.S. Fish and Wildlife Service
AFS student-units (UAF, UAA, UAS, SJ)

Registration

Ray Hander, U.S. Fish and Wildlife Service
AFS student-units (UAF, UAA, UAS, SJ)

Communications

Allen Bingham, Alaska Department of Fish and Game

Audio/Visual

AFS student-units (UAF, UAA, UAS, SJ)

Plenary

Bill Wilson, NOAA Fisheries
Francis Wiese, North Pacific Research Board
Brad Griffith, University of Alaska Fairbanks
Jim Reynolds, University of Alaska Fairbanks

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Banquet

Ronnie Greer, Pitlochry Fish Laboratory, Scotland

Session Chairs

Nicola Hillgruber, University of Alaska
Cecil Rich, Alaska Department of Fish and Game
Kim Hastings, U.S. Fish and Wildlife Service
Tom Paragi, Alaska Department of Fish and Game
Nick Hughes, University of Alaska
Kyle Hebert, Alaska Department of Fish and Game
Bonita Nelson, NOAA Fisheries
Eric Anderson, Alaska Department of Fish and Game
Kate Wedemeyer, Minerals Management Service
Jeff Adams, U.S. Fish and Wildlife Service
Hal Geiger, Alaska Department of Fish and Game
Terry Quinn, University of Alaska

Instructors

Judd Monroe
Jim Dewitt, Guess & Rudd P.C.

Vendors

LOTEK: Henry Tam, (http://www.lotek.com/)
HDR: Andra Love (http://www.hdrinc.com/)

Donors of Silent Auction Items to Benefit Alaska AFS Student Travel Fund

Mountain Sports
Gulliver's Books
Silver Gulch Brewery
Prospector
Alaska Tent and Tarp
Apocalypse Design
A Desert Passage
Sportsmen's Warehouse
The Alaska Fly Shop
College Town Pizza

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2006 Guest Speaker

Ronnie Greer has worked for 23 years at the Freshwater Fisheries Laboratory at Pitlochry in Scotland. He takes an interest in and has worked extensively with Arctic char and pisciverous brown trout and is a member of the International Society of Arctic Char Fanatics. Ronnie has worked in Scandinavia and North American on various issues pertaining to Arctic char and environmental issues. Outside of fisheries, Ronnie has a wide range of interests pertaining to the environmental and human history of Scotland. He has specific interests in riparian woodland management and is the founder of the Loch Garry Tree Group and the Ferox '86 Group. He is the author of *Ferox Trout and Arctic Charr*. In his free time, Ronnie likes to compose film scripts, write poetry and songs, and is a frequent guest speaker at the Robert Burns Club.

2006 Annual Alaska Chapter AFS Conference

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Agenda at a Glance

Wedgewood Resort - Fairbanks, Alaska - November 13-16, 2006				
Day/Date	**Time Period**	**Borealis Ballroom**	**Gazebo Court**	
Monday, November 13	Morning	Continuing Education Course – Technical Writing Workshop (day 4)		
	Afternoon		Continuing Education Course – Risk Management for Non-profit Agencies	
	Evening			**Opening Reception – Gardenside Room**
Tuesday, November 14	Morning	**Plenary Session**		Conference Registration
	Early Afternoon	Session: Alaskan estuaries	Session: Preserving fish habitat	
	Late Afternoon	Session: Contributed papers (I)	Session: Preserving fish habitat	
	Evening	Poster Session		**Poster Session/Vendor Social – Gazebo Court**
Wednesday, November 15	Early Morning	Session: Marine derived nutrients	Session: Behavioral ecology	Conference Registration
	Late Morning	Session: Marine derived nutrients	Session: Aquatic education	
	Early Afternoon	Session: Marine ecology	Session: Aquatic education	Past Presidents Lunch - Boardroom
	Late Afternoon		**Business Meeting**	
	Evening	Social & Banquet		**Social and Banquet**
Thursday, November 16	Early Morning	Session: Climate change and Alaska fisheries	Session: Contributed papers (II)	Conference Registration
	Late Morning	Session: Climate change and Alaska fisheries	Session: Contributed papers (II)	
	Early Afternoon	Session: Ecosystem-based fisheries management	Session: Contributed papers (II)	
	Late Afternoon	**Awards and Adjournment**		

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Monday, November 13

Borealis Ballroom – *Technical Writing – Judd Monroe, instructor*
9:00am – 5:00pm

Gazebo Court – *Risk Management for Non-profit Corporations – Jim Dewitt, instructor*
1:00pm – 5:00pm

Sitting Salon – *Registration*
4:00pm – 7:00pm

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5:30pm – 9:30pm

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12:00pm – 1:20pm **BUFFET LUNCH**

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Session: Preserving Fish Habitat in the 21st Century – Cecil Rich, Chair
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Threats to Fish Habitat in Alaska – *Frank Rue*
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Conceptual model for the population structure of Pacific halibut (*Hippoglossus stenolepis*) using insights from satellite tagging – *Andrew Seitz*

3:00pm – 3:20pm BREAK

Gazebo Court – *Concurrent Session # 2*

Session: Behavioral Ecology – Nicholas Hughs, Chair

8:20am – 8:40am
Summer and Fall chum salmon spawning and incubation habitat in the Yukon River Drainage, Alaska: Possible differences of sensitivity or response to change? – *James Finn*

8:40am – 9:00am
Maximum Water Temperature Mediated Interactions of Native Char (*Salvelinus* spp.) and Trout (*Oncorhynchus* spp.) – *Gordon Hass*

9:00am – 9:20am
Salmon eggs forage for oxygen: description and test of a model that predicts the oxygen uptake and survival of developing salmon eggs – *Nicholas Hughes*

9:20am – 9:40am
Humpback Whitefish *Coregonus pidschian* in the Upper Tanana River Drainage Reduce Risk of Confinement by Exhibiting Feeding Habitat Fidelity – *Randy Brown*

9:40 – 10:00am
The Effects of Salmon Migration Behavior on Sonar Estimates of Escapement – *Suzanne Maxwell*

10:00am – 10:20am BREAK

Gazebo Court – *Concurrent Session # 2*

Session: Aquatic Education – Bonita Nelson & Erik Anderson, Co-Chairs

10:20 – 10:40am
The Kuskokwim Native Association High School Internship Program – *Heather Hildebrand*

10:40am – 11:00am
Incorporating Science Camps into Fishery Research Projects – *Laurel Devaney*

11:00am – 11:20pm
Successful Adult Aquatic/angler Education Program Delivery Through Effective Partnership Development – *Shann Jones*

11:20am – 11:40pm
Student Involvement in Fisheries Research – *Karen M. Dunmall*

11:40am – 12:00pm
Aquatic Education on the Thorne Bay Ranger District Prince of Wales Island, Alaska – *Jim Beard*

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12:00pm – 1:20pm BUFFET LUNCH (Past Presidents Lunch – Boardroom)

1:20pm- 1:40pm
Fundamentals of an Effective Outreach Program through the Alaska Sea Grant Marine Advisory Program – *Paula Cullenberg*
1:40pm- 2:00pm
ADFG Sport Fish Aquatic Education Program – *Fritz Kraus*
2:00pm- 2:20pm
Scientists and Outreach: Making the Connection – *Bonita Nelson*
2:20pm – 2:40pm
Combining traditional ecological knowledge (TEK) and fisheries science to develop partnered research on Yukon River Delta Bering cisco (*Coregonus laurettae*) – *David M. Runfola*
2:40pm – 3:00pm
Open –

Gazebo Court – *Business Meeting* – Scott Maclean, President
3:20pm – 5:00pm

Borealis Ballroom
6:30pm – 7:00 pm Social (no host bar)

7:00pm – 9:30 pm Banquet-Guest Speaker Ronnie Greer, "Brief History of the Scottish Environment from a Charr's Point of View"

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8:00am – 12:00pm

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8:20am – 8:40am
Arctic change and Alaska's marine fisheries – *Susan Sugai*
8:40am – 9:00am
Geographical shifts in the spatial distribution of Northeast Pacific groundfish populations: effects of temperature and changes in abundance – *Franz Mueter*
9:00am – 9:20am
Long-term trends in annual Bristol Bay and- Chignik sockeye salmon scale growth at sea in relation to sockeye abundance and climate change, 1955 – 2000 – *Jennifer Nielsen*

9:20am – 9:40am
Global climate change and potential effects on salmonids in freshwater ecosystems of Southeast Alaska – *Mason Bryant*
9:40 – 10:00am
Glacier loss in the Brooks Range: How will this affect North Slope stream ecology? – *Matt Nolan*

10:00am – 10:20am BREAK

10:20 – 10:40am
Predicting Climate Change Effects on Freshwater Foodwebs – *Mark Wipfli*
10:40am – 11:00am
Potential effects of climate warming on production of freshwater and anadromous stocks in the Yukon Territory – *Jody Mackenzie*
11:00am – 11:20pm
Does global climate change put Alaska waters at greater risk of biological invasion? – *Dennis Lassuy*
11:20am – 12:00pm
Panel Discussion

12:00pm – 1:20pm BUFFET LUNCH

Borealis Ballroom – *Concurrent Session # 1*

Session: Ecosystem-Based Fishery Management – Terry Quinn, Chair
1:20pm- 1:40pm
Sustaining sustainable fisheries management: status and future of long term observing programs in Alaska – *Phillip Mundy*
1:40pm- 2:00pm
Estimating multi-species maximum sustainable yields for the Bering Sea/ Aleutian Islands and Gulf of Alaska groundfish complexes – *Franz Mueter*
2:00pm- 2:20pm
Extending single-species stock assessments to account for predation: application to cod, mackerel and pollock in the Aleutian Islands – *Doug Kinzey*
2:20pm – 2:40pm
A fishery ecosystem plan for the Aleutian Islands – *Bill Wilson*
2:40pm – 3:00pm
Panel Discussion

3:00pm – 3:20pm BREAK

Borealis Ballroom – *Awards and Adjournment*

3:30pm – 4:00pm

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Gazebo Court – *Concurrent Session # 2*

Session: Contributed Papers (II) – Hal Geiger, Chair

8:20am – 8:40am
A Decision tool to evaluate proposed changes to Steller sea lion mitigation measures for the pollock, Pacific cod and Atka mackerel fisheries in the Gulf of Alaska and Aleutian Islands/Bering Sea – *Peggy Merritt*

8:40am – 9:00am
Aquatic community development in response to salmon carcass and salmon analog enrichment in newly restored fish habitat, Resurrection Creek, Alaska – *A. E. Martin*

9:00am – 9:20am
A straightforward Bayesian Jolly-Seber model for estimating spawning escapement – *Xinxian Zhang*

9:20am – 9:40am
Why do we think these Ricker curves work? – *Hal Geiger*

9:40 – 10:00am
Landscape correlates of threespine stickleback (*Gasterosteus aculeatus*) presence in small Southeast Alaska lakes – *David Gregovich*

10:00am – 10:20am BREAK

10:20 – 10:40am
Community-based habitat restoration: the Pullen Creek Fish Passage and Habitat Restoration Project – *Amber Bethe*

10:40am – 11:00am
Influence of brown bear predation on stream-life and production of chum salmon in McNeil River, Alaska – *Ted Otis*

11:00am – 11:20pm
Bioelectrical Impedance Analysis: a non-lethal tool to measure composition/energy density in fish – *Keith Cox*

11:20am – 11:40pm
Nondestructive Field Estimation of Fat Content of Yukon River Salmon – *Joe Margraf*

11:40am – 12:00pm
Non-native Northern Pike *Esox lucius* populations: habitat, and management in Colorado trout fisheries – *David Orabutt*

12:00pm – 1:20pm BUFFET LUNCH

1:20pm- 1:40pm
Geomorphology and selection of spawning habitat by Inconnu: a heuristic model – *Theresa Tanner*

1:40pm- 2:00pm
Working the Magic: Management of Prince William Sound Pink and Chum Salmon Commercial Fisheries – *Bert Lewis*

Friday, November 17

Chena Hot Springs Retreat

8:00am

Shuttle bus departs Wedgewood lobby

3:30pm

Shuttle bus arrives Fairbanks Airport. Room is still available. If interested let Lisa Stuby know by November 15th.

2006 Annual Alaska Chapter AFS Conference

ABSTRACTS

SESSION: Plenary

Faces of Alaska's Fisheries – The Introduction to the AFS Parent Society's 2005 Annual Meeting, Anchorage, September 11-15 And Tribute to Molly Ahlgren

Bill Wilson

North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
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The Plenary Session of the annual Parent Society meeting in Anchorage, September 11-15, 2005, included a visual introduction to Alaska and its fishery resources. This 12-minute presentation was meant to show the grandeur of Alaska and the diversity of Alaska's fishery resources to an audience of meeting attendees from across the U.S. and dozens of foreign nations. The presentation concludes with a short memorial to Dr. Molly Ahlgren. The Alaska Chapter now manages a scholarship fund in Molly's name, which soon will grow to be a significant resource for scholarship awards to many future Alaskan fishery biologists. Some members of the Chapter missed the 2005 meeting Plenary Session and asked that this introductory presentation be given again.

Ecosystem programs in Alaska

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Many different descriptions of what constitute an Ecosystem Program exist. Generally, however, the purpose of such a Program is to conduct scientific studies that integrate the interests and participation of local communities, industry, government and non-government agencies and other stakeholders to ultimately supply resource-management agencies the necessary information and tools to make scientifically based, better informed decisions that balance the costs and benefits for both the ecosystem and society. Underlying this concept is that resource management agencies have adopted an ecosystem-based approach to management that considers the entire ecosystem, including humans. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern, as it considers the cumulative impacts of different sectors. Governmental agencies and other grant funding sources increasingly request proposals with an ecosystem perspective. Similarly, scholarly journals are also suggesting that authors present their research findings in this larger context. In Alaska, several organizations and agencies support research on a large scale in order to address ecosystem questions, especially in face of climate change. These include, but are not limited to ADFG, AOOS, AYKSSI, NOAA, NPFMC, NPRB, NSF, PICES, Sea Grant, USFWS, and USGS. Many of these form part of the Bering Sea Interagency Working Group in an attempt to coordinate research in the Bering Sea, specifically. This talk will present a general overview of the focus of each of these larger programs, outline how the fit together, and point out funding opportunities where appropriate.

Heterogeneity in climate warming effects on fish and wildlife habitats and populations

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Since ~1920, average global temperature has increased at a rate unprecedented in the past 1,000 years. Temperature at the end of the 21st century is predicted to increase by an additional 2-6 ^{o}C. The relatively sudden and rapid rate of increase in temperature has caused alarm because changes in temperature and associated moisture regimes are logically expected to affect the phenology and productivity of habitats, access to habitats and the distribution and abundance of plant and animal species. However, substantial multi-scale temporal and spatial heterogeneity in warming precludes simple statements regarding net effects. For example:1) warming is pronounced in northwestern North America but northeastern North America is cooling, 2) earlier green-up increases forage during reproductive events but subsequent earlier senescence reduces forage quality prior to pre-winter fattening and 3) climate induced wetland drying may reduce habitat for waterfowl and fish but increase habitat for moose. Many recent studies are of small temporal and spatial scale, report relatively weak correlations (i.e., R^2 <0.3) between local population characteristics and global climate indicators and emphasize the potential negative effects of warming on wildlife. However, it is expected that warming will have both positive and negative effects on populations and species. Net effects can only be estimated by quantitative assessment within and among years and decades. Because the warming may be considered to be a very large uncontrolled experiment; reliable advancement of knowledge will require critical emphasis on study design, unambiguous identification of mechanisms, estimation of biologically meaningful effect levels, and serious consideration of alternative explanations. Given the rate, magnitude, and heterogeneity of the recent warming, it is certain that successful field studies of any fish and wildlife habitat or population process will require explicit assessment of any background trend that may be attributable to warming.

Training of Community Members in South Pacific Island Nations for Biological Monitoring of Local Fishing Grounds

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Communities of Indo-Pacific island nations are often the owners of local fishing grounds. During the 1990s, community interest shifted from simple exploitation to sustainable uses of these resources. This interest has resulted in creation of the Locally Managed Marine Area network (LMMA), a partnership of communities and organizations dedicated to marine conservation and sustainable development. The LMMA supports communities in developing and executing their own management plans. These plans include the need for biological monitoring to measure results and share "lessons learned". The LMMA has produced a training video, aimed at both trainers and community members, that provides guidance for biological monitoring methods in basic, layman terms. Selected segments of the first (English) version of the video will be shown, allowing time for discussion at the conclusion.

SESSION: Alaskan Estuaries

Distribution of larval eulachon (*Thaleichthys pacificus*) in the surface waters of Berners Bay, Alaska

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The Berners Bay estuary in the upper Lynn Canal of Southeast Alaska provides highly productive spawning and nursery habitat as well as a migratory pathway for forage fishes such as Pacific herring (*Clupea pallasi*), capelin (*Mallotus villosus*), sandlance (*Ammodytes hexapterus*), juvenile salmonids (*Onchorynchus sp*.), and eulachon (*Thaleichthys pacificus*). It is particularly the latter that attract large abundances of marine mammals and sea birds during their annual springtime spawning migrations through Berners Bay. However, in spite of their ecological importance, little is known about most aspects of the early life history of eulachon in Alaskan waters. Here we describe larval eulachon abundance patterns and examine the potential for larval retention in Berners Bay. Berners Bay is characterized by a seasonal counterclockwise surface current that is fed from the three rivers in the north of the bay. Tidal vertical migration or large-scale estuarine currents are the most likely forces to promote the retention of larval fishes within an estuary. To explore estuarine residence and timing of outmigration of larval eulachon we sampled the surface waters of Berners Bay weekly from 5 June to 4 August 2004 off a small skiff using surface plankton tows, plankton tows to 5m depth and vertical plankton tows to 35m depth. Larval eulachon density and length frequency were determined at four sites within Berners Bay. In 2004, eulachon spawning occurred from approximately April 26 to May 14 on the Antler River. Eulachon larvae were first collected in the bay on 5 June and positive catches were recorded until 25 August. Peak density of eulachon was 25.1 m^{-3} and was recorded on 25 June.

Overwinter changes in energy content and proximate composition of juvenile capelin in southeastern Alaska

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Little is known about the role of winter in the early life history of marine fishes in Alaska. Recent surveys indicate that pelagic species, in particular, experience extreme fluctuations in lipid and energy content over winter. These fluxes are believed to result from reduce prey availability and subsequent nutritional stress, suggesting that winter may be an important bottleneck to recruitment of juveniles to adult stages. We examined the change in size, protein, lipid and energy content of juvenile capelin over winter in Berner's Bay, an embayment in northern southeast Alaska. Average lengths of age-0 capelin increased between December 2004 and March 2005, however the maximum length of remained constant. In contrast, lengths of age-1 capelin remained constant. Energy content of both age classes of capelin declined over the period, but the sources of this energy depended on age. Energy lost in age-0 capelin derived primarily from protein, while lipid supplied the entirety of energy lost by age-1 fish. Consumption of protein during periods of nutritional stress indicates starvation. Thus, we conclude that increased length of age-0 capelin resulted from size selective mortality. Winter is therefore likely to be an important bottleneck to the recruitment of capelin to adult stages.

Distribution of sticklebacks in Kuskokwim Bay, Alaska

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Little is known about the nearshore distribution of sticklebacks in Western Alaska. We examined the distribution of ninespine stickleback (*Pungitius pungitius*) and threespine stickleback (*Gasterosteus aculeatus*) in Kuskokwim Bay, Alaska during the summers of 2003 and 2004 while conducting surveys for juvenile salmonids. From the mouth of the Kuskokwim River, we sampled a grid of stations across a salinity gradient of 0 to 30. We used a modified Kvichak Surface trawl to collect fish from June through August in 2003, and from May through June in 2004. Oceanographic data, including temperature, salinity, turbidity, and fluorometry, and zooplankton were collected at each station. A total of 5247 sticklebacks were counted and released in 2003 and 2004. We present stickleback catch data in relation to oceanographic variables and the distribution of other fishes. Based on stickleback distributions over time, it appears that threespine sticklebacks move from the bay into the Kuskokwim River and small ponds adjacent to the bay in May. At the same time, ninespine sticklebacks move from freshwater habitats into the bay. In May 2004, threespine stickleback were observed migrating into tundra ponds on the eastern shore of Kuskokwim Bay. By July, both species are again distributed throughout the bay. We compare and contrast stickleback movements with those of other species that use Kuskokwim Bay.

Spatial and temporal distribution of wild and hatchery chum salmon fry (*Oncorhynchus keta*) of two rearing strategies in the Taku Inlet

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In the present study, we examine spatial and temporal overlap in 2004 and 2005 between wild chum salmon fry (*Oncorhynchus keta*) in the Taku River estuary (Taku Inlet) and hatchery fry from Douglas Island Pink & Chum hatchery (DIPAC) of two rearing strategies: fry released May 9-11 at ~ 2.2 g (early) and fry released May 22 – June 1 at ~ 4.0 g (late). We sampled from late April until late June using beach seines and tow nets and stratified catch according to inlet location. Collected chum salmon fry were measured and weighed and otoliths examined for thermal marks. Most wild and early fry had left the estuary by the time late fry were released. Peak catch in seines in the inner inlet was: 17 wild fry/set the week of May 17, 2004 and 4 early fry/set the week of May 10, 2004; 24 wild fry/set week of May 3, 2004 and 0.54 early fry/set the week of May 10, 2005. Peak catch in seines in the outer inlet was: 11 wild fry/set and 626 early fry/set the week of May 10, 2004; 31 wild fry/set the week of May 10, 2005 and 265 early fry/set week of May 17, 2005. Hatchery fry were rare in the inner inlet both years, but comprised over 95% of the catch in the outer estuary during the peak of outmigration. Hatchery fry were significantly larger than wild fry in both beach and neritic samples. There was apparent growth of wild and early fry throughout the season but late fry appeared to emigrate out of the estuary soon after release. The highest level of spatial and temporal overlap occurred in littoral habitat between wild and early fry in the outer inlet in mid May both years, indicating the greatest potential for interaction.

Trophic Interactions among Wild and Hatchery Juvenile Chum Salmon in Taku Inlet, Southeastern Alaska

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Mortality of Pacific salmon during their marine life history is highest during the early period and may be related to competition for food. To assess trophic interactions as a potential cause for declining wild adult chum salmon returning to the Taku River, we examined diet and energy content of wild chum and DIPAC hatchery chum juveniles utilizing Taku Inlet from late April to late June, 2004. Juveniles caught in beach seines and townets at stations in inner, middle, and outer Taku Inlet were preserved for stomach analyses or frozen for calorimetry to determine energy content. Otoliths were extracted and examined for hatchery thermal marks, then subsamples representing wild and hatchery stocks were processed for diets (n=486) and calorimetry (n=571). We also determined a baseline energy content for hatchery chum (n = 63) upon release in May and diet and energy content for both stocks from summer trawl catches in Icy Strait (n=114) to compare their condition as they approach the Gulf of Alaska (GOA). Hatchery chum were initially larger and had greater energy content (cal/g WW) than wild fish; however, energy values converged by mid-June in Taku Inlet, and wild fish in Icy Strait were in similar condition as hatchery fish. Multivariate analysis of 54 prey measures indicated that diets of the two groups were distinct throughout the season in all inlet locations, and converged in Icy Strait. Further analysis is needed to determine if the diet partitioning and energetic differences in Taku Inlet are related to high densities of hatchery fish residing short-term in outer Taku Inlet. If density-dependent interactions are affecting wild chum salmon in the inlet, the negative effects must occur very rapidly because juvenile survivors enter the GOA with no apparent disadvantage.

SESSION: Contributed Papers (I)

Three-stage catch survey analysis of Kodiak red king crab

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Waters around Kodiak Island in the central Gulf of Alaska once supported the world's largest fishery for red king crab (*Paralithodes camtschaticus*). The fishery was characterized by low-level harvests in the 1950s. However, annual landings increased rapidly in the 1960s to a peak harvest of 42,800 mt (94.4 million lb) in 1965. Stock abundance declined dramatically in the late 1960s, and again in the early 1980s, and a commercial fishery closure since 1983 failed to result in stock recovery. The failure of the Kodiak red king crab resource to recover remains a mystery. Our overall project goal is to use numerical modeling in a retrospective analysis of the red king crab stock around Kodiak Island to understand the conditions surrounding the stock's rise and collapse, and failure to rebuild. Specific objectives are to: (1) reconstruct the king crab spawning stock abundance and recruitment over 1960 to present; (2) estimate a stock-recruit relationship (if any); and (3) analyze temporal changes in the stock biogeography with respect to oceanographic conditions, ecological factors, and historical harvests. Ultimately, a stock synthesis model will be developed that incorporates a variety of data to reconstruct Kodiak king crab abundance. The model will reflect temporal changes in data availability: no surveys before 1972; pot surveys during 1972 to 1985; and trawl surveys since 1985. As an interim step, here we describe a three-stage catch-survey analysis (CSA) using pot survey data for 1972 to 1985 and trawl survey data for 1985 to 2004. Carapace length is used to assign male crabs as pre-recruits, recruits, or post-recruits. A female model was similarly developed with "recruits" being females that mature in the current year, "pre-recruits" being one molt shy of maturity, and "post-recruits" being mature more than one year. Results of CSA and future research plans are discussed.

Spatial variation in Dungeness crab megalopae abundance and transport in Glacier Bay, Alaska: Implications for the size and location of marine reserves

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Glacier Bay, Alaska was established as a marine reserve in 1999 and is the largest marine reserve for Dungeness crabs, *Cancer magister*, throughout their range. Here, we examine spatial variation in larval abundance and transport among proximal locations within the bay to elucidate the connectivity of early life stages and to identify locations that may be important for early life stages. Dungeness crab megalopae abundances were compared within the area of highest adult crab abundance in Glacier Bay. We used light traps to collect surface and bottom (10 m depth) samples at three sites separated by 2 – 7 km in 2004 and 2005. Cross-correlation analyses on ARIMA residuals were used to relate pulses of megalopae with physical variables in 2005. Megalopae abundances decreased with increasing distance from the mouth of Glacier Bay in both years with significant differences among sites in 2005. Surface traps collected 96.5 – 99.4 % of megalopae. Correlations with lunar, tidal and wind cycles were variable among the two sites with high megalopae abundances suggesting that supply to each of these sites is governed by different transport mechanisms. Hydrodynamic processes paired with megalopae behavior may lead to spatial variation in megalopae abundance in the lower portion of Glacier Bay. Similarity between adult abundance and patterns of larval supply suggest that larval supply may drive spatial variation of adults.

Marine-terrestrial linkages in Gulf of Alaska watersheds: Monitoring the effects of anadromous marine derived nutrients on biological production in sockeye salmon systems

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The objective of this project is to assess the role of salmon derived nutrients in the ecology of an anadromous system. Karluk Lake, which has a naturally large population of returning sockeye salmon, is compared to nearby Spiridon Lake, which is stocked annually with juvenile sockeye salmon, but has no access for returning adults. From 2004–2006, nine times throughout the growing season, we sampled two lake and two river stations from each lake. Temperature profiles, nutrient concentrations, chlorophyll, zooplankton biomass and species composition, and several other lake parameters were measured. Experiments were conducted to assess the primary productivity rate of each lake. Natural abundance of isotopes was measured in phytoplankton, zooplankton and smolt, and smolt outmigration was monitored and sampled. Incidentally, the three years of this project spanned the whole breadth of temperature variability measured in these systems over the past 12 years. Both lakes were nutrient limited, but Karluk Lake had higher phytoplankton standing crop, higher productivity and a higher $\delta^{15}N$ signature than Spiridon Lake. Both lakes had poor to intermediate zooplankton biomass compared to historical data. We conclude that Karluk Lake smolt production is bottom-up controlled by marine derived nutrients, whereas Spiridon Lake smolt production is top-down controlled by smolt stocking numbers.

Humpback whale habitat use patterns and interactions with vessels at Point Adolphus, Alaska

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Humpback whales at Point Adolphus, inside waters, southeastern Alaska, have developed strategies to exploit predictable times to feed which are tidally-induced and do so while in the presence of vessel traffic. Point Adolphus is unique because of abundant prey resources that attract high concentrations of humpback whales during the summer and high levels of vessel activity. Using scan sampling and focal behavior observation sessions, data were collected from an elevated shore station on the north coast of Chichagof Island in southeastern Alaska in 2001. Whales were distributed to the west during ebbing tides and to the east during flooding tides. Humpback whale swim speeds were faster as vessel numbers increased and when the nearest vessel was within 100 m. Responses differed among individual whales. Swim speeds of three individual whales slowed as number of vessels increased. A mother and calf swam faster when the nearest vessel was 500 – 1000 m and slower when the nearest vessel was greater than 1000 m or within 500 m. Whales at Point Adolphus appeared to maximize energy gain by selecting optimal feeding times, and minimize energy loss by short-term avoidance strategies necessary to feed in the presence of vessel traffic.

A remote sensing/GIS based approach to predicting and estimating juvenile Chinook salmon rearing habitat within a transboundary river floodplain in Southeast Alaska

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Remote sensing offers an alternative method to researchers and managers in monitoring large rivers and the aquatic habitat within. Large rivers are not accommodating for traditional (on the ground) fish habitat surveys due to their size and typically complex habitat. This study investigates the capabilities of using high spatial resolution digital aerial photography and thermal infrared images to spatially map and quantify potential juvenile Chinook salmon habitat in the Unuk River. Airborne digital images acquired in the spring of 2003, 2004, and 2005 were processed and analyzed using commercial image processing software and a geographic information system (GIS). Classification of the images provided spatial layers for the following landscape elements: large wood, water, sand/gravel, and vegetation, at an overall accuracy of ~ 85%. Large wood dynamics (e.g., quantity and distribution) were assessed over the three year time period for annual changes. Chinook salmon indicator layers and metrics derived from the classified imagery were weighted and integrated to produce a potential rearing habitat map for a continuous 12 km section of the Unuk River floodplain. Remote sensing techniques developed in this project provide a successful method for monitoring and evaluating change in large wood dynamics. Thermal infrared imagery shows great potential for mapping and delineating river channels, particularly in areas obstructed by forest canopy, including shadow effects. Results from this study provide a promising foundation towards an alternative methodology for predicting and monitoring salmon habitat that will assist managers toward the ultimate goal of linking habitat conditions with salmon production.

2006 Annual Alaska Chapter AFS Conference

SESSION: Preserving Fish Habitat in the 21st Century

Threats to Fish Habitat in Alaska

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I will present a way to compartmentalize fish habitat that helps organize a discussion of threats to fish habitat and solutions to address those threats; I will give a quick summary of the current fish habitat situation in Alaska; I will lay out what I believe to be the greatest threats to fish habitat; I will suggest strategies to address these threats; and finally, I will suggest a role(s) for AFS and fisheries scientists in addressing threats.

Essential Fish Habitat in Alaska

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The Magnuson Stevens Fishery Conservation Management Act (Act) provides for the conservation of fish habitat, termed Essential Fish Habitat (EFH). EFH provisions are still fairly new. Just recently, EFH throughout Alaska was updated through a multi-year public EIS and regulatory process. Updates include *refined EFH Descriptions, a new process for identifying Habitat Areas of Particular Concern (HAPC's), and pre-cautionary measures to protect EFH for fishing effects*. This analysis was coordinated through the North Pacific Management Council and the Alaska Fisheries Science Center. Importantly, the Act also provides the mechanism to conserve EFH through consultation of those human induced activities that may adversely EFH. Consultation focuses on managed fish (marine groundfish, crab, salmon, scallops), not all fish. Consultation is required for Federal action agencies and recommended for State actions. NMFS coordinates with other Federal and State Habitat specialists to conserve these resources and their habitats. Through consultation, NMFS offers conservation recommendations to protect EFH. This also includes consultation for actions that NMFS regulates. For example, NMFS recently took action to protect roughly 300,000 nm^2 of diverse marine habitats to bottom fishing impacts: ~280,000 nm^2 of undisturbed marine habitats; 8,000 nm^2 of areas known or thought to contain higher densities of hard and soft corals in the Bering Sea, Gulf of Alaska, and Aleutian Islands; and over 5,000 nm^2 of Alaska Seamounts.

Federal Protection of Fish Habitat in Alaska

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It is my intent to present a synopsis of Federal conservation and environmental laws that involve a habitat and species conservation program; e.g. the Clean Water Act, National Environmental Policy Act, Fish and Wildlife Coordination Act, the Federal Power Act, Magnuson- Stevens Act, Endangered Species Act. I also intend to provide an overview of the difference between what is regulatory and what is advisory.

State (DNR) Protection of Fish Habitat in Alaska

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The Office of Habitat Management and Permitting (OHMP) is an office within the Alaska Department of Natural Resources that works to preserve the state's fish and wildlife resources by protecting the areas they need to complete their life cycles. I will discuss a range of habitat protection activities, which include permitting under the Anadromous Fish Act, and the Fishways Act. OHMP also coordinates with other agencies during project review including working with the state Division of Forestry to review timber harvest plans; working with the DNR Office of Project Management and Permitting (OPMP) on large project teams for hard rock mines, oil and gas development and major new transportation projects; and providing comments to OPMP on projects under review for consistency with the Alaska Coastal Management Program. OHMP also works cooperatively with the Alaska Department of Fish and Game to maintain and revise the Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes. This document lists water bodies that are known to be used by anadromous fish and legally gives these streams and lakes protection as important fish habitat.

Agencies Working Together to Protect Habitat

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Developers need to work through a combination of Federal and State processes to obtain the necessary permissions to implement a project that could impact fish habitat. Many large project developers bring all appropriate parties together early in the process to collectively identify issues of importance. All parties work together to avoid, minimize and mitigate potential impacts. Total agreement among parties is seldom achieved. In the end, developers submit to appropriate reviews for both the State and Federal processes. These reviews are often done simultaneously. Coordination between State and Federal reviewers often results in a permitted project that significantly avoids, minimizes, and mitigates most impacts.

National Fish Habitat Initiative

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The National Fish Habitat Action Plan (Action Plan) was developed by the National Fish Habitat Initiative (NFHI) Core Work Group spearheaded by the International Association of Fish and Wildlife Agencies (IAFWA). Its basic elements are based in part on the highly successful North American Waterfowl Management Plan (NAWMP). It is a voluntary program designed to encourage a variety of diverse partners and stakeholders to more effectively utilize existing and new resources to successfully execute conservation efforts to protect, restore, and enhance fish habitats across North America. I will highlight ways in which implementation of the Action Plan in Alaska will support preserving fish habitats.

2006 Annual Alaska Chapter AFS Conference

JOINT SESSION: Marine Derived Nutrients in Alaskan Ecosystems

In addition, this session is co-sponsored by the Alaska Chapter of the Wildlife Society, the Yukon River Chapter of the Society of American Foresters.

Marine-Derived Nutrients in Stream Ecosystems: The Value of Setting Ecological Escapement Goals

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Adult salmon provide tons of marine-derived nutrients and energy (MDN) to stream ecosystems each year when they spawn, die, and decompose. This influx of biomass commonly increases biological productivity and influences stream and riparian community dynamics. All major trophic levels (i.e., biofilm, invertebrates, fishes) in streams respond to MDN inputs, in a variety of ways (including typically increased abundance, growth rates, marine isotopic signatures, and lipid reserves). And salmon eggs are a more nutritious food resource than many other available food items. Further, carcasses scattered throughout riparian habitats by floods or vertebrates are quickly colonized and eaten by terrestrial invertebrates, facilitating nutrient cycling and energy flow back to stream systems. Anadromous and resident fishes, as well as other aquatic and riparian consumers, ultimately benefit by feeding on the more abundant aquatic and terrestrial prey, and from feeding directly on salmon tissue and eggs. Marine-derived nutrients clearly have broad ecological value, influencing productivity and benefiting a wide range of consumers in both stream and riparian ecosystems. The nutrients should be considered in multi-species and ecosystem management decisions.

Marine Nutrient Subsidies to Freshwater and Terrestrial Ecosystems: Insights from Stable Isotopes

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Anadromous fish transport tons of nutrients annually from the sea to terrestrial ecosystems, representing an ecologically important subsidy that potentially enhances biological productivity. In the Yukon River system for example, Pacific salmon alone bring at least 150, 20, and 30 metric tons of N, P, and S respectively on an annual basis. These quantities are small compared with total exports from the system, which are approximately 1,100 to 57,000 times greater depending upon the nutrient under consideration. However, the flux of salmon-derived nutrients is confined to a narrower time window and can be highly directed to specific regions within the drainage. Under these circumstances, significant shifts in the isotopic composition of nutrient pools are possible, although the magnitude of the shift is highly dependent upon inter-annual variability in spawning returns and pathways by which subsidies are incorporated into producer and consumer compartments. Among the light stable isotope systems, $\delta^{15}N$ and $\delta^{34}S$ have proven to be valuable tools in quantifying marine nutrient subsidies to freshwater and terrestrial systems. This talk will review recent stable isotope-based studies of resident stream fishes and parr salmon to assess the importance of subsidies and highlight gaps in our current understanding. Additionally, a ten-year study of brown bear ecology will be used to illustrate the importance of inter-annual variability in salmon returns. In this study, the proportion of salmon in assimilated diet estimates was shown to closely track salmon availability. In addition, negative population level effects (lambda, survival) were observed during recent salmon run failures in western Alaska (1997-1998). This example highlights the far reaching impacts of marine nutrient subsidies on terrestrial ecosystems. Future inter-disciplinary studies that merge stable isotopes with other techniques, such as analysis of lipids and fatty acids, will lead to a more comprehensive understanding of the ecological importance of marine nutrient subsidies.

Pacific Salmon, Nutrients, and the Dynamics of Freshwater and Riparian Ecosystems

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Pacific salmon (*Oncorhynchus spp*.) accumulate substantial nutrients in their bodies as they grow to adulthood while at sea. These nutrients are carried to predominantly oligotrophic lakes and streams, being released during and after spawning. Research over >3 decades has shown that the annual deposition of salmon-borne, marine-derived nutrients (MD-nutrients) is important for the productivity of freshwater communities throughout the Pacific coastal region. However, pathways and mechanisms for MD-nutrient transfer and accumulation in freshwater ecosystems are virtually unexplored with many uncertainties remaining. This presentation addresses two related topics. First, I summarize recent advances in understanding linkages between MD-nutrients, freshwater (including riparian) ecosystems, and community dynamics, and then I review large-scale and long-term processes in the atmosphere and ocean that govern variability in salmon populations. Second, I evaluate the 'validity' of the discoveries and their implications for active ecosystem management, noting areas where extrapolation of results still requires extensive caution. Collectively, the data suggest that the freshwater portion of the salmon production system is intimately linked to the ocean and, therefore, to be sustainable, requires a holistic approach to management. This holistic approach, presented in a conceptual framework, treats climate cycles, salmon, riparian vegetation, predators, and MD-nutrient flowpaths and feedbacks as an integrated system.

Salmon Escapement Goals for Wildlife: A Case Study at McNeil River, Alaska

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Salmon are an important food resource for many wildlife species in Alaska, including bears (*Ursus* spp.). Since 1967, the McNeil River State Game Sanctuary has been managed by the Alaska Department of Fish and Game (ADF&G) to provide permanent protection for brown bears (*U. arctos*). Few places in the world provide such a dramatic example of how direct the relationship between bears and salmon can be. Chum salmon (*Oncorhynchus keta*) provide the principal food resource for the extraordinary number of bears that annually gather along lower McNeil River, where up to 144 bears have been identified in one summer. However, consistently low chum salmon escapements into McNeil River since 1988 have led to annual closures of the commercial fishery and are implicated as a factor contributing to a recent decline in bear use at McNeil Falls. In 2005, ADF&G's Wildlife Conservation and Commercial Fisheries Divisions initiated a cooperative study to better understand the relationship between McNeil River chum salmon and bears. Our primary objective in this study was to establish a recommended escapement goal for McNeil River which explicitly incorporates bear use of salmon and thus encourages optimal salmon productivity. This was accomplished using radio tagged chum salmon and daily monitoring of chum salmon capture rates by bears at McNeil falls. Bears were found to capture a significant number of pre-spawning chums, and the stream-life factor currently used to calculate annual escapement indices was found to be too high. These data should allow us to recommend changes to the escapement goal that would both assure a predictable food resource for McNeil bears and benefit the commercial fishery. Finally, this project may also serve as a model for other systems throughout Alaska where salmon escapement goals may not be adequately accounting for broader wildlife and ecosystem needs.

The Impacts of Salmon Carcasses on Plant-available Soil Nutrient Pools in Southeast Alaska

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Brown and black bears may capture, carry to the riparian forest, and partially consume a large fraction of the returning salmon to some systems. If salmon-derived nutrients can influence the productivity of recipient freshwater systems, if follows that the remaining biomass (and associated nutrients) of bear-killed salmon carcasses may influence riparian processes as well. However, the impact of salmon carcasses on soil nutrients, including plant-available N and P, is not well understood. Using an experimental approach, we examined how salmon carcasses may influence the spatial and temporal dynamics of soil carbon, nitrogen, and phosphorous in riparian forests of southeast Alaska. At their peak, ammonium (NH_4^+-N) concentrations in soil 10 cm from carcasses were as much as several orders of magnitude greater than soils in adjacent control plots and remained elevated until the onset of winter. Nitrate (NO_3^--N) concentrations also increased in plots with carcasses, although NO_3^--N was only 3% of NH_4^+-N at its highest measured concentration and lagged the peak in NH_4^+-N. Soil $\delta^{15}N$ showed an increase in plots with carcasses, coincident with maximum NH_4^+-N concentrations. Phosphorous levels also increased by several orders of magnitude over background concentrations and, at all spatial scales, appeared to peak after several weeks, drop off, and then rise again, possibly reflecting differences in decay rates of different tissues. Yet changes in soil nutrient concentrations were highly localized: soil N concentrations were only moderately elevated 20 cm from carcasses, and closely resembled background concentrations at 30 cm. These results suggest that salmon carcasses, via bear foraging activities, can dramatically influence soil nutrient dynamics, although the impacts appear to be highly localized and will be largely dependent on the spatial distribution of carcasses in the riparian forest. Caution should be taken when ‘scaling up’ to ecosystems responses.

Incorporating Information on Marine-Derived Nutrients into State Land Management

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Interest in the transport and effect of marine-derived nutrients into terrestrial ecosystems has increased rapidly over the last decade. However, little has been done to incorporate this growing body of information into land management decisions. This presentation summarizes existing riparian management standards on multiple use land managed by the State of Alaska, particularly forested land. Riparian buffers, forestry best management practices, land use classifications, and guidelines in regional land use plans are the main tools that currently guide riparian management. Decisions on incorporating information on marine derived nutrients into land management decisions will depend on the public resources affected by changes in nutrient distribution, the geographic extent of impacts, effects of land management activities on nutrient transport and accumulation, and the significance of these effects. Options for bringing information on marine-derived nutrients into land management decisions include science and technical committees and land use planning processes.

SESSION: Marine Ecology

Ecological differences between black (*Sebastes melanops*) and dark (*S. ciliatus*) rockfish

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Black and dark rockfish co-occur across much of the nearshore waters of the Gulf of Alaska and Aleutian Islands, often in the exact same locations. Over 20% of survey jig locations in eastern Aleutian Islands, for example, caught both species. Both species support sport and commercial fisheries with commercial landings sometimes composed of both species. The state of Alaska received full management authority for black rockfish in 1998 and the North Pacific Fisheries Management Council is currently reviewing the possibility of turning management authority for dark rockfish over to the state as well. ADF&G has been actively gathering the data need to develop management plans which will insure the sustainability of this mixed species fishery. We present the results of 5 years of research on growth, size and age of maturity, food habits and behavior for the two species. Jig, hydroacoustics, and underwater video were used to conduct surveys and collect specimens from Unalaska Bay in the Aleutian Islands to the outer Kenai Coast in the central Gulf of Alaska. While outwardly similar, these co-geners have very different life histories. Dark rockfish live longer but attain a smaller maximum size than black rockfish. Maximum age for dark rockfish is over 80 years while black rockfish have been only documented as old as 52 years. Dark rockfish release their larvae in March-May while black females release in December to February. Preliminary work indicates that dark rockfish mature at an older age but smaller size than black rockfish. There is broad overlap in their diets, but black rockfish are generally more piscivorous. Underwater observations reveal that black rockfish often form large semi-pelagic schools while dark rockfish are generally more solitary and demersal.

An early life history model for Pacific herring in Prince William Sound, Alaska

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Our modeling efforts support Hjort's concept of mortality in the larval stages as the most "critical period" in determining year-class strength of herring fisheries. Using published data, we integrated information about survival in egg, larval and juvenile life stages into a mathematical model that used means and standard deviations to characterize the early life history of Pacific herring (*Clupea pallasii*) in Prince William Sound (PWS), Alaska. The early life history model predicted survival after the first year to be 118 herring out of one million eggs and a 95% confidence interval of 5 - 2,822 herring. Survival estimates differed for all life stages in the first year, with survival the lowest in the larval stage. Estimates of survival of the egg stages, fall juveniles and winter juveniles were two orders of magnitude greater than the survival of larvae. The single-stage sensitivity analysis demonstrated that for age-0 herring the influence of altering daily mortality resulted in an estimated total survival that was not equivalent for each life stage. The largest influence to the total survival was by increasing or decreasing the daily mortality in the larval stage. The results of the interaction sensitivity analysis of all possible paired life stages affirmed the results of the single life stage sensitivity, i.e., the larval life stage, in combination with any other life stage, contributed the most to total survival of first year herring. Environmental processes, including food availability, water temperature, and transport processes, act on the larval stage to determine survival of Pacific herring.

An examination of habitat structural complexity and fish distribution in nearshore waters of Kachemak Bay, Alaska

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Habitat structural complexity can determine fish abundance and diversity. Increasingly complex habitats influence predator prey interactions, reduce water flow, and can serve as areas for feeding, reproduction, and recruitment, all of which can be beneficial to fish populations. Recent legislation has increased interest in fish habitat particularly in regard to juvenile fish. The goal of this study was to examine macroalgal and substrate complexity with respect to juvenile and adult fish habitat. Juvenile and adult fish were collected from multiple sites within different nearshore habitat types along with substrate and algal complexity measurements. Standard Monitoring Units for the Recruitment of Fish (SMURFs) and light traps were used to capture juvenile fish. SCUBA visual surveys were used to collect adult fish and habitat data. Fish abundance and composition as well as kelp cover varied over time in the macroalgal sites. Adult fish communities were comparable in areas of similar habitat. The dominant fish included gadids, hexagrammids, sebastids, cottids, and pleuronectids. Adult gadids and hexagrammids were abundant at both canopy and understory sites while adult sebastids were more prevalent at understory sites. All of these groups were lacking at sand sites. Juvenile gadids were more abundant in understory sites while juvenile sebastids were captured in all habitat types, including sand. Juvenile hexagrammids were lacking at all sites. Adult and juvenile cottids were apparent at all sites. Pleuronectids were only found in sand sites. Fish abundance varied more in macroalgal stands than in sandy areas suggesting some degree of linkage between fish and macroalgal habitat types. Particularly, understory kelp and substrate composition, not canopy kelp were influential in structuring fish community. This study indicates that different groups of fish may have different habitat preferences in Alaska's nearshore waters requiring different management strategies depending on fish species and life history.

Larval recruitment of Dungeness crabs in Glacier Bay, Alaska

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Dungeness crabs are a commercially important crustacean, however little is known about their early life history in Alaska. We studied temporal patterns of larval recruitment in Dungeness crabs in Bartlett Cove, within Glacier Bay, Alaska from 2000 to present, using light traps in the water column to attract late-stage larvae (megalopae) and settlement collectors on the shore to collect settlers. Larval abundance varied four- to five-fold interannually. Larvae were abundant over a two and a half month period from August to November, with peaks roughly within one week before and after the new moon in September and October. However, the number and breadth of peaks varied interannually. For example, in 2005 larval abundance peaked once, for less than a week in October; whereas, in 2003 and 2004 larval abundance was relatively high for several weeks in September and for about a week in October. In 2003, we observed a small peak in late-stage larval abundance in August. Abundance of larvae was linearly and strongly related to abundance of settlers (R^2=0.91). Larvae that settle first may have a growth advantage over individuals that settle later in the season, as juvenile growth rates slowed over the winter. Under laboratory conditions, crabs that settled in September, on average, reached the third juvenile molt (J3) in January, while crabs that settled in October did not reach this stage until March. Survival in the lab was lower for the October cohort. Studies in Oregon have indicated that late-stage larval abundance of Dungeness crabs is an important indicator of strength of the year class in the fishery once these larvae reach the fishery. That relationship will be tested with this time series in Alaska, given time for the larvae that were observed in this study to reach fishery age, approximately five to six years later.

Conceptual model for the population structure of Pacific halibut (*Hippoglossus stenolepis*) using insights from satellite tagging

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Currently, Pacific halibut (*Hippoglossus stenolepis*) are managed as one population extending from California through the Bering Sea. However, previous satellite tagging results support the idea that the fish in the Bering Sea and Aleutian Islands belong to a separate population from those in the Gulf of Alaska. We hypothesized that separate populations may be formed by geographic and bathymetric separation, reinforced by regional behavioral adaptations to the environment. This presentation compiles the results from several satellite tagging investigations of Pacific halibut and integrates the new insights into a conceptual life history model that describes mechanisms of potential population structure for Pacific halibut. Geographic landforms and discontinuities in the continental shelf appeared to limit the interchange of Pacific halibut among areas and delineated the boundaries of potential populations in the Gulf of Alaska and eastern Bering Sea, with apparent smaller, localized populations along the Aleutian Islands. The mean seasonal dispersal distance in each region appeared to be influenced by the distance between major discontinuities in the continental shelf. Regional differences in migration timing and average monthly depth of Pacific halibut were most likely a response to different bottom temperatures and we propose that migration timing and depth evolved to maximize the survival of progeny. By using the satellite tagging results and relying on key assumptions from previous research, we built a conceptual population structure model for Pacific halibut that relied on physical and behavioral separation of spawning grounds, potential retention gyres for pelagic stages, delivery of larvae to nearshore nursery areas, and contranatant migration of juveniles.

SESSION: Behavioral Ecology

Summer and fall chum salmon spawning and incubation habitat in the Yukon River Drainage, Alaska: Possible differences of sensitivity or response to change?

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Chum salmon populations from the Arctic-Yukon-Kuskokwim (AYK) area of Alaska persist because they are adapted to the rigors of spawning and incubating under harsh winter conditions. It is generally assumed that chum salmon spawning at the northern limits of their range are dependant on groundwater upwelling areas where temperatures are maintained around 4 ºC. Fall chum salmon spawn in the upper reaches of the Yukon River drainage and later in the season (September – November) in areas that are maintained by large scale glacially influenced hydrological systems. Water temperatures in spawning gravels are relatively constant and remain around 4º C through the incubation period. Summer chum salmon, however, spawn in the lower and middle reaches of the Yukon River, from late June to August, in clear water run-off areas that are maintained by relatively small scale hydrological mechanisms. Water temperatures in summer chum salmon spawning gravels range from near 0 ºC to over 10 ºC. Analysis of the inter-gravel conditions at both fall and summer chum salmon spawning areas suggest that dramatically different hydrological mechanisms control the dynamics of temperature and dissolved oxygen in these areas. Whereas, fall chum salmon spawning sites are controlled by large scale groundwater systems as generally believed, summer chum salmon spawning sites are maintained by small scale and local hydrological mechanisms that are more influenced by surface water conditions. There is evidence that flow regimes within the Yukon basin may be changing. Hydrological data from 1943 – 2005 indicate a trend for spring ice-out occurring earlier and fall freeze up occurring later, thereby increasing the ice free period. Given the differences between the mechanisms that control conditions in fall and summer chum salmon spawning areas, it is likely that they will respond differently to changes in temperature and flow. Further work is needed to assess the sensitivity and summer and fall chum salmon stocks to changing temperature and flow regimes.

Salmon eggs forage for oxygen: description and test of a model that predicts the oxygen uptake and survival of developing salmon eggs

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In this presentation I will describe a model that predicts the oxygen uptake and survival of developing salmon eggs incubating in stream gravels. The inputs to the model are water temperature, oxygen concentration, and the velocity of water flowing through the gravel. The model visualizes the egg as a rectangular patch of membrane and uses equations for molecular diffusion to predict how much oxygen the egg will be able to obtain, as a function of water velocity and oxygen concentration. The model then compares this oxygen uptake potential to an estimate of the peak oxygen demand by the developing embryo. This will depend on water temperature. If the potential for oxygen uptake exceeds the peak oxygen demand the model predicts the salmon egg will survive, if not the egg is predicted to perish. I test the model using field data on the survival of incubating chum salmon eggs in relation to the relevant habitat variables. The model performs well.

Humpback Whitefish *Coregonus pidschian* in the Upper Tanana River Drainage reduce risk of confinement by exhibiting feeding habitat fidelity

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Humpback whitefish *Coregonus pidschian* are an important fishery resource for people in the upper Tanana River drainage, where salmon are rarely encountered. A life history investigation involving sampling and radio telemetry was undertaken to identify demographic qualities of fish in the region, seasonal migrations, and feeding, spawning, and overwintering habitats. An important finding of this work was that tagged fish exhibited a feeding habitat fidelity rate of 0.86 (95% CI: 0.80-0.91). Humpback whitefish actively fed in the spring and early summer in open lake systems in the upper Tanana River drainage. Some lake systems were perpetually open to the river, while others were temporally open during high flow periods. Fish entering a temporally open lake to feed during the high flows of spring, could become trapped if late summer flows were insufficient to allow access back to the river. A fish trapped in an off-channel lake would miss the opportunity to spawn in the fall and could die in the lake if conditions did not support overwintering. Selection of a feeding habitat, among the many choices in the region, is therefore thought to be an extremely risky but important process for humpback whitefish. It is hypothesized that feeding habitat selection is a random process during initial recruitment, and that feeding habitat fidelity is a behavioral trait that minimizes the risk of selecting a confining feeding habitat in subsequent years. In this paper, I present the evidence for this behavior, discuss the nature of the off-channel lake habitats used for feeding, hypothesize on mechanisms of initial recruitment to feeding habitats, and explore the implications of feeding habitat fidelity on annual survival rates and productivity.

The effects of salmon migration behavior on sonar estimates of escapement

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Using sonar to estimate salmon (*Oncorhynchus sp.)* escapement in large, turbid rivers is a difficult task. Sonar estimates of escapement are questioned whenever estimates of fish passage are unexpected or the estimate is not what the fisheries community wants to hear. To reduce the level of uncertainty in these estimates, it is necessary to study salmon migration behavior, specifically, upstream-downstream travel, vertical distribution, and cross-river distribution. Each of these behaviors can affect sonar escapement estimates, i.e., estimates may be too high if downstream-traveling fish are not assessed or too low if fish rise up over the sonar beam or move offshore of it. Images from a dual frequency identification sonar (DIDSON) deployed at a fixed location nearshore, show that migrating salmon move mostly upstream, are near bottom if the current is strong, and nearshore counts constitute the majority of the run. In mobile DIDSON surveys few or no fish were found mid-river in rivers with a strong current velocity. Drift gillnetting captures from one river were predominately sockeye salmon (*Oncorhynchus nerka*) in nearshore drifts and king salmon (Oncorhynchus tshawytscha) in offshore drifts suggesting that fish size is a factor a species' cross-river distribution. However, coho (*Oncorhynchus kisutch*), pink (*Oncorhynchus gorbuscha*), and chum salmon (*Oncorhynchus keta*), which are more similar in size to sockeye salmon, are often captured in offshore drifts. Estimating a sonar variance, based on each source of error, would help build confidence in our sonar estimates. We are beginning to quantify sources or error that stem from migratory fish behavior. What is still unknown is how fish behavior changes as current velocity, fish density, river level, and bottom slopes change, and how these factors affect both the sonar estimates and species apportionment methods.

SESSION: Aquatic Education

The Kuskokwim Native Association High School Internship Program

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The Kuskokwim Native Association developed a high school internship program to help students gain exposure to fisheries work. Young people in the Kuskokwim region have a well developed sense of ecology and fisheries science. Most of them have been hunting and fishing with their families all their lives and enjoy being outside and working with nature. A lot of them have not been aware that they could make a career out of what they love to do. Students are assigned to either the George or the Tatlawiksuk River weirs for a one week period. During that week students assist technicians with weir duties such as daily counts, age-sex-length samples, and maintenance. In addition, the students complete daily assignments designed to expose them to various aspects of ecology and fisheries science. Returning students from previous years complete more advanced daily assignments and work as actual crew members during their week at the camp. Since the program began in 1999, 14-17 students per summer have participated and nine have gone on to be hired by either the Kuskokwim Native Association or the Alaska Department of Fish and Game as fisheries technicians. These students have also increased their communities' understanding, acceptance, and ownership of the various fisheries projects being conducted in their region, by going home and talking to family and community members about their experiences. It is the goal of the Fisheries Department to encourage and support local youth to pursue fisheries and other natural resources related careers. We use the high school internship program to provide opportunities and experiences to further students' understanding of fisheries projects in the Middle Kuskokwim region and to help their future career choices.

Incorporating Science Camps into Fishery Research Projects

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Fishery field research projects can be an ideal location to host a science camp for high school-age students. The result can be increased career awareness, improved recruiting from the local workforce, better understanding of the role of the research project in fisheries management, and improved community relations. Fishery research projects are often located near rural communities, can have many impacts on them, and are often poorly understood. Hosting an annual science camp at these sites can result in many positive impacts for your project. This session will briefly describe an on-going summer science camp located at the Andreafsky River weir including a history of the project 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.

Successful Adult Aquatic/angler Education Program Delivery Through Effective Partnership Development

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Two foci predominate North American aquatic/angler education programs: teaching novice-level skills, and presenting environmental stewardship topics. There are a litany of agencies, at the federal, state and regional levels, involved in offering such programs primarily to children and adolescents. Additionally, many sport fishing clubs, non-profits and tackle manufacturers have developed and/or sponsor their own programs as well help with agency efforts to bring young people to sport fishing. Adults have not been completely left out of this movement. Over 125 post-secondary institutions across North America offer sport fishing classes, some of which have a strong science base. Also, many private companies, small businesses, non-profit organizations and fishing clubs provide adults such outdoor skills. However, a cursory review of aquatic/angler programs across the nation suggests that the vast majority of hands-on programming resources are focused at youths and adolescents. Research presented at previous American Fisheries Society and other professional meetings clearly show that adults are interested in attending both aquatic education programs and angler skills training. Of course, the cry from most agencies and angler groups is, “we don’t have the resources to support adult outdoor education”. This presentation attempts to partially address this dilemma by tracking the explosion of the UAF Sport Fishing Program from under 50 participants in only five programs during 2001-02 through its growth to over 190 registrants in a dozen events last year. What has been remarkable about this growth is that UAF only provides funding for the instructor (only if minimum registration levels are met), and through any course/materials fees that are collected. The author will highlight some of the creative partnerships he forged with agencies and groups that led to this rapid program growth if the face of meager funding. Both the successful and not so successful partnerships will be analyzed.

Student Involvement in Fisheries Research

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Incorporating meaningful public involvement or outreach opportunities within program objectives is one of the major challenges in fisheries research today. Many funding sources are now requiring outreach or community involvement to be written into funded proposals, and similarly many communities are also becoming more involved in research regarding their fisheries resources. Meaningful outreach and public involvement is often easily accomplished by involving the youth within a community. This involvement may also direct students to pursue higher education in fisheries and may foster interest in fisheries as a career option. We discuss options for involving youth in fisheries projects and we also discuss methods for effective information transfer to students regarding opportunities in fisheries. We include a student presentation regarding her summer internship experience to offer real, workable options for student involvement and outreach in fisheries research.

Aquatic Education on the Thorne Bay Ranger District Prince of Wales Island, Alaska

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Prince of Wales Island (PWI) is largely public land managed by the Tongass National Forest, with local communities physically embedded within the Forest. The Island historically had large-scale resource extraction, however recently this trend has shifted to smaller-scale resource extraction with more focus on sustainability of the resources. The focus of our conservation education program on PWI is teaching children about the sustainability of natural resources. The heart of our program is our on-going relationship with community schools. Working together we are building a place-based approach to conservation education that helps local school children appreciate the unique natural resources that surround them. Our goal is to build an awareness and understanding of the interrelationships between the land, natural resources, and people. Our conservation education program works to instill a conservation ethic in the island's children, provide an appreciation for the unique natural resources of the island, and helps provide critical thinking skills to help children reach their own conclusions about resource use.

Recently, we developed a PWI Conservation Education & Interpretation Strategy to provide overall program guidance. At Thorne Bay, in partnership with the Southeast Island School District, we have developed a watershed health curriculum that uses watersheds as a baseline to explore fish & aquatic resources, wildlife & birds, trees & plants, geology, etc. We work with the students in both classroom and field settings using a roving “ecomobile” to explore their backyard. We have participated in science fairs, summer camps, outdoor conservation days, kids fishing days, math festivals, and classroom salmon incubation projects. The focus of this presentation will be on the aquatic education portion of our program, through which kids learn about the importance of watersheds, streams, riparian areas, fish identification, fish life histories, and aquatic insects among many other things.

Fundamentals of an Effective Outreach Program through the Alaska Sea Grant Marine Advisory Program

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Using science to support Alaska's coastal communities is one of the core purposes of the Alaska Sea Grant Program. The Marine Advisory Program (MAP) is the extension arm of Alaska Sea Grant and is a network of fourteen university faculty members located in nine communities in Alaska. Extension work can be defined as *designing activities* and *educational processes* that *effect behavior change* through *community driven programs* focused on producing *outcomes* over a *continuum of time*.

Building an outreach component into a research project or management program at the front end will ultimately result in a more successful outcome. In developing an outreach program, first consider what level of community involvement is best suited to a project. Least effective is an outreach program that just "informs" stakeholders after the project is complete. Most effective is a project or program that includes "partnerships" or some level of "stakeholder control." Between these two extremes are options such as two-way communication, use of local knowledge or local residents as assistants, or developing an advisory committee consulted with throughout the project.

The highest level of community partnership may be the most work but may result in the greatest rewards. What are the rewards? They include a better project design through incorporation of local knowledge, local acceptance of research results, the ability of local residents to explain the project to others thus increasing buy-in and increased compliance with regulatory outcomes.

A collaborative research project carried out the Prince William Sound and Southeast Alaska Marine Advisory agents resulted in longline adaptations for small boats that deter seabird bycatch. National Sea Grant recognized this project as a Best Management Practice as an example of good project design and the rewards of including outreach into research.

ADFG Sport Fish Aquatic Education Program

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The Alaska Department of Fish and Game, Sport Fish Division's Aquatic Education Program began in 1991. The goal of the program is to make Alaska's public more aware of the state's valuable salmon resources. The program educates thousand's of school children and adults every year by offering hands-on salmon opportunities to program participants. This presentation will focus on activities developed to accomplish these goals.

Scientists and Outreach: Making the Connection

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Outreach and educational activities are increasingly gaining recognition as an important and necessary function of private and governmental natural resource agencies as well as their funding organizations. However, many scientists are reluctant to engage in these endeavors. A successful outreach program engages the public as well as the presenter while communicating the agency's message or knowledge. This means that outreach activities must be created and modified to not only fit the target audience but the variety of staff who may be presenting or leading the activities as well.

The Auke Bay Laboratory, a division of the Alaska Fisheries Science Center (AFSC), has conducted a successful outreach program for over 25 years. Our program server over 1500 students, parents and community members annually while engaging the efforts of 50 staff with a minimal budget. I will describe our major outreach activities and how they are tailored to not only different audiences but modified for various staff presenters as well. I will also discuss the overall outreach efforts conducted by AFSC's other laboratories to illustrate NOAA fisheries commitment to outreach.

Combining traditional ecological knowledge (TEK) and fisheries science to develop partnered research on Yukon River Delta Bering cisco (*Coregonus laurettae*)

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Throughout the arctic and subarctic healthy whitefish populations are increasingly recognized as key components of ecosystems and subsistence economies. Despite its importance, whitefish biology is poorly understood and has seen limited investigation. Proper management of this resource requires more sufficient data. It is also essential to include the cooperative efforts of local resource users to ensure their role in determining future research and management plans which will affect their communities. Many indigenous resource users possess information that can be used for this purpose. With their unique knowledge of whitefish, local fishermen can assist biologists in establishing a broader scientific understanding of these species and their life histories. Our study objectives include documentation of whitefish TEK data, collection of whitefish life history data as indicated by TEK interviews, and development of a model for partnered research between subsistence communities and resource managers. During this study we have recorded whitefish TEK data with the cooperation of subsistence users in Scammon Bay, Alaska. Review of these data and preliminary biological sampling directed us to investigate life history and the ecological role of Bering cisco (*Coregonus laurettae*). Preliminary results of our biological study indicate that juvenile Bering ciscoes likely utilize Yukon Delta estuaries as rearing habitat, and that larger individuals are feeding throughout the system on ninespine sticklebacks (*Pungitius pungitius*) while smaller individuals remain in stream channels feeding on invertebrates. We also conclude that TEK data can have a role in biological research. While indigenous subjects may offer descriptions of the natural world that are independently valuable as ethnographic observations, biologists can utilize TEK as a guide in making preliminary observations which may or may not lead to specific objectives of scientific research. However, it must not be an essential goal to reconcile these two distinct forms of inquiry.

SESSION: Climate Change and Alaska Fisheries

Arctic change and Alaska's marine fisheries

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At the confluence of mid-latitude storm tracks and Arctic air masses, Alaska is highly susceptible to changes in climate. Changes in storm tracks and reduction in the spatial and temporal distribution of sea ice pose the greatest stresses to marine ecosystems and coastal communities throughout Alaska. Recruitment, growth, and distribution of fish species are already being influenced by increases in ocean water temperatures, storm frequency, and freshwater runoff. Because each predator and prey species adapts differently to these coupled climate variables, reorganization of marine ecosystems is occurring at the same time that managers are increasingly mandated to treat regional ecosystems holistically in setting sustainable harvest goals for target species. Management strategies in a changing climate will need to incorporate human values as well as physical and economic constraints placed upon harvesters responding to transitions in Alaskan fisheries. This presentation will discuss recent findings on climate-driven changes already occurring in Alaskan marine ecosystems and suggest possible issues surrounding system "tipping points" that might be addressed through research and regional management decisions.

Geographical shifts in the spatial distribution of Northeast Pacific groundfish populations: effects of temperature and changes in abundance

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The spatial distribution of many marine populations shifts seasonally, inter-annually, and at longer time scales. There is increasing evidence that the distributions of both terrestrial and marine populations shift in response to climate changes. Here, we used trawl survey data from the Gulf of Alaska and eastern Bering Sea to investigate geographical shifts in the distribution of numerous fish and invertebrate populations. Our results imply significant changes in both the North-South distribution and in the depth distribution of numerous taxa in response to changes in temperature and abundance. In particular, we found a significant increase in the total biomass and in the biomass of individual species in the northern parts of the Bering Sea survey region over the past 25 years. The apparent increase in demersal biomass in the northern part of the survey region was not fully accounted for by the apparent effects of temperature on distribution. Changes in the Gulf of Alaska over the same time period imply an increase in relative biomass during the summer over deeper portions of the shelf, and a corresponding decrease in shallow waters. These changes were primarily attributed to increases in the abundance of slope inhabitants and secondarily to distributional shifts in response to temperature changes. Our results are discussed in the context of global climate changes.

Long-term trends in annual Bristol Bay & Chignik sockeye salmon scale growth at sea in relation to sockeye abundance and climate change, 1955 – 2000

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Pacific salmon populations rearing in the North Pacific Ocean and Bering Sea increased substantially after the marine climate shift during the mid-1970s. Density-dependent growth has been observed among many stocks of Pacific salmon raising questions about the relationship between salmon ocean growth, survival and production. We measured annual marine scale growth of Bristol Bay and central Alaska sockeye salmon, 1955 to 2000, to test whether annual salmon growth at sea was positively or negatively associated with the large increase in salmon abundance that began after the mid-1970s change in ocean condition. Sockeye runs increased when early marine scale growth increased beyond average scale growth, suggesting that greater growth during both the first and second years at sea were associated with greater survival. Bristol Bay sockeye runs tended to be relatively low when scale-growth during the first and second year at sea was below average. These analyses indicate growth during the first two years at sea was a critical factor in the large abundance of Alaska sockeye following the 1970's regime shift. Density-dependent growth may occur during early marine life however, density-dependent growth was most apparent in the later stages of life when reduced growth likely has less effect on survival.

Global climate change and potential effects on salmonids in freshwater ecosystems of Southeast Alaska

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General circulation models predict increases in temperatures from 1 ^{o}C to 5 ^{o}C as atmospheric CO_2 continues to rise. Thermal regimes in freshwater ecosystems will change as air temperatures increase regionally. Changes in precipitation distribution and intensity will alter freshwater hydrology. As continental ice sheets melt, increasing sea-levels will flood low elevation floodplains and wetlands. Although anadromous salmonids exist over a wide range of climatic conditions along the Pacific coast, individual stocks have adapted life history strategies --time of emergence, run timing, and residence time in freshwater-- that are often unique to regions and watersheds. The response of anadromous salmonids will differ among species depending on their life cycle in freshwater. For pink salmon that migrate to the ocean shortly after they emerge from the gravel, higher temperatures during spawning and incubation may result in earlier entry into the ocean when food resources are low. Shifts in thermal regimes in lakes will affect juvenile sockeye salmon growth and survival, whereas, changes in seasonal precipitation distribution and intensity that alter stream flows will affect growth and survival of juvenile coho salmon. Rising sea-levels will inundate low elevation spawning areas for pink salmon and floodplain rearing habitats for juvenile coho salmon. Resulting changes in climatic conditions may not extirpate anadromous salmonids in the region, but it will impose greater stress on many stocks that are adapted to present climatic conditions. Survival of sustainable populations will depend on the existing genetic diversity within and among stocks, conservative harvest management, and habitat conservation.

Glacier loss in the Brooks Range: How will this affect North Slope stream ecology?

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We have measured ice volume change over the past 50 years of about 140 glaciers in the Brooks Range and found nearly all of them to have lost volume. This volume loss began about 1890AD, and our measurements indicate that the rate of volume loss has been increasing with time, at least in the eastern Brooks Range where we have repeated measurements over the past 50 years. Our modeling indicates that even if climate stays the same for the next 150 years, most of these glaciers will disappear, or at least stop contributing to stream flow through further volume loss. If climate continues on the same trend as it has the past 100 years, these glaciers will disappear even sooner, many within the lifetimes of our children. Since streamflow over the past 100 years has been augmented by glacier volume loss, presumably stream ecosystems have had enough time to adapt to this increased water and sediment flux. Therefore, should the glacier influence disappear, it seems worth considering what impact this might have on the flora and fauna that have grown accustomed to it. As a glaciologist, I have no expertise to help answer such questions. The goal of my presentation is simply to present what we know about the glacier response to recent climate change in hopes that those that study streams and fisheries might find it useful in predicting ecosystem response.

Predicting Climate Change Effects on Freshwater Foodwebs

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Many of the predicted direct effects of climate change on freshwater ecosystems, such as habitat loss from drying and warmer water temperature, have some obvious consequences for these ecosystems and their resident biota. However, indirect effects from climate change, such as changes in nutrient cycling, energy flow and food supply that support fishes and other consumers, are far less clear. Freshwater systems in Alaska are generally nutrient-limited, leading to food limitation for upper level consumers like fish. And nutrient and energy flow will change in somewhat predictable ways as a consequence of climate change. Climate affects vegetation cover, and most vegetation cover models predict a northward movement of coniferous tree species, eventually followed by deciduous species in some areas. Consequently, forest type affects amount of solar energy reaching streams and the quality and quantity of plant litter inputs that drive stream foodweb dynamics and productivity. Riparian plant species also affect the flow of terrestrial invertebrates to streams – prey that are crucial for fishes and other aquatic and riparian consumers. Further, warming ocean currents are predicted to push salmon stocks northward, influencing the amount of marine nutrients entering freshwater via salmon runs, further influencing freshwater productivity and fishes. The magnitude and extent of these climate-driven productivity changes and the interactions with other environmental variables are less clear, as well as the specific effects on individual consumer species.

Potential effects of climate warming on production of freshwater and anadromous stocks in the Yukon Territory

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There is little doubt that we are currently undergoing a period of climatic warming and the effects of this warming are already evident across the North. Although long term data is often lacking in the North, changes in aquatic systems have already been observed by both resource users and biologists alike, and models predict even more dramatic changes than have been observed to date. Temperature is often a key variable in development of hypotheses to explain changes observed in both freshwater and anadromous stocks and our work suggests that even moderate temperature increase could lead to dramatic changes in production in both freshwater and anadromous species alike. Our discussion will focus on potential changes in productivity of both freshwater and anadromous stocks in the North as a result of temperature-driven changes in habitat availability under climate warming.

Does global climate change put Alaska waters at greater risk of biological invasion?

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Global climate change may pose direct risks to Alaska ecosystems by facilitating establishment of specific invaders -- for example, Chinese mitten crabs, purple loosestrife, European green crabs. However, climate change may also play an indirect role in influencing invasion risks. For example, a reduction in sea ice may create new shipping lanes and thus increased risks from ballast water transfer and hull fouling. More open water may also enable new offshore oil and gas drilling opportunities, which would likely require the movement of drilling rigs (notoriously highly bio-fouled) into Alaska waters from locations outside Alaska. These risks, some initial supporting evidence, and options for how to prepare for or avoid such risks will be discussed.

SESSION: Ecosystem-Based Fishery Management

Sustaining sustainable fisheries management: status and future of long term observing programs in Alaska

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Competent ocean observing systems are essential to sustaining sustainable fisheries management for many species. The global ocean observing system is now about 60 per cent complete. In the United States there are observing systems with varying degrees of coverage in all coastal areas, including Alaska and Hawaii. The status and future of long term observing programs in Alaska are sufficiently secure to discuss using the data in environmentally driven assessments of productivity for species that may not be amenable to other methods. Since managing fisheries sustainably requires at a minimum, knowledge of the time rate of production of biomass for the target species (productivity) it is important for ocean observing systems to provide data for use in estimating productivity of populations of single species. As an ideal, productivity may be reasonably estimated for some species from intrinsic attributes of the populations of interest, such as abundance, age structure, size at age and fecundity. On the other hand there are other species for which productivity may only be reasonably specified by extrinsic attributes, such as a variable combination of predation, competition, temperature, salinity, and food availability. While no fish species represents an ideal of extrinsic or intrinsic control of productivity, populations of species such as Pacific halibut and Pollock have been successfully managed in the long term as intrinsically controlled. On the other hand populations of species such as Pacific herring, red king crab and pandalid shrimps have not been amenable to long term management in many cases under the assumptions of intrinsic control of productivity. Sustaining sustainable management of species with a large component of extrinsic control of productivity requires the participation of fisheries scientists in developing the ocean observing systems.

Estimating multi-species maximum sustainable yields for the Bering Sea/ Aleutian Islands and Gulf of Alaska groundfish complexes

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A major challenge for implementing an ecosystem-based approach to fisheries management is the lack of appropriate multi-species or ecosystem-level reference points. While federal fisheries management plans specify optimum yield ranges for the Eastern Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) groundfish complexes, these are based on estimates of single-species maximum sustainable yield (MSY) from data available in the 1980s, which may not adequately reflect current ecosystem constraints. Here we provide a simple empirical approach to estimating the total yield that can be removed from the BSAI and GOA groundfish complexes on a continuing basis. We used time series of biomass and catches for all major commercial groundfish stocks in the BSAI and GOA to compute annual surplus production for 1977–2004. Annual surplus production and average annual biomass were aggregated across stocks within each region to examine the relationship between total surplus production and total aggregated biomass. We fit two surplus production models (Graham-Schaefer and Pella-Tomlinson) to the observed relationships to estimate maximum multi-species surplus production (equivalent to MSY) of the groundfish complexes in these ecosystems. Maximum multi-species surplus production was estimated to be approximately 2.5×106 t in the BSAI and 330×103 t in the GOA. These point estimates were smaller than the sum of single-species MSY proxies from recent stock assessments, and estimates for the GOA were much smaller than earlier estimates that were used to specify optimum yield ranges for the GOA groundfish complex. Therefore, optimum yield ranges for the Gulf of Alaska may need to be re-assessed to reflect more recent conditions.

Extending single-species stock assessments to account for predation: application to cod, mackerel and pollock in the Aleutian Islands

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Statistically-based methods for assessing the population dynamics and potential productivity of fish stocks have developed over recent decades to incorporate diverse information from fisheries and non-fisheries sources. These methods are conventionally applied to a single species. However, information provided by time-series of stomach samples on interactions among species in the form of predator-prey relationships is available. This information could potentially inform the assessment for a single species as well as elucidate it's role in the ecosystem. The paper outlines an age- and length-structured framework for including data on predator-prey interactions among assessed species. A case study using this framework to assess populations of walleye pollock, Atka mackerel, and Pacific cod on the Aleutian shelf is outlined. Parameter estimates and derived outputs produced by the conventional single-species approach and the multispecies framework are compared.

A fishery ecosystem plan for the Aleutian Islands

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The North Pacific Fishery Management Council has embarked on a focused strategic planning effort for ecosystem-based fishery management for the Aleutian Islands region. Given its unique environment, large and diverse marine mammal and seabird populations, and challenging fishery management issues, the Aleutian Islands region poses an opportunity for the Council to test an ecosystem-based management approach recommended by two national Ocean Policy groups and the National Oceanic and Atmospheric Administration. The Council has appointed an Ecosystem Team to guide development of a Fishery Ecosystem Plan (FEP). The Aleutian Islands FEP will provide an ecosystem perspective as the Council manages the fishery resources in the Exclusive Economic Zone in this region. In recent years, the Aleutian Islands area has been the stage for several new initiatives and management challenges including revisions to measures to protect Steller sea lions and seabirds, conservation of benthic habitats that support coral and other associated organisms, and allocation issues related to the pollock and Pacific cod fisheries. Recent scientific investigations suggest a clear ecological difference between the eastern Bering Sea (EBS) shelf ecosystem and the western Aleutian Islands archipelago. Far less is understood about the ecological interactions in the Aleutians than in the EBS, yet currently the two regions are managed conjointly in all Federal fishery management plans. The Council intends to more directly consider fishery interactions within the Aleutian Islands ecosystem by developing a FEP, and in so doing, test an approach to explicit ecosystem-based fishery management in the North Pacific.

SESSION: Contributed Papers (session 2)

A Decision tool to evaluate proposed changes to Steller sea lion mitigation measures for the pollock, Pacific cod and Atka mackerel fisheries in the Gulf of Alaska and Aleutian Islands/Bering Sea

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North Pacific groundfish fisheries were significantly impacted with the implementation of protective measures for the endangered Steller sea lion beginning in 2000. The North Pacific Fishery Management Council reinstituted the Steller Sea Lion Mitigation Committee to track recovery and accept proposals for changes to fishing regulations in 2006. Development of a multi-criteria decision tool was required to evaluate proposals for their potential impacts to the Steller sea lion and their prey field. The Analytic Hierarchy Process was used during a series of facilitated discussions to assist the committee in identifying and rating dimensions of the problem, the set of variables that were open to change, and in scoring potential impacts of fishing. The model was developed to answer three primary questions: (1) to what extent does fishing alter the target prey field, (2) how important are the target prey species to the diet of Steller sea lions, and (3) what are the spatial and temporal aspects of the Steller sea lion's sensitivity to fishing activity. The model is useful for comparing the impacts of a proposed change to the status quo, and in comparing among various proposals. The Council must then weigh potential impacts of a proposed change in fishing regulations in consideration of other issues, such as economic and social benefits.

Aquatic community development in response to salmon carcass and salmon analog enrichment in newly restored fish habitat, Resurrection Creek, Alaska

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Off-channel stream habitats can be important rearing environments for juvenile coho salmon. These habitats were lost throughout 1.5 km of Resurrection Creek, on the Kenai Peninsula, Alaska, due to placer mining over the past century. Based on recent surveys and historical data from nearby un-mined stream reaches, these habitats were abundant and heavily used by rearing coho in the mined reach before mining. In conjunction with a U.S. Forest Service stream restoration project, off-channel habitats (alcoves) were constructed and experimentally enriched with nutrients to help achieve fish habitat restoration goals. We tested the effectiveness of adding marine-derived nutrients (MDN), via salmon carcasses (in 2005) and salmon analog pellets (in 2006), to newly created alcoves for accelerating aquatic community development and productivity. The objectives of this project were to: 1) measure aquatic community development (biofilm, macroinvertebrates) in newly formed alcoves, 2) compare changes in alcove communities with and without MDN additions, and 3) document changes in biomass, condition factor and abundance of juvenile coho in response to MDN additions. Biofilm, macroinvertebrates and juvenile salmonids were sampled during the summer of 2005 and 2006. Each year, colonization of alcoves was rapid, with substantial invertebrate and fish colonization occurring in less than a week in most alcoves. Results from 2005 indicated salmon carcass enrichment provided no significant change in measured responses. Preliminary results from 2006 suggested salmon analog enrichment may have produced a more detectable effect than in 2005. Ultimately, these results will provide insight into the importance of MDN in freshwater food webs, and whether nutrient supplementation accelerates recovery and elevates aquatic productivity in stream systems undergoing restoration.

A straightforward Bayesian Jolly-Seber model for estimating spawning escapement

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Jolly-Seber methods are often used to estimate fish population size when the population is not closed (allows for birth, death, immigration, and emigration). I present a Bayesian Jolly-Seber model for capture-recapture data analysis. This Bayesian model includes two parts: (1) a product of conditional multinomial likelihoods of capture-recapture data and (2) informative or uninformative prior probability distributions. I show how to use this model to estimate spawning escapement (the total number of fish returning to a river to spawn). I then examine this model with a set of tag-recapture data on sockeye salmon in Falls Lake, Southeast Alaska. I also compare the Bayesian approach to the classical maximum-likelihood approach. Both approaches give similar estimates of escapement. However, I find that the Bayesian procedure is straightforward and easy to perform in the WinBUGS package. Also, the variances and precisions of parameters are estimated using random samples drawn from their posterior distributions and it avoids cumbersome formulas used for classical Jolly-Seber models.

Why do we think these Ricker curves work?

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Salmon management agencies, particularly in the Pacific Northwest, have been rightly criticized for continuing failed policies, continuing to use techniques that have not worked, and generally denying or ignoring failure. Part of this problem seems to stem from fisheries education, which prepares future specialists to work in one of several technical guilds, and usually these guilds approach each new problem as an opportunity to use the existing tools of the guild. Often these guilds assume without question that their tools are effective. In Alaska, since the 1980s, the Ricker-curve guild has dominated recruitment forecasting and escapement goal estimation for Pacific salmon. Although there is an impressive body of grey literature documenting the Ricker curve fitting in Alaska, there is very little work on evaluating the actual performance of these models. In other words, no one seems to be asking the question, do these models really work? Ricker models and modified Ricker models have a multi-decade history of performance for pink salmon forecasting, replicated in space. Interestingly, these models consistently failed. Outright failure has been hard to identify because poor model performance is sometimes confused with recruitment variability. Because Ricker-based pink salmon return estimates in Southeast Alaska were historically outside of the 80% confidence intervals approximately 60% of the time, modelers should have noticed unambiguous failure of the Ricker model for this purpose. In the Yakutat area, Ricker-based escapement goals came into use in 1985 for the largest stock in the area. Ricker-based goals were introduced over time for other stocks in the area. As the Ricker curves were updated over time, first the escapement goals declined and then later yield declined, even as marine survivals for other species remained high. This pattern is consistent with an obvious mode of model failure. However, this mode was not discussed, examined, or even recognized in the escapement goal documentation for these stocks. The Yakutat case study supports the idea there should be less emphasis on tedious statistical complexity and more emphasis on the question, “Hey, does this stuff really work?”

Landscape correlates of threespine stickleback (*Gasterosteus aculeatus*) presence in small Southeast Alaska lakes

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Although threespine stickleback are known to inhabit a wide range of habitats, their distribution in lakes of Southeast Alaska is not known. These fish appear to be an important component of freshwater ecosystems. Additionally, isolated populations may be genetically unique and thus important from a conservation perspective. This study focused on identifying landscape models and factors useful in predicting the presence of threespine stickleback in small (0.5–5 ha) lakes of Southeast Alaska. Stickleback presence was assessed via snorkeling and minnow trapping in 54 lakes which were divided into calibration (n=36) and prediction (n=18) data sets. A number of models representing four methodologies— generalized linear models, generalized additive models, classification trees, and artificial neural networks—were built based on the calibration set, and evaluated using the prediction set of lakes. Lake elevation was consistently retained in all models as an important predictive factor, and stickleback were not detected in lakes above 205 m. Other useful predictors included the length and slope of lake outlet streams. Lake surface area and depth were not useful in predicting stickleback presence. All four models predicted stickleback presence better than that expected by chance. Results suggest that the likelihood of stickleback presence is highest in low elevation lakes near the coast. Human development and recreational activity also tends to occur largely in this landscape position, and so land-use planning should account for the high potential for threespine stickleback occurrence here.

Community-based habitat restoration: the Pullen Creek Fish Passage and Habitat Restoration Project

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Pullen Creek is a small anadromous fish stream that bisects the busiest part of downtown Skagway. As an urban stream, it faces typical challenges including fish passage obstructions, sedimentation, and habitat degradation. Unlike most streams, it is also a prime tourist attraction in a town that receives nearly one million visitors per year. When the newly formed Taiya Inlet Watershed Council (TIWC) undertook to restore the most heavily impacted reach of Pullen Creek, it had little idea of the challenges involved in urban stream habitat restoration. By working with local stakeholders, as well as gaining the involvement of several state and federal entities, TIWC incorporated the priorities of the community in the project. Our objectives are to restore juvenile fish passage, create and improve fish habitat, improve the safety of the area for pedestrians and provide an educational opportunity for residents and visitors. Construction was split into four phases to accommodate complex design and funding needs. Phase I involved construction of a stream channel extension at the downstream end of the project area. Phase II will replace the first of two culverts; while Phase III will involve installation of a pump station, relocation of utility lines, and replacement of a second culvert. In Phase IV, habitat restoration will be completed in the upstream portion of the reach. Phase I was completed in summer 2006; it is anticipated that the remaining phases will be completed by fall 2009. A plan for monitoring the long-term effectiveness of the project has been started and baseline data was collected. Upon completion, interpretive signs will be installed and the site will provide educational and fish viewing opportunities to hundreds of thousands of cruise ship visitors each year. Additionally, this project will allow access to two miles of quality habitat for juvenile salmonids and will restore hydrologic function to the stream.

Influence of brown bear predation on stream-life and production of chum salmon in McNeil River, Alaska

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The Alaska Department of Fish and Game (ADF&G) has used the area-under-the-curve method to calculate annual escapement indices from aerial surveys of McNeil River chum salmon since 1976. A prolonged era of low chum salmon returns prompted ADF&G to conduct a radio telemetry study in 2005–2006 to estimate the number of pre-spawning fish killed by bears, evaluate use of available spawning areas, and determine whether the average stream-life (SL) factor used to calculate escapement indices was too high. We used esophageal "mort" tags, remote data-logging stations, and frequent aerial and ground tracking to determine spawning distribution (above and below McNeil Falls), when fish died, how they died, and whether or not they had spawned before death. We deployed 70 transmitters in 2005 and 85 in 2006, yielding 43 and 63 valid data points, respectively. In 2005, only 7% of the fish tagged made it above McNeil Falls; approximately 47% were killed by bears before spawning, and average SL was 11.5 days. In 2006, 27% of the fish tagged made it above the falls, 44% were killed by bears before spawning, and average SL was 16.1 days. The SL estimate for both years combined was 13.4 days, 23% lower than the SL historically used (17.5 days). These study results will allow ADF&G to improve the accuracy of annual escapement indices calculated from aerial surveys and will facilitate a retrospective analysis of bear and salmon abundance and distribution trends to evaluate whether a minimum escapement threshold exists, below which bear predation slows run recovery by restricting chum production to the limited spawning areas available below McNeil Falls. This information should allow staff to revise the chum salmon escapement goal to improve stream-wide salmon production in order to benefit the long-term sustainability of the commercial fishery and bear viewing programs at McNeil River.

Bioelectrical Impedance Analysis: a non-lethal tool to measure composition/energy density in fish

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The literature is replete with studies of energy flow at individual through ecosystem levels. Inherent in most estimates of energy flow is the need to sacrifice animals for proximate composition, negating the ability for repeated measures on individuals and suppressing study of endangered species. Ancillary to sacrificial problems, estimates of proximate composition are time consuming and costly. Here we present a method of estimating proximate composition in lower vertebrates quickly, cheaply, and after validation, without the need to sacrifice. Although this method has been used in human and veterinary medicine since the 1950's, there has been little work done outside these arenas. Furthermore, our initial results indicate that bioelectrical impedance analysis provides better compositional estimates when used on fish. An overview and detailed explanation of this method will be discussed. The non-lethal estimation of body composition using bioelectrical impedance analysis in lower vertebrates will permit increased precision in energy flow and proximate composition studies as well as permits study of community energetics and condition on spatial and temporal scales not previously possible.

Nondestructive Field Estimation of Fat Content of Yukon River Salmon

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Field measurement of the ecological condition of fish has been greatly constrained by the lack of a means to directly determine *in vivo* energy density or fat (lipid) content. Knowledge of the amount of fat (energy) available to Pacific salmon during their upriver spawning migration is a critical need for understanding and predicting the consequences of fisheries management practices, human development activities, and global climate change. Fortunately, recent developments of Bioelectrical Impedance Analysis (BIA) promise a simple, nondestructive means of estimating proximate composition (e.g. fat, protein, water content) for field applications with fish. In this study we demonstrate the utility of BIA for estimating the proximate composition of Chinook and chum salmon on their spawning migration in the Yukon River, Alaska. From a sample of 134 fish, we were able to estimate fat content using BIA with 90% accuracy relative to the amount of fat measured by standard laboratory proximate analysis. Similar results were obtained for protein, water, and energy density. While some minor refinements in field technique are still needed, we now have a reliable and accurate means of estimating proximate composition and energy density of live fish that can be used in a variety of research or management contexts.

Non-native Northern Pike *Esox lucius* populations: habitat, and management in Colorado trout fisheries

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Non-native northern pike *Esox lucius* predation on trout is a serious fisheries management problem throughout Western United States. To explore potential management options, we examined northern pike populations and habitat in eight Colorado trout reservoirs: Crawford Reservoir, Elkhead Reservoir, Elevenmile Reservoir, Lake Catamount, Spinney Mountain Reservoirs, Stagecoach Reservoir, Tarryall Reservoir, and Williams Fork Reservoir. Northern pike densities were estimated during 2003 using mark-recapture in Spinney Mountain Reservoir, Stagecoach Reservoir, and Lake Catamount. The Huggins closed population estimator in Program MARK was used to analyze the mark-recapture data. Northern pike density estimates ranged from 4.94 to 7.38 fish/ha. Aquatic vegetation surveys were done in 2002 and 2003. Submerged vegetation coverage ranged from 0 to 52% of reservoir surface area and emergent vegetation coverage ranged from 0 to 81% of reservoir shoreline length. Reservoir northern pike habitat suitability was evaluated using a habitat suitability index model and ranged from low to high-medium. Fisheries management options were explored and include habitat manipulation, physically or chemically removing northern pike, encouraging anglers to harvest northern pike, and stocking large (~330 mm TL) rainbow trout *Oncorhynchus mykiss* in the fall.

Geomorphology and selection of spawning habitat by Inconnu: a heuristic model

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Current studies of inconnu (*Stenodus leucichthys*) spawning behavior suggest a high level of habitat selectivity. This implies that there are specific habitat characteristics that these fish require for spawning. The purpose of this study is to build a heuristic habitat model that can be used to better understand inconnu spawning site selection within Alaskan watersheds. Drainage basin morphology influences finer-scale habitat attributes, which in turn, influence biologic communities. Using readily available, low- or no-costs remote sensing data layers, geographical information systems (GIS) were used in conjunction with multivariate statistics to elucidate relationships between geomorphologic features and spawning site selection.

Working the Magic: Management of Prince William Sound Pink and Chum Salmon Commercial Fisheries

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The mission of the Division of Commercial Fisheries is to manage, protect, and develop fisheries consistent with the sustained yield principle. The Sustainable Escapement Goal (SEG) midpoint for Prince William Sound (PWS) is 2 million pink salmon and 175 thousand chum salmon. Large-scale hatchery production of pink and chum salmon represent a high percentage of current returns to PWS. The management objective is the achievement of escapement goals while allowing for the orderly harvest of all fish surplus to spawning requirements. In addition, ADF&G follows regulatory plans to manage fisheries to allow hatcheries to achieve cost recovery and broodstock objectives. The PWS salmon management area is divided into eleven districts that correspond to local geography and distribution of salmon. Commercial fishing management is primarily based on escapement monitoring. Escapement of pink and chum salmon is monitored through the season by weekly aerial surveys of 209 index streams. Escapement estimates are compared to weekly and seasonal escapement goals to track inseason progress of salmon runs. As escapement requirements are met commercial fisheries harvest surplus fish. Management is further guided by stock contribution data from thermally marked otolith analysis and pink salmon sex ratios. Run forecasts gauge the magnitude of returns and aid in the development of a pre-season management strategy. Hatchery corporate escapement goals are managed by opening and closing subdistricts near the hatcheries. Subdistrict openings are also utilized to target hatchery stocks when wild salmon escapement is weak.

SESSION: Poster

Patterns of development, mortality, mixing, and distribution of Dungeness crab larvae in Glacier Bay and neighboring straits

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Patterns of development, mortality, mixing, and distribution of the larval Dungeness crab, *Cancer magister*, were investigated inside and outside of Glacier Bay, southeastern Alaska, biweekly from late May to mid-September and monthly in Icy Strait from late May to late August in 2004. Larvae, salinity, and temperatures were collected during daylight hours at 3 inner and 2 outer Glacier Bay stations in two different portions of the water column: above and below the thermocline or greatest temperature change in the water column, and at 4 stations in Icy Strait from a depth of 200 m or within 10 m of the bottom to the surface double obliquely. Larval mortality was markedly high for three larval stages, zoeae I (ZI), zoeae IV (ZIV), and zoeae V (ZV) while it was relatively low for zoeae II (ZII) and zoeae III (ZIII). In late May, ZI predominated at all stations and ZI density gradually decreased thereafter. Zoeae I were collected from late May to late July. Larval stages progressed seasonally from ZI to ZV and density decreased from ZI through ZV. The densities of each zoeal stage at the inner and outer bay stations and at the shallow and deep depths were similar. However, rostrum lengths had a bimodal distribution with two distinct patterns at station 4 on 28 May and 14 June, indicating that larvae incubated at different temperatures appeared to be mixed in our study area. The pattern of spatial distribution of larval stages for the inland waters encompassed by Icy Strait was markedly different than the pattern reported for Dungeness crab larvae from other parts of the species range: many of the early and intermediate stages were retained within inland waters, as opposed to increasing in abundance with distance offshore.

The effects of spawning salmon on aquatic macroinvertebrates in four southcentral Alaskan streams

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The effect of spawning salmon on macroinvertebrate communities was measured in four south central Alaska streams using a paired Before-After Control-Impact study design, where salmon presence indicated "impact". Each stream was sampled up- and downstream of pre-existing barriers to salmon before and after the arrival of spawning salmon. Macroinvertebrate abundance was lower in salmon reaches than non-salmon reaches following the arrival of spawning salmon. This is hypothesized to be the result of an increase in generalist predator populations and/or substrate disturbance caused by spawning salmon. A concurrent reduction in macroinvertebrate taxon richness was largely explained by the reduction in macroinvertebrate abundance. Total phosphorous, nitrate + nitrite, and ammonium were generally higher in salmon reaches than non-salmon reaches both before and after the arrival of salmon, thereby suggesting that an MDN subsidy effect was present. Community assemblage was unaffected by salmon presence but was significantly influenced by lake presence and sampling period.

Public access and navigability of waterbodies in the State of Alaska

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The goal of the navigability program for the Alaska Department of Fish & Game (ADF&G) is to ensure that the state's title to lands beneath navigable waters is protected. The Alaska State Constitution provides for free access and common use of public and navigable waters by any citizen of the United States (US) or resident of Alaska. State ownership of the beds of navigable waters is an inherent attribute of States sovereignty protected by the Constitution. The State of Alaska received title to the beds of navigable waters at the time of statehood. State title to these lands is essential to protecting access to public lands. Federal land conveyances and land management activities, however, have clouded the ownership of navigable waters in Alaska. Disputed land ownership has blocked access for the public. To help resolve disputes, the State's navigable waters program was created to gather sufficient information about the uses and physical characteristics of individual waterbodies so that accurate determinations could be made. Gathering information has proven challenging in some areas of the state and the program hopes to work with field personnel to fill information gaps. Personnel working in remote areas throughout the State are involved in activities that could assist the navigability program. Documentation of observed boating use, and collection and recording of physical attributes for waterbodies could be used to support state navigability assertions. By helping ADF&G gather this information you can ensure public access will be maintained.

Yukon River coho salmon genetics

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Little is known about the genetic structure of Yukon River coho salmon. Here we examine the extent and pattern of genetic diversity in Yukon River coho salmon by assaying eight microsatellite loci. Yukon River coho salmon are geographically structured (G_{ST}=0.103), with a strong genetic disjunction between lower and upper river populations. Upper river populations have much lower levels of genetic diversity in comparison to the lower river populations and to other populations from around Alaska. This deficit is likely the result of a founder or bottleneck effect. Mixed-stock analysis using microsatellite variation assayed here can accurately (95%–99%) and precisely (S.D. 1%–3%) allocate coho salmon in mixtures to regions providing data that can increase the knowledge base and ability to actively manage Yukon River coho salmon. Finer geographic scale management may be possible by increasing baseline sample sizes, improving baseline representation, and, if necessary, assaying additional diverse loci.

Alaska's only endemic salmonid species (?) – the old man charr (*Salvelinus anaktuvukensis*)

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The old man charr is presently known only from the vicinity of Anaktuvuk Pass in the central Brooks Mountain range, and is generally thought to be a small headwater resident charr. It has long been noted as a distinct type from other co-occurring charr with its own name (angayukaksurak charr) by Alaskan natives and was scientifically proposed as a distinct species in the 1970s. However, scientific acceptance of its distinct species status from Arctic charr (*S. alpinus*) or Dolly Varden (*S. malma*) has been limited. The American Fisheries Society presently gives it subspecies status.

This confusion is usually justified as being due to insufficient or inconsistent specific information, especially since charr are known to exhibit highly plastic morphologies and complex life-history strategies. Determination of their species designations has been a difficult task, but can nonetheless be a critical one. This is exemplified by the fairly recent redescription and acceptance of bull trout (*S. confluentus*) as a distinct charr, which rapidly became a key freshwater fish species now driving endangered species and land management relations in the western contiguous United States. The status of the old man charr could be similarly important on a local scale given its potential as an endemic Salmonid in Alaska with a limited distribution associated with National Parks, and also its high subsistence use and value.

The goal of our present project is to determine the biological species status of the old man charr, and to provide a long-needed non-lethal field identification protocol for it and/or Dolly Varden and Arctic charr. We are collecting and will examine charr from the same Anaktuvuk Pass regions and from other areas where at least Dolly Varden, Arctic charr, and/or their notable life-history forms are known to co-exist. Comparisons will be made using morphometric, genetic, ecological, and biogeographic methods.

The Kuskokwim Native Association Fisheries Program: local involvement in Kuskokwim River fisheries research and monitoring

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The Kuskokwim Native Association (KNA) is a regional non-profit organization representing the middle Kuskokwim River area villages. The KNA Fisheries Program began in 1996 with the inception of the George River Weir, a cooperative project with the Alaska Department of Fish and Game Commercial Fisheries Division. We received a Partners for Fisheries Monitoring grant in 2002 and the Fishery Partners Biologist increased KNA's technical abilities and expanded the program. The Fisheries Program is now the Fisheries Department and has two full time and one seasonal fisheries biologists and 14-16 seasonal fisheries technicians and college interns. The KNA Fisheries Departmental goal is to actively participate in managing and conserving Kuskokwim fisheries resources to ensure long-term sustainability of the subsistence way of life for our members. We do this by partnering on fisheries research and monitoring projects; serving as a liaison between our members and agencies; listening to, communicating with, and educating our members about fisheries research and management; and encouraging local youth to pursue fisheries careers. We have partnered on fourteen research and monitoring projects including five completed and nine ongoing projects. The KNA Fisheries Department informs management agencies and Kuskokwim fisheries researchers about local concerns and needs by participating in groups such as the Kuskokwim River Salmon Working Group and the Kuskokwim Fisheries Research Coalition. The Fishery Partners Biologist leads the outreach efforts which include attending local and regional meetings, hosting local community meetings, and conducting classroom visits and educational activities. We have several college and high school internship programs that are aimed at providing local youth a pathway to enter the fisheries field. These partnership efforts strengthen agency and community relationships and create more effective and better received fisheries management. The KNA is building its technical capacity and becoming a leader in fisheries conservation and management.

Habitat assessment of juvenile salmonids with aerial imagery of a southcentral Alaskan stream

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Important habitat characteristics required for juvenile salmonid rearing in lower Kenai Peninsula streams have not been identified. New habitat concerns of elevated stream temperatures coupled with continued increases in recreational, residential, and commercial development make assessment and preservation of conditions that sustain salmonid populations a priority for fisheries and land management agencies. Accessibility to undisturbed areas for the collection of baseline data can be cost prohibitive. This study will compare the accuracy of assessing habitat from aerial imagery with 45 cm spatial resolution acquired from the ADF&G in 2005, with field measurements. Field data was collected July-September 2006 following EPA's Environmental Monitoring and Assessment Program-Surface Waters (EMAP): Western Pilot Study Operations Manual for Wadeable Streams, to quantify 12 habitat parameters among 15 sample sites within reaches of the Chakok River, and North and South forks of the Anchor River. Processing of aerial imagery will be with ERDAS Imagine and ArcGis software to quantify six of the parameters including instream fish cover (large woody debris, boulder, and overhanging vegetation), backwater, side channel presence or absence, sinuosity and channel unit (pool/glide, riffle) length and frequency. Snorkeling and minnow trapping will be conducted, summer 2007, to evaluate the distribution and relative abundance of juvenile chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), and rainbow/steelhead (*O. mykiss*) among these sample sites. Once the habitat characteristics of juvenile salmonids are defined, rearing habitat can be identified and monitored with the aid of remote sensing.

Temperature as a spatial and temporal limit of Chinook salmon spawning habitat

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Determining carrying capacity of a river based on the availability of critical habitat is highly desirable for management and development purposes. However it requires a deep understanding of the biological needs of fish at each stage of development as well as of the qualities and quantities of habitat present. Research has been focused on a few well studied rivers in the Pacific Northwest, but is therefore limited in the diversity of habitats, fish species, and geographical extent. Alaska's economic dependence on fish and the remoteness of the majority of the state means this is the state where these new methods will be most critical. One of the ways that Alaska salmon habitat is very different is the thermal regime. Water temperatures will be measured along 233 kilometers of the Chena River. ATUs will be calculated to classify the length of the river into high quality, low quality and marginal thermal habitats. Arrival timing will be measured with weekly aerial surveys during the month of July. Description of the spawning habitat based on biological requirements of the Chinook salmon will allow for a more accurate quantification of the habitat for such projects as habitat carrying capacity models, better protection of critical habitats, and modeling the impacts of climate change.

Outbreeding depression and the inheritance of traits in coho salmon (*Oncorhynchus kisutch*): an analysis of second-generation hybrids of three geographically distinct Southeast Alaska populations

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Pacific salmon (*Oncorhynchus spp.*) home to natal streams promoting reproductive isolation, which allows diversifying selective pressures to act on distinct populations. Each population may adapt to varying environmental conditions with adaptations possibly resulting from both additive and non-additive genetic effects. Hybridization that results from the removal of reproductive barriers may break down these adaptations, which in turn may cause losses of fitness known as outbreeding depression. Such losses in fitness and the genetic mechanisms that underlie the losses are the focus of this study. We ask: Does the interbreeding of distinct salmon populations result in a loss of fitness? And if so, by what genetic mechanism does this occur? To investigate these questions we made F_2 hybrids from returning F_1 adults bred from three distinct Southeast Alaska coho salmon populations. Replicates of the parental and F_1 hybrid cross types were created along with hybrids of the F_1 cross types. We sampled returning adults for length, sex, and seven bilateral meristic traits. We determined the identity of their parents and their experimental group from microsatellite DNA variation at five loci. Tests of homogeneity were conducted to assess survival. Although survival rates differed between F_2 hybrid groups ($P = 0.05$), significant differences were not observed among all groups, between controls, hybrids and controls or between F_1 and F_2 hybrid cross types. Line-cross analysis was used to assess whether additive or dominance genetic interactions best described the observed phenotypic data. The results were mixed; while most traits and crosses exhibited additive genetic interaction, others were best explained by dominance interactions, and still others potentially epistatic interactions. We will also analyze the variation in meristics and extent of fluctuating asymmetry across the experimental groups. Analysis of variance will be used to test for a genetic component in the inheritance of meristics and degree of fluctuating asymmetry. While preliminary analyses do not indicate outbreeding depression, further analyses to be concluded could provide better measures of this loss in fitness and better define what genetic mechanisms best describe the observed results.

Development of an in-stream passive integrated transponder (PIT) tag system to monitor coregonid movements at Whitefish Lake, Alaska

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Coregonids including, humpback whitefish *Coregonus pidschian*, broad whitefish *C. nasus*, and least cisco *C. sardinella* form an important part of the subsistence harvest in the Kuskokwim River drainage. Research on migration and population status of these fish is in its infancy, yet resource extraction is planned and accelerating in the Kuskokwim River watershed. Passive integrated transponders (PIT) tags offer a unique opportunity to collect information from long lived species on habitat use, spawning periodicity, and migration timing from individual fish. In 2005 we initiated a pilot project to develop and test the use of PIT tag technology to monitor whitefish movements in a remote location. Tests were conducted by surgically implanting PIT tags in broad, humpback and least cisco and testing movements past two flow over flat plane antenna spanning 28 meters, the entire outlet creek of Whitefish lake. Two PIT tag readers, manufactured by Oregon RFID® and a data-logger run on a Palm® handheld were used to detect the Texas Instruments ® 23mm half duplex glass PIT tags implants. A detection rate of 77.6% of the 125 fish implanted with PIT tags was achieved. Equipment malfunctions were responsible for a portion of the missed fish. Remote unattended operations were achieved from July through late October.

Seasonal distribution of pond smelt (*Hypomesus olidus*) and rainbow smelt (*Osmerus mordax*) in Kuskokwim Bay, Alaska

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The smelts (*Osmeridae*) are distributed through the Pacific Ocean from the Bering Sea to Southern California, often dominating the estuarine fish fauna. However, in spite of their extensive geographic range and ecological importance, only little is known about their nearshore distribution in Alaskan waters. As part of a study on juvenile salmonids in western Alaska, we examined the seasonal distribution of pond smelt (*Hypomesus olidus*) and rainbow smelt (*Osmerus mordax*) in Kuskokwim Bay. Fish were sampled on a grid of 22 stations with a modified Kvichak surface trawl. Concurrent to fish sampling, zooplankton was sampled in the surface waters and physical data were recorded including temperature, salinity, turbidity and fluorometry. Sampling was conducted in June, July and August of 2003. Altogether, a total of 303 pond smelt and 399 rainbow smelt were caught in 2003. Smelt were found in salinities from 0-30. Here we describe seasonal patterns in abundance of both species and relate them to the measured physical factors. In addition, we examine seasonal, species-specific patterns in length-frequency distributions to better understand ontogenetic difference in estuarine use by pond smelt and rainbow smelt.

Improved effectiveness of hatchery salmon smolt production

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Production of Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) smolts require extended freshwater rearing and caretaking. Traditionally hatcheries fed presmolts for maximum growth in overwinter culture, but currently, hatcheries reduce feeding during the winter not only for better cost efficiency but also to simulate natural conditions in hopes of producing healthier smolts. One recent idea is that a period of complete food deprivation and the resulting compensatory growth may improve the fitness of the smolts. This study is of whether food-deprived smolts can compensate and grow to be as healthy as smolts that were subjected to a reduced-feeding schedule. To determine the affects of food deprivation on the fitness of smolts, growth rates (both length and weight), condition factor, hematocrit levels, proximate analysis, and a Na+/K+ ATPase activity were measured throughout the study.

Evaluation of a dual-frequency imaging sonar for detecting and estimating the size of migrating salmon

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Fixed-location, side-looking sonar techniques are often the only way to obtain in-season abundance estimates for anadromous fish stocks in rivers that are too wide for weir structures and too occluded for visual observations. Acoustic assessment sites currently exist on ten rivers in Alaska. One of the primary barriers to wider use of sonar assessment has been difficulty in discriminating among fish species. Experiments were conducted with a DIDSON (Dual frequency IDentification SONar) acoustic system to evaluate the potential for estimating fish size from images of tethered and free-swimming fish in two Alaskan rivers. DIDSON is a recently developed imaging sonar that incorporates a sophisticated lensing system to improve image quality. In the first experiment, DIDSON images were collected from six Chinook salmon *Oncorhynchus tsawytscha* and four sockeye salmon *O. nerka* tethered in the center of the DIDSON's multibeam array. In the second experiment, 130 Pacific salmon *Oncorhynchus* spp and Dolly Varden *Salvelinus malma Walbaum* were allowed to swim freely through the DIDSON multibeam array after being released from a weir live-box. DIDSON length measurements differed greatly depending on whether they originated from tethered or free-swimming fish. Length estimates from DIDSON images of tethered fish were subject to a positive bias that increased with range of the fish from the transducer (approximately 1.3 cm/m of range). Measurements from free-swimming fish did not demonstrate the same size bias with range. Given that DIDSON measurements of free-swimming fish were not subject to substantial bias, we conclude that reasonably good estimates of fish length can be extracted from DIDSON images of free-swimming fish at close distances (<12 m) in the high frequency (1.8 MHz) mode. Under these conditions, DIDSON measurements of fish length show good potential for discrimination among species.

A six year mark-recapture study on sockeye salmon in Kanalku Lake indicates that escapement levels are recovering, but still too low to support an unregulated subsistence harvest

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In 2001, we completed the first reliable escapement estimate of sockeye salmon (*Oncorhynchus nerka*) returning to Kanalku Lake to spawn, and were very alarmed at the extremely low size of the spawning population, estimated at less than 250 fish. In response the community of Angoon proposed a voluntary subsistence closure, which they implemented in cooperation with ADF&G during each of the next four years (2002–2005). Continuing annual estimates of sockeye escapement in Kanalku Lake allowed us to examine the effectiveness of the fishing closure in rebuilding this stock, although we had no previous information on which to judge a "normal" stock size. With the exception of one more year of extremely low escapement in 2003, escapement levels from 2002 to 2006 increased and appeared to have stabilized at over 1,000 spawners per year. Thus, the subsistence closure appears to have been somewhat effective initially in rebuilding Kanalku Lake sockeye runs. However, taking into account that the average annual subsistence harvest reported by permit-holders from 1994 through 2001 was at least 1,500 sockeye salmon, it appears that current escapement levels are not yet high enough to support a subsistence fishery at former harvest levels. The subsistence fishery was re-opened in 2006 under a reduced season. Observations during aerial surveys and reports from Angoon residents suggest that only a few hundred sockeye salmon were harvested. We plan to continue estimating the sockeye spawning population size each year, adding a weir in 2007 to confirm the accuracy of our mark-recapture estimates. If funding and logistics allow, we would also like to estimate the subsistence fishery harvest using an on-site survey.

Pacific sleeper shark: a potential predator or scavenger of harbor seals

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[2]UAS, National Science Foundation
Research Experiences for Undergraduates 2006

In northern southeast Alaska, harbor seal (*Phoca vitulina*) numbers have declined, in some areas by more than 65%. The cause of this decline is unknown, although one hypothesis is that Pacific sleeper sharks (*Somniosus pacificus*) may be preying on or in competition for food with declining seal populations. The goal of this project was to better understand sleeper shark distribution relative to harbor seal pupping areas and to assess the possibility that sleeper sharks may be preying on harbor seals. The study region was focused on Yakutat, Alaska, a community near a tidewater glacial fjord where seal declines have been reported. Because sleeper sharks are commonly caught as bycatch on longline commercial fishing gear, we created a standardized and structured survey and interviewed 14 fishermen from Yakutat. The intention of this survey was to gather perceived sleeper shark distribution and concentrations relative to fishing efforts. Also, we worked as crew on a commercial halibut longlining expedition to; 1) to gain direct experience with sleeper sharks, 2) collect stomach contents and tissue samples, 3) to improve our interviewing skills through a hands-on fishing experience. From the 430 hooks set while fishing, 10 sleeper sharks were caught as bycatch, 6 of which were necropsied. No obvious seal remains were found in the shark stomachs; however, we were not fishing near known harbor seal concentrations. Fishermen in Yakutat reported the highest concentration of sleeper shark bycatch near the tidewater glacial fjord used by ~1,000 breeding harbor seals. This suggests a correlation between the distribution of sharks and harbor seals. Furthermore, 3 of the fishermen interviewed had cut open sleeper shark stomachs, 2 of which reported finding harbor seal remains indicating that sleeper sharks either preyed on or scavenged harbor seals. The information from this project supports the hypothesis that sleeper sharks are interacting with harbor seals, and thus warrants further studies.

Interannual and spatial variation in population genetic composition of northeastern Gulf of Alaska young-of-the-year Pacific Ocean perch

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The genetic structure of a species, which mirrors its distribution and scale of productivity units, is a key element in developing effective management strategies. We know little about populations of Gulf of Alaska (GOA) and Bering Sea rockfish, including Pacific ocean perch (POP); and there is little early life history information, even though larval and juvenile rockfish incur the highest mortalities. To understand and interpret the population structure of adult rockfish, we need knowledge of the genetic variation, which reflects the extent of dispersal of individuals and genetic divergence between cohorts of fish from the same geographic area. Young-of-the-year Pacific ocean perch collected during surveys of salmon juveniles in the Gulf of Alaska and Bering Sea are the first large concentrations of juvenile rockfish that have been observed and collected in Alaskan waters. Coincidence in timing and location of several collections between years permits analysis of interannual microsatellite variation (between cohorts) and geographic variation (within cohorts). Preliminary analysis of YOY samples collected in different years showed significant differences between the years at similar locations. Large-scale geographic divergence has been observed among adult POP from east to west. Preliminary analysis of YOY data indicated little or weak divergence among hauls made along a transect (fine-scale genetic divergence), but large divergence among transects (large-scale divergence). Some of the results of the comparison of the genetic compositions of juvenile pools and adult collections are consistent with the juveniles originating from nearby aggregations of adults. Comparison of geographic structure to current management areas will provide insight into the effectiveness of area management divisions.

Stock identification of coho salmon (*Oncorhynchus kisutch*) on the Yakutat Foreland of southeast Alaska revealed from otolith chemistry

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A lack of proper stock identification of Yakutat Foreland coho salmon confounds proper management of economically important commercial, subsistence, and sport fisheries. An analysis of coho salmon otoliths and stream water chemistry of the Yakutat Foreland was utilized to identify sub-stocks and determine straying rates. Element ratios, including Sr/Ca and Ba/Ca, were measured in stream waters and otoliths of spawned adult and young of the year (YOY) coho salmon. Ratio data was subsequently used to pair coho salmon to their stream of origin. Otolith chemistry revealed previously unidentified sub-stocks and a minimal rate of straying. Future otolith chemistry investigations of Yakutat Foreland coho salmon could identify relative proportions and migration timing of commercially fished sub-stocks.

2006 Annual Alaska Chapter AFS Conference

Business Meeting Agenda

November 15, 2006
3:20 p.m., Fairbanks, Alaska

1. Call to Order

2. Establish a Quorum

3. Approval of the Agenda

4. Approve minutes from September 14, 2005 business meeting

5. Reports:
    a. Treasurer's
    b. Committee Reports
        i. Aquatic Education
        ii. Awards
        iii. Chapter Historian
        iv. Continuing Education
        v. Cultural Diversity
        vi. Electronic Communications
        vii. International Relations
        viii. Membership
        ix. Molly Ahlgren Scholarship Committee
        x. Student Sub-units
        xi. Wally Noerenberg Award
        xii. Environmental Concerns
        xiii. Newsletter
        xiv. Past Presidents
        xv. Resolutions and Bylaws

6. Outgoing President's Address

7. New Business
    a. Student Travel Fund Criteria
    b. Electronic Newsletter
    c. Chapter Logo

8. Installation of Officers

9. Announcements

10. Next meeting

11. Adjourn

Attachments: Student Travel Fund Criteria

2006 Annual Alaska Chapter AFS Conference

Student Travel Fund Criteria

Student travel to American Fisheries Society meetings is important for both the student and the Society. Students need to take an active role in both the Chapter and the Parent Society. Active participation provides learning opportunities by making public presentations and meeting other professionals that can offer advice or insight into particular issues that students may have regarding their chosen profession or project. With these ideas in mind it is important that the Alaska Chapter of the American Fisheries Society provide financial assistance to students who wish to travel to Chapter events. Students also need to be proactive in raising funds for travel to such events as well. The following guidelines are recommended to insure that student travel is supported by the Chapter while allowing students the opportunity to show their interest in Chapter events.

1. The Alaska Chapter will provide travel funds to the elected student president and vice-president of each Campus Group. If those officers have research assistance grants which provide for travel to professional meetings, the Alaska Chapter would provide travel for the secretary or treasurer of the Campus Group. If those officers also have other travel funds available, then funds can be used for other students chosen by the Campus Group officers (priority should be given to students who are presenting a paper or poster at the annual meeting).

2. Campus Groups are expected to conduct local fundraising events to raise travel funds for student travel to Chapter events. Each Campus Group will be expected to provide travel funds for its members that do not have research assistance grants that support travel to professional meetings. The Alaska Chapter will match travel funds generated by the Campus Group in order to make additional travel funds available to students of that Campus that have no other means to pay for travel.

3. Alaska Chapter meetings rotate between S.E. Alaska, S.C. Alaska, and Interior Alaska, which allows at least one Campus Group each year to attend a Chapter event without travel expenses. If the Chapter event scheduled for an area is held in a location outside of the Campus Group location, additional travel funds may be made available by the Chapter to the home Campus Group to supplement student travel. For example, if S.E. Alaska is the scheduled rotation area and the Chapter meeting is held in Ketchikan, then the Chapter may provide travel funds for an equal number of students from each Campus Group.

4. Student travel will consist of advanced purchased coach airfare or Alaska Marine Highway System fare, shared room costs whether it is a dormitory, hostel or hotel, and a per diem allowance to cover meals. The Chapter will also waive the Student registration fee for the annual meeting, as long as #5 below is met.

5. Students that receive travel assistance from the Chapter are required to attend the Chapter business meeting and are expected to provide a minimum of 6 hours of

work assistance at the Chapter meeting. Students that do not meet these two requirements will be expected to pay the Alaska Chapter the Student registration fee for the annual meeting. Should a student with travel support know initially that, due to other time commitments, they will be unable to meet both of these requirements, then they will pay the Student registration meeting fee PRIOR to the meeting.

6. Funds generated at the Chapter meeting from auctions, raffles or other types of sales for student travel will be used by the Chapter to fund student travel. These funds will be held in the Student Travel Fund Account. If these funds are insufficient to cover student travel for the following year, then the Chapter will use general funds to cover the agreed upon costs for student travel.

7. Any student (officer or Campus Group member) that is in line to receive support from either a Campus Group or the Chapter must be a current American Fisheries Society member / student member in good standing.

2006 Annual Alaska Chapter AFS Conference

Alaska Chapter, American Fisheries Society
Annual Business Meeting, Anchorage, Alaska
September 14, 2005

Call to Order by Hal Geiger at 12:12. A quorum of the membership was established.

Approve agenda: Move Tim Joyce. Second Ray Hander

Changes to agenda: Move award for Senator Stevens to earlier as well as include Introduction of Guest Speakers.

Approve minutes: Move Joe Margraf. Second Chuck Meachum.

Cindy Hartman introduced guest speaker from Anchorage visitor bureau – Jim Henderson –Vice-President for sales.

The 2005 AFS Meeting was one of the largest conventions Anchorage has ever hosted.

Bill Wilson accepts plaque for chairing Parent Society Meeting.
Joe Margraf, Allen Bingham, Larry Peltz, Bill Hauser, Mary Whalen, and local arrangements committee honored also.

Ted Stevens Award for a Career of Accomplishments in Fisheries Conservation.
Accepted by Jim Egan for Senator Stevens.

Jim asked for input from members on issues relating to the reauthorization of the Magnason/Stevens Act.

Treasurer's Report by Ray Hander

Thanks to Bob Ourso for all his help

Ahlgren Family provided the Chapter with a challenge to manage a scholarship fund that will include Molly's estate and part of their estate.

Todd Fletcher from UBS presents status of Financial Services for Chapter funds.

Committee Reports:

Aquatic Education – Laural Devaney.

AFS chapter directory online at Web site.

Survey for interest in Workshops.

Awards Committee – Cheryl Dion- presented by Hal Geiger

Needs more members for committee

Continuing Education Committee - Hamachan Hamazaki

Did technical report writing workshops.

Cultural Diversity Committee – Lisa Stuby

No respondents for applications for the award this year. Possibly timing of Parent Society meeting was a conflict.

Electronic Communications – Allen Bingham
Web Site runs through Parent Society.
Allen will stay on as chair if he gets help doing web site.
International Relations Committee – No report
Membership Committee – Scott Maclean
Gained about 20 members over last year
Past presidents Finance Committee - No report
Student Sub-unit - Kyle Deerkop
Summarized activities from different subunits.
Wally Noerenberg Committee – Doug Palmer
Created in 1981 – 12 recipients so far. 3 chapter past- presidents plus Doug Palmer. Carol Woody finished her term, replaced by Tim Joyce
Environmental Concerns Committee – presented by Hal Geiger
Should limit comments to public policy.
Wrote editorial on Chilkat River jet boat usage.
Newsletter Editor _John Thedinga _Not here
New editor will be Gretchen Bishop.

Presidents outgoing address.
Accomplishments – financial plan biggest thing so far in long while. We are financially stable. What do we want to do? Utilize financial and creditability capital to accomplish things. Not harp on anti-development all the time. Look at research that is usable. Find new ways to get our point cross. Substance matters. Use credibility for open honest discussion of issues.

Introduction of Candidates – VP: Bert Lewis and Jamal Moss
Secretary – Steve Zemke

Assign procedures manual to Bylaws Chair: Move Chuck Meachum. Second Carol Ann Woody. Pass unanimous.

Create Liaison with UBS and put Ray Hander in that position: Move Tim Joyce. Second Chuck Meachum. Pass unanimous.

Molly Ahlgren scholarship plan
Introduced by Kyle Deerkop
Moved to adopt by: Tim Joyce. Second Carol Kerveliet
Joyce spoke to motion. The Ahlgrens will be donating a good portion of Molly's estate to scholarship fund at the rate of $40,000/year, since Molly did not have a will. They will also put half of their estate into fund at the time of their deaths. The wish to see the scholarship have a priority for Sheldon Jackson Students, particularly undergraduates, as that was Molly's biggest desire. Chapter funds will provide scholarship of $2,000 for each of the first two years plus $3,000 for the principal of the scholarship fund. After that the Chapter will donate $5,000/year to the fund unless it has already reached $100,000 in value. If in the future, the

fund generates an income in a substantial amount, the Alaska Chapter ExCom can diversify the scholarship to other campuses as long as Sheldon Jackson gets a priority. The schools will choose the student based upon the criteria that the Chapter provides and the Chapter will control the funds and disperse the money.

Joe Margraf spoke that the Alaska Chapter may not be ready to take on this responsibility. Would like to see other campus students involved having access in the future.

Allen Bingham liked fund, was concerned about not allowing other campus units to access fund. Needs more time to study. Concerned the Chapter may not be able to sustain effort required for a project this big.

Alex Wertheimer(??)_ spoke that he liked plan and commended the ExCom for putting so much thought into it.

Keith Cox supports plan. Molly's parents liked plan.

Ray Hander: Chapter will approach financial aspect in conservative manner.

Chuck Meacham: Support plan. Appreciates Joe's question. Appreciates flexibility.

Allen Bingham: What happens to money above $100,000? ExCom will decide how much will go to award.

LeeAnn Gardner: Concerned about selection committee being Sheldon Jackson. Concerned that if we expand to other campuses that Sheldon Jackson would choose those students.

Joe Margraf raised same point and ability of Sheldon Jackson to select candidate.

Allen Bingham suggested making recipient a member of AFS. This will happen by ExCom action.

Hal Geiger called for a vote. The motion to adopt the Molly Ahlgren Scholarship Plan as presented passed unanimously.

Motion to increase Cultural Diversity Award to $15K. – Ray Hander. Point of order: Tim (Joyce?) – This action was taken last year.

Award to Hal Geiger for his work as Chair of Chapter.

LeeAnn Gardner will become Treasurer later this fall as Ray Hander will be resigning.

2006 Annual Alaska Chapter AFS Conference

New president: Scott Maclean. Goals are to maintain student involvement and provide stability for student travel to attend annual meetings, find help to manage the Chapter's web site, and facilitate arrangements for the 2006 annual meeting.

Presentation of Molly Ahlgren plaque: Accepted by Kyle Deerkop for Sheldon Jackson College.

Comments: Joe Margraf – Alaska Chapter got Chapter of the Year Award from Western Division. Did not get national award.

Talked about Betsy's key and potential for Chapter to take on as a project.

Next meeting: Fairbanks

Move to adjourn: Hal Geiger. Second Ray Hander. Passed by unanimous consent.

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.*

This society 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. Our chapter is one of the larger ones with over 400 members. 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 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 Painting of Steelhead by Betsy Bear. Cover Assembled by Lisa Stuby

Local watercolor artist Betsy Bear has always loved Alaska's wildlife, landscapes, and extremes, and strives to capture the essence of its beauty in her paintings. Betsy has been painting since her retirement from teaching in 2001, and has found that art is a wonderful way to express her love of nature. Contact Betsy at her North Pole Studio (907) 488-2129, or by visiting her web site at http://www.betsybearcreations.com