MONDAY, FEBRUARY 2, 2009

Opening Reception

Hosted by Bering Sea Fishermen's Association on behalf of Alaska-Yukon-Kuskokwim Sustainable Salmon Initiative

The Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative

Karen Gillis, John White, Christian Zimmerman, *AYK Sustainable Salmon Initiative/ Bering Sea Fishermen's Association*

Declining salmon abundance in the late 1990s and early 2000s caused severe hardship for the fishery-dependent communities in the Arctic-Yukon-Kuskokwim (AYK) region. In response to observable salmon declines, several regionally based organizations and one non-profit organization generated enough momentum to pioneer the establishment of the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYK SSI). These regional groups sought to achieve research and restoration efforts that lead to better understanding of the root causes of declines of salmon populations in the AYK that might bring some relief to resource-dependent people in the region. The groups aspired to forge a long-term solution to these problems. In this presentation we examine the evolution and performance of what has emerged as one the largest examples of cooperative management of research throughout the full life history of Pacific salmon: the AYK SSI. The AYK SSI is a partnership between public and non-profit institutions which provides a forum for native regional organizations and state and federal agencies to cooperatively identify and address salmon research and restoration needs. The AYK SSI's governance and science-driven mission provides a strong foundation of integrity. We will present the principles behind the establishment, implementation, and scientific pathways which have guided the AYK SSI since its 2002 inception.

Waterfront Ballroom Foyer, 6:00–9:00 pm

AYK SUSTAINABLE SALMON INITIATIVE

BSFA

Seafood-centric appetizers as well as cocktails will be provided.

Following presentations provided by our hosts, attendees will enjoy festive live music provided by local musicians, including hearty sea shanties and other fish-themed melodies. Musicians include:

- **Jim Edmondson** who contributed to the Ecotrust-sponsored CD "Salmon Nation Artists' Project"
- **Dennis Lakusta**, who focuses on Aboriginal issues, the environment and the plight of Canada's west coast salmon
- **Evelyn Pinkerton** who is a maritime anthropologist who has been collecting and performing songs about fish, fishing, coastal communities, and people's relationship to the natural world for several decades. She also contributed to Salmon Nation Artists' Project
- **Brian Robertson**, who grew up and fished commercially and recreationally on the BC coast and is best known for a strong collection of image laden songs about the coast.

Pacific Rim Scale Challenges, Opportunities & Leadership

Topical issues that are shaping salmon conservation and management challenges will be highlighted. Ranging from socio-economic perspectives to implications of rapid climate change to the role of political leadership and our understanding of ecological systems, esteemed speakers from around the North Pacific will help set the stage for the entire conference.

Garnering public support for essential oceans and fisheries research

David Anderson, *Director, Guelph Institute of the Environment, University of Guelph*

The role of politics in science policy is determining funding levels and, in general terms, determining priorities, and areas of concentration of effort. This in turn means generating public support for a schedule of priorities. The public has supported fisheries research over the decades in large part by reason of the strong identification with Pacific salmon by the peoples of the Pacific Coasts. Research efforts have been concentrated on the fresh water phase and near shore, in part because of the cost and complexity of ocean research work.

Today the threat of climate change and the role of the oceans in affecting global temperature make expanded scientific research in the North Pacific a necessity. The public has yet to realize this, and support for funding has consequently not yet developed. Pacific salmon, an icon for the peoples of the Pacific coast, can be used to help mobilize the public support for the research work required.

In order to focus public attention, we need an overarching international plan for oceans and salmon fisheries research concentrated in a definable period of time, similar to the International Polar Year.

The Kol River (Kamchatka) as a model of a salmon refuge

Vladimir A. Belyaev, *Director, Department of Science & Education, Russian Federal Agency for Fisheries*

Conservation of salmon is a key goal for our generation. Current practices of exploitation of salmon stocks require changes to sustainable, long-term and scientifically-based methods. Due to the huge number and variety of salmon rivers and lakes in Kamchatka, it is essential to organize and demonstrate this work on specific waterbodies as pilots or models in order to garner enthusiasm to expand it.

The Kol and Kekhta Rivers make ideal candidates for the pilot projects for many reasons, including: high indicators of salmonid diversity and productivity in Kamchatka; natural, or close to natural, conditions within these watersheds; their scenery and minimal human impact; the traditional character of the existing economic activities in the area; as well as their scarce human populations and difficulty of access. These factors contribute to easy organization for safeguarding and managing salmonid populations.

Therefore, the Kol and Kekhta rivers have been selected as models for establishing a salmon sanctuary of great significance, where in-depth research and monitoring of salmonid populations can be conducted in order to convinc-ingly justify their stable, long-term and sustainable management.

Thus, work in the Kol and Kekhta rivers will fulfill two objectives: to develop a model of stable, long-term and sustainable management of salmonid populations, considering the social and eco-nomic complexities of Kamchatka and simultaneously, to preserve their rare biological diversity in order to conserve the gene pool of wild salmonids in general. In the future, these methods and results may be replicated across the entire territory of the Russian Far East.

Other Keynote abstracts are not available.

Highlights from Around the Pacific Rim

Speakers from South Korea, Japan, Russia, Canada and the U.S. will provide perspectives on current issues from their region such as status of salmonid populations, key policy initiatives, and observed environmental changes; intended to illuminate both shared and unique challenges faced across the North Pacific Rim.

Salmonid status and its relation to environmental conditions in Hokkaido, Japan

Mitsuhiro Nagata, *Director, East Research Branch of Hokkaido Fish Hatchery*, **Yasuyuki Miyakoshi,** *Hokkaido Fish Hatchery* **and Masahide Kaeriyama,** *Hokkaido University*

Chum salmon *(Oncorhynchus keta)* are found mainly in Hokkaido and northern Honshu Islands of Japan. While the chum population size in Hokkaido was less than five million until the 1960s, it increased linearly from five to eight million in the early 1970s to 30 million in the late 1980s owing to favorable oceanic conditions as well as hatchery programs. Although Hokkaido chum maintain high abundance (over 40 million fish), recent return rates have varied not only between brood years, but also between local populations. Chum in the Okhotsk Sea have sharply increased since the 1990s. In contrast, those in the Japan Sea have decreased, as have Korean chum. High mortality of chum salmon occurs in their early ocean life. Sea ice in the Okhotsk Sea has a tendency to disappear earlier. Recent coastal studies in the Okhotsk Sea suggest that the long period of optimal seawater temperature from 8 - 13°C in coastal waters after seaward migration may positively effect survival of chum. However, if a decrease in sea ice is caused by global warming, optimal seawater temperatures for chum may become scarce within 50 years. Pink salmon *(Onchorhyncus gorbuscha)* inhabit mainly eastern Hokkaido. Their population size was low, ranging from one million for even-numbered years to two million for dominant, odd-numbered years during the 1970s and 1980s. However, in the early 1990s, the population increased sharply and shifted from odd-year to even-year dominance. More recently, odd-year dominance has resurged. In contrast, masu salmon *(Oncorhynchus masu)* occur mainly in Hokkaido and spend more than one year in freshwater before seaward migration. Their population size remains low mainly due to deterioration of freshwater environments despite many costly efforts to restore them, including hatchery programs. As wild masu populations still exist, we have undertaken research and restoration programs to rehabilitate freshwater environments.

Status review of chum salmon from Korea

Sukyung Kang, *Fisheries Research Scientist, National Fisheries Research and Development Institute*, **Suam Kim,** *Pukyung National University*, **and Ki Baik Seong,** *National Fisheries Research and Development Institute*

Pacific salmon are the dominant fishes in the Pacific Ocean and the total catch of Pacific salmon has been at historical high levels. Among the salmon species, chum salmon are the species of Pacific salmon that are of most interest and importance to Korean researchers. Chum salmon hatcheries were established in the northern Korean Peninsula in 1913 and in South Korea in 1967. For the last four decades, Korea's chum salmon program has focused on improving the conditions of salmon stocks by artificially fertilizing eggs, raising fingerlings, and releasing them. Despite the hatchery production, the catch of chum salmon declined from 553 tons (t) in 1997 to less than 200 t at present. Korea is located at the southern range for chum salmon distribution, an area where Pacific salmon production is known to be negatively impacted by climate change. Thus, future changes that warm the surface waters would be expected to reduce the production of chum salmon. During the presentation, we will mention the fluctuations of the Korean chum salmon population, variations of survival rates, and climate effects on Korean chum salmon.

Climate change and Pacific salmon catch dynamics in Russia: Do trends cross a ridge?

Vladimir I.Radchenko, *Director, Sakhalin Research Institute of Fisheries and Oceanography (SakhNIRO)*

In 2008, coastal Pacific salmon harvest in the Russian Far East was lower than that of 2007 (348,700 metric tons, mt) as well as previous even years' values (276,400 mt). The pink salmon harvest has decreased to 163,731 mt, close to the average for 1991-2004 (161,000 mt). The portion in the total Pacific salmon catch has declined to below 63.8%, similar to levels in the 1980s – early 1990s. This is a large decrease relative to levels since 1992, which consistently exceeded 70%. In 2008, the pink salmon harvest decreased after a large increase in 2005-2007. On the contrary, the chum salmon coastal harvest doubled in 2008 in comparison with 2004; the sockeye salmon harvest doubled in 2007 in comparison with 2000, suggesting gradual continued growth. Recently, close correlations were recognized between the Russian pink salmon harvest and the world ocean upper layer heat budget. The last point in the heat budget data series for the year 2007.5 was also lower than three previous values. After the gradual warming, opposite trends are observed in the far-eastern seas. Repetition of the atmospheric circulation patterns above the far-eastern seas supposes further progress of the "cold-type" forms, which determine severe synoptic conditions and

Climate change and Pacific salmon catch dynamics in Russia: Do trends cross a ridge? (CONTINUED)

a decrease in sea surface temperatures. However, pink salmon harvest trends also correlated with the solar activity index (Wolf numbers) dynamics. The 24th solar cycle began in 2008. The inception of the 20th and 22nd solar cycles in the past coincided with positive trends in pink salmon dynamics. Beginning in 2009, fisheries regulation by the TAC and quota allocations will be abolished for the coastal salmon fishery. Notable changes of Pacific salmon stock conditions and their harvest remain predictable, but could be supported by the quickly developing hatchery program, salmon habitat conservation measures, etc., and realization of natural potential of Pacific salmon populations.

Alaska's salmon fishery managment – 50 years of sustainability

John Hilsinger, *Director, Division of Commercial Fisheries, Alaska Department Fish and Game*

Alaska's highly successful salmon fishery management system is briefly described. This approach is based on inseason management by local biologists using emergency order authority to achieve established spawning escapement objectives that are designed to sustain yields over the long term and provide substantial benefits to the public. This management system provides a vibrant framework for public participation, including adoption of regulations and allocations by an independent lay board acting as a buffer between managers and users. Responding to increasingly complicated fisheries over time, management has evolved toward the use of complex regulatory management plans that contain conservation, allocation, and product quality elements. These plans require more detailed stock assessments, often relying on genetic methods, and more accurate and timely escapement monitoring. Stock status trends throughout the state show that while Alaska's salmon fisheries are quite healthy overall, effects of climate change appear to be complicating management and requiring re-evaluation of some elements of management plans. Some climate related impacts include wider variation in size and timing of salmon runs and changes in species distributions. Responding to these changes will require greater management flexibility in the future, for which Alaska's system of abundance based management is well designed. Protecting important salmon habitat is a growing challenge in Alaska, and represents a key element for sustainable fisheries in the future. Alaska's Policy for Management of Mixed Stock Salmon Fisheries, Policy for the Management of Sustainable Salmon Fisheries, and Policy for Statewide Salmon Escapement Goals are the foundation for a more consistent approach to management, management planning, and terminology throughout the state. Current policy issues include assessment and certification of sustainability, managing hatchery and wild stocks, and increased interest in development of Alaska's resources.

Perspectives of managing, restoring and conserving salmonids in the southern Pacific Northwest and northern California.

Frank Lake, *Research Ecologist, USDA-Forest Service, Pacific Southwest Research Station*

The southern distribution of salmonid populations in the western United States, in southern Oregon and California, are influenced and affected by environmental, managerial, policy, and socio-cultural factors. In the Klamath River Basin, coho salmon are threatened. Summer Steelhead are proposed to be listed threatened. Spring chinook, once the most abundant run of the Klamath River, have severely declined from historical pre-dam population levels. Proposed removal of dams in the upper Klamath River to provide access to former habitat, improve hydrologic connectivity and water quality is one of the greatest issues facing salmonids and local communities in the Klamath River Basin. Changing climate is affecting precipitation delivery, water resource availability, vegetation, and influencing the severity and extent of wildfires in sub-watersheds with critical salmonid refugia. Federal and state agencies, tribes, and community organizations are implementing various restoration projects for improvement of salmon habitat. These include watershed restoration for road decommissioning, fish passage enhancement, entrapment prevention, riparian improvements, and post-fire rehabilitation/repair work. Currently, the largest socio-political and environmental issue for the Klamath River is a proposed dam removal settlement and restoration agreement between governmental agencies, American Indian tribes, community organizations, industry, and other stakeholders, regarding water allocation, habitat restoration, regulatory assurances, water rights and fisheries harvest allocations.

James Irvine, *Pacific Biological Station, Fisheries and Oceans Canada*

The wide variety of Canadian ecosystems that produce Pacific salmon, ranging from the Okanagan (Columbia watershed) in the south to the Mackenzie in the far north make it difficult to provide a coarse scale status assessment. Recent commercial catches, only ~45% of long-term means, are indicative of overall status. Within British Columbia (BC), southern populations tend to be less healthy than those in the north (see http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/salmon/webdocs/SalmonStockOutlook2009.htm). Many southern coho, sockeye, chinook, and steelhead are doing poorly, while most chum and pink are doing better. Yet within the Fraser River watershed, while some populations of sockeye and chinook are doing well, others are at risk of endangerment. While some sockeye in central BC are doing poorly, other species are generally about average. Status is also highly variable in northern BC. Most chinook, coho, pink, and chum are above average but in the Skeena, many non-Babine sockeye are depressed. Within the Yukon, chinook and fall chum predominate and are near average levels of abundance while the less abundant coho appear to be above average.

James Irvine, ***Pacific Biological Station, Fisheries and Oceans Canada (CONTINUED)***

There are increased reports of Pacific salmon in the Canadian arctic with all 5 species having been caught in or near the Mackenzie River; however only chum appear to be natal.

There are many examples of biological responses to recent environmental changes. For instance, before the early 1990's, the Strait of Georgia was important for young coho and chinook but now appears to be more important for chum and pink. In southern BC, survival of salmon that went to sea in 2005 were almost universally bad resulting in poor returns of coho in 2006, much poorer than forecast sockeye returns in 2007 and 2008 and poor chinook returns in 2007. We see evidence of subtle changes in the timing of sea entry for young salmon, and significant within-species variability in survival. The year of 2008 had the highest sockeye returns on record in the Okanagan, returns to the Fraser were much lower than anticipated while in the north were highly variable.

Recognizing the importance of conserving population and habitat diversity, Canada released its wild salmon policy in 2005 (http://www-comm.pac.dfo-mpo.gc.ca/publications/wsp/default_e.htm). This policy heralded a major shift in the way salmon are managed and assessed. Policy implementation is resulting in an increasingly ecosystem-based approach to fisheries and habitat management.

Salmon and climate in the western continental US: recent highlights

Tim Beechie, ***Supervisory Fish Biologist, NOAA Northwest Fisheries Science Center***

In the western continental United States, salmon abundance, climate, and management policies have each taken unexpected turns in the past three years. A few highlights are:

Salmon abundance

- Chinook salmon populations in the western US have declined dramatically since 2005, especially in California.
- The Columbia River sockeye run in 2008 was nearly double the largest run in the previous 12 years.

Climate

- Continued climate warming and drying drove increased fires in the western United States.
- Ocean conditions off of Washington and Oregon shifted towards a more favorable regime for chinook and coho salmon.

Policy

- The U.S. government's 2005 policy including hatchery fish in evaluations of salmon status was set aside by the courts.
- Native American Tribes and the Bonneville Power Administration reached an agreement under which US$900 million would be spent on salmon habitat restoration in the Columbia basin.

These events illustrate unique challenges in managing salmon populations near the southern limit of their range, where human land and water uses severely constrain the resilience of salmon populations and competing needs for water force political compromises in salmon ecosystem management. Salmon management in this portion of their range must focus on strategies that will increase salmon resilience to climate change and its accompanying stresses on riverine ecosystems.

The role of the North Pacific Anadromous Fish Commission in conservation and protection of Pacific salmon

Vladimir Fedorenko, ***Executive Director, North Pacific Anadromous Fish Commission***

The North Pacific Anadromous Fish Commission (NPAFC) was established under the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, signed at Moscow on February 11, 1992 and entered into force on February 16, 1993.

Pacific salmon are very important to the economies, cultural activities, and heritage of the people of the North Pacific Rim. At present, the total North Pacific Rim catch of salmon is almost 1 million metric tons at gross value of more than $1 billion annually.

Approximately 5 billion hatchery salmon per year are released into Convention waters and adjacent seas to augment natural salmon runs.

With development of the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, the process of establishment of the comprehensive international regime of conservation of salmon resources in the North Pacific Ocean has been completed.

The goal of conservation is consolidated by prohibition of directed fishing for anadromous fish in the Convention Area. Therefore the Convention represents an important instrument of collective responsibility and cooperative efforts of the contracting parties in protection and conservation of the North Pacific salmon resources.

The NPAFC promotes the conservation of salmonids in the North Pacific Ocean and its adjacent seas and serves as a forum for cooperation in and coordination of enforcement activities and scientific research.

The strength of this Commission lies in the shared purpose and active efforts of the contracting parties to ensure the conservation and sustainable utilization of North Pacific salmon resources for the benefit of domestic fishermen in their respective waters. As a result, the Commission in its brief history has become a model of positive and successful international cooperation.

Vancouver Aquarium Reception

Hosted by Pacific Ocean Shelf Tracking Project and Census of Marine Life

Frank L. Cassidy Jr., "Larry", *Chair, Pacific Ocean Shelf Tracking (POST) Project,* **Frederick G. Whoriskey Jr.,** *Vice President, Research and Environment, Atlantic Salmon Federation*

The Pacific Ocean Shelf Tracking (POST) Project provides researchers with the infrastructure and data clearinghouse capability necessary to track the movement and behaviour of a variety of marine and anadromous species along the Pacific coast of North America, from Point Reyes, CA, to Prince William Sound, AK. In partnership with groups such as NOAA's Southwest Fisheries Science Center and the Prince William Sound Science Center, POST maintains a broad-scale array of acoustic receivers running in lines on the ocean floor, effectively "curtaining off" segments of the coast in CA, OR, WA, BC and AK. Scientists from federal, state and provincial agencies, universities, and other non-governmental agencies outfit animals with tiny acoustic transmitters, so their journeys through fresh- and saltwater can be accurately documented. POST is one of 14 field projects of the Census of Marine Life (CoML), a global network of researchers in more than 80 nations engaged in a 10-year scientific initiative to assess and explain the diversity, distribution, and abundance of life in the oceans. The world's first comprehensive Census of Marine Life - past, present, and future - will be released in 2010.

Vancouver Aquarium, 7:00–10:00 pm

CENSUS OF MARINE LIFE

POST
PACIFIC OCEAN SHELF TRACKING PROJECT

vancouver aquarium™

- Shuttle service will be provided from the Fairmont Hotel to the Vancouver Aquarium at 6:30, 6:45, and 7:00 PM. Return service will be available at 9:30, 9:45, and 10:00 PM.
- A healthy portion of appetizers as well as cocktails are included in the admission fee.
- In addition to the presentation provided by our hosts, reception attendees will enjoy the breathtaking scenery of the world famous Vancouver Aquarium.
- Several videos will be screened during the reception which document activities of the Pacific Ocean Shelf Tracking Project, the Census of Marine Life, and the Wild Salmon Center. Additional videos will include images from Felt Soul Media's recent documentary Red Gold, and spectacular footage from Manu Esteve documenting the behavior of salmonids and the ecosystems upon which they thrive.

Conservation Principles & Their Integration

The articulation of broad level conservation principles and how they are being addressed and integrated around the Pacific Rim.

Principles for the proactive conservation of aquatic resources

Jack Williams, *Senior Scientist, Trout Unlimited*

Despite considerable efforts directed toward salmon conservation, we continue to see losses in the diversity and abundance of these important resources. Impacts associated with rapid climate change are likely to add further stress and uncertainty to existing management situations. Therefore, it is appropriate to reexamine our basic management philosophy in order to become more effective and to increase the ability of salmon and their watersheds to withstand additional stressors. A number of conservation principles emerge from an examination of past management and future threats. First, to be effective over the long term, we must become more proactive in our efforts to address emerging threats and to insure that a network of the best remaining strongholds are secured at large enough scales to protect their integrity and the ecological processes that support them. Second, we must make certain our actions work in harmony with natural processes. We should not be overly reliant on technology and artificial measures to achieve our goals. Third, we must find ways to characterize conservation goals as fundamentally important in the value sets of a greater proportion of the public, land managers and government leaders. Finally, we must have a more robust monitoring, evaluation, and reporting system in order to determine our most effective course of action in the face of rapid societal and environmental change. My presentation will expand on these basic principles and their potential application to salmon conservation.

Fishery selection: Size, age, and the timing of migration

Thomas P. Quinn, *Professor,* **Christopher P. Boatright, Neala Kendall, Katy K. Doctor, and Trevor A. Brandh,** *School of Aquatic and Fishery Sciences, University of Washington*

Many fisheries are selective for certain ages or sizes of fish, and there has been considerable recent interest in the phenotypic and genetic effects of this selection on diverse species including northern pike and Atlantic cod. For several decades there have also been reports of decreasing body size of Pacific salmon, and fishery selection has been recognized as one of many possible contributing factors. However, size and age at maturation are strongly influenced by environmental conditions. In contrast, the timing of migration and spawning are strongly controlled by genetics, and vary systematically within and among population complexes. Many fisheries are also selective with respect to migration timing, either for the convenience of the fishermen or by regulation. This presentation discusses these two forms of selection, highlighting recent work on sockeye salmon in western Alaska, and concludes that the selection on timing is likely widespread and can have important effects within and among salmon populations.

Coordination of harvest, hatchery, and habitat management for recovery of depressed chinook salmon populations in Puget Sound, USA

Kit Rawson, *Senior Fisheries Management Biologist, The Tulalip Tribes of Washington*

Management of harvest, hatcheries, and habitat all affect salmon populations. However, the implementation of programs in each of these sectors typically lack reference to the other "H's". The 2007 recovery plan for threatened chinook salmon *(Oncorhynchus tshawytscha)* in Puget Sound, Washington State, USA, not only included habitat acquisition and restoration programs, harvest management guidelines, and reform of hatchery practices, but it also mandated coordination of these towards common recovery goals. As a result, managers are beginning to develop harvest management and hatchery production strategies keyed to the status of habitat, habitat restoration programs based on the desired future status of both the salmon populations and harvest levels, and hatchery supplementation programs that address limiting factors of habitat. One major challenge in this work is to develop a "common currency" through which the effects that harvest, hatchery, and habitat management have on the salmon resource can be assessed concurrently. Although these initial efforts towards "H-integration" are promising, much work remains to be done, especially in the area of habitat protection.

Conservation principles of natural spawning of salmonids in Hokkaido, Japan

Mitsuhiro Nagata, *Director, East Research Branch of Hokkaido Fish Hatchery*, **Yasuyuki Miyakoshi,** *Hokkaido Fish Hatchery,* **and Masahide Kaeriyama,** *Hokkaido University*

While hatchery-based management in Hokkaido has been successful for chum salmon *(Oncorhynchus keta)*, masu salmon *(Oncorhynchus masu)* still remain at low levels because of distinct life histories (see the abstract by Nagata et al. in Session 2). In addition, the Hokkaido Federation of Fisheries Cooperative Associations have been challenged to acquire Marine Stewardship Council (MSC) certification for the Hokkaido chum salmon set net fishery in order to maintain a profitable position to export chum to Europe and North America via Chinese fish processors. However, MSC and its certification body requested that the Federation manage wild/natural chum salmon and control hatchery activity. In order to conserve wild salmon and to catch hatchery salmon for enhancement programs in freshwater, commercial and game fisheries in Hokkaido are legally restricted to coastal waters. But, as monitoring programs such as counting wild/natural salmon have not been undertaken in freshwater, sustainable escapement goals and management plans for wild salmon have not been established. Potential solutions to the problem which have been considered include a wild salmon policy to conserve wild salmon and biological diversity of hatchery-origin salmon, as well as restoration programs to rehabilitate freshwater environments and improve fish habitat. Harmony between ecosystems and the coexistence of wild and hatchery salmon could be achieved on the basis of zone management.

Creation of a network of protected areas for the conservation of Pacific salmon habitat

Alexander Kulikov, *Regional Wildlife Fund, Khabarovsk*

Creation of a network of protected areas is one of the major objectives for the conservation of Pacific salmon habitat. A protected areas network plays an important role in the reproduction of economically valuable species of salmon (chum, pink, coho, and Sakhalin taimen), and also is the most effective way of protecting rare and endangered species.

A complicated network of protected areas already exists in Khabarovsk Krai for the conservation and reproduction of Pacific salmon. It includes such protected areas as Botchinsky, Komsomolsky, Bolonsky and Dzhugdzhursky Reserves; the National Parks Anyuisky, and Shantar Islands (which is currently being created); the Nature Park Khoso; Federal Zakazniks Tumninsky, Oldzhikansky and Udyl; and Regional Zakazniks Priozerny and Chukensky. Also, Regional Zakazniks Alkan, Gursky, Gorinsky, Khutinsky, Ulsky, Verkhnetumninsky were created to focus particularly on protection of salmon by limiting fishing on 292,000 hectares in total. An additional Zakaznik limiting fishing activities is in its final stage of creation in the basin of the Koppi River, encompassing 80,000 hectares.

Protective forest buffer strips along spawning grounds, rivers and reservoirs are important for Pacific salmon conservation. The Forestry Code of the Russian Federation designates specific protected forests where only limited logging is allowed. Such protected forests encompass several thousands of hectares. An additional several thousands of protected forests include additional protection for water conservation. Thus, a rather structurally complex network of protected areas exists in the Khabarovsk Krai for Pacific salmon habitat conservation.

The Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative: barriers and bridges to cooperative management of fishery research

John White, Joseph Spaeder, *Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative/ Bering Sea Fishermen's Association*

In an effort to mitigate resource conflicts and engage diverse stakeholders in sustainable resource management, decentralized collaborative approaches have evolved over the past decade and a half. Through cooperative management (or co-management), governmental managers and local or regional groups of resource users have jointly devised collaborative approaches to resource management and research. These co-management efforts meld aspects of governmental and community-level approaches. In this presentation, we examine the evolution and performance of what has emerged as one the largest examples of cooperative management of research and restoration addressing Pacific salmon: the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYK SSI). In 2001, in response to salmon declines, a diverse set of stakeholders established this innovative partnership including: two federal agencies, one state agency, one non-governmental organization, and three regional native organizations representing three different Alaska Native cultures (Inupiat, Yup'ik and Athabascan). Based on five years of experience in the implementation of this collaborative research initiative, we examine a series of challenges including: 1) establishing a shared vision of research priorities necessary to understand the cause of salmon declines and support sustainable management; 2) using consensus to make research funding decisions among diverse stakeholders; 3) integrating capacity building for local involvement in salmon research into all aspects of the research program. We will discuss how such collaborative processes work and how they influence governmental research and management institutions. Understanding how these barriers and challenges have been addressed reveals both strengths and fragility of this cooperative research initiative and suggests potential modifications for future regime design.

Canada's Wild Salmon Policy … conservation planning for an uncertain future

Brian Riddell, ***CEO/President, Pacific Salmon Foundation***

"The health of Pacific salmon depends not only on their abundance but also on their biological diversity. That diversity includes the irreplaceable lineages of salmon evolved through time, the geographic distribution of these populations, the genetic differences and life history variations observed among them, and the habitats that support these differences. Diversity of Pacific salmon represents their legacy to-date and their potential for adaptation to future changes in climate, fishing, and habitat. Protecting diversity is the most prudent policy for the future continuance of wild salmon as well as the ecological processes that depend on them and the cultural, social, and economic benefits drawn from them." (Canada's Policy for the Conservation of Wild Pacific Salmon, June 2005)

But to survive, wild salmon also need appropriate freshwater and marine habitat: no habitat, no salmon. The Policy explicitly recognizes the importance of diversity within and between salmon populations, the essential need to protect and restore their habitat, and for salmon to function within their natural ecosystems. The Wild Salmon Policy provides an integrated management framework for the future but its success requires the development of new regionally-based planning and decision processes. The latter may be the ultimate challenge for the future.

Oregon native fish policy and coastal coho applications

Ed Bowles, ***Fish Division Director, Oregon Department of Fish and Wildlife***

Oregon developed several key policies early this century to help restore or maintain sustainable native fish populations and guide fish management. Central to this effort is the Native Fish Conservation Policy adopted in 2002. This policy is implemented primarily through conservation plans. The approach is conceptually simple: identify species management units (i.e., population groupings); describe recovery or desired status based on sustainability characteristics (e.g., abundance, distribution, survival, population structure); describe existing status; identify key factors causing gaps between existing and desired status; select and implement management actions to address limiting factors; and monitor and evaluate results for adaptive management. The approach invites participation by management partners (agencies and tribes) and encourages complementary policies and standards to aid the conservation of native fish and their habitats. Public involvement is encouraged to help shape decisions for local watersheds from a menu of scientifically acceptable management options. This approach provides necessary leadership in the Oregon Plan and federal and state recovery plans by defining the recovery "bar" and focusing recovery efforts on factors most critical to the fish. Since adoption, Oregon has completed a statewide status assessment of key native fish species and has completed or is working on approximately 18 conservation plans.

Endangered Species Act perspective

Robert Walton, ***Assistant Regional Administrator, Salmon Recovery Division, NOAA Fisheries Service***

Under the U.S. Endangered Species Act, the developing science has pointed salmon management efforts towards "viability" at the population level. This had become the fundamental goal of recovery efforts for protected runs. In my opinion, this creates the opportunity to adapt this approach in managing strong runs as well.

The geographic range of salmon and steelhead overlaps with many human activities, including dams, water withdrawals in tributaries and other forms of habitat degradation. As a result, the quantity and quality of spawning, rearing and migration corridor habitat has been reduced or eliminated throughout the lower 48 states. Progress has been made in curtailing egregious practices of the past, but protection and restoration of habitat and corridors is essential to protecting wild runs.

Salmon hatcheries have been operating in the Pacific Northwest for over 120 years. Extensive research and "reform" efforts are underway to reduce the impact of hatchery origin fish on the fitness of wild salmon and steelhead.

Overall, harvest rates on salmon and steelhead have been reduced from previous levels; selective harvest opportunities offer opportunities but questions remain about what levels are sustainable.

Integrating all the above with improved research and monitoring is both an obstacle and an opportunity.

Innovative Approaches to Applying Conservation Principles – Part One

Examples of conservation principles in action: using case studies and stories from those working on each side of the North Pacific to inspire fresh thinking and widespread adoption of best practices.

What are the fishery and conservation benefits of life history diversity in salmon stocks?

Daniel E. Schindler, *Professor, Aquatic & Fishery Sciences/Department of Biology, University of Washington*

Pacific salmon have remarkable abilities to develop population specific adaptations to local variation in habitat features. Locally adapted life history characteristics are evident at all stages of the salmon life cycle, from the seasonal timing of migrations between freshwater habitats and the ocean, to morphometrics, to age composition, and even to feeding strategies in the ocean. Life history differences among populations and heterogeneous filtering of regional climate by local geomorphology and hydrology interact to produce asynchronous population dynamics within salmon stocks. Fisheries are inherently more resilient to variation in regional environmental forcing because they integrate across this life history variation and associated asynchrony in population dynamics. Similar 'portfolio effects' also benefit large, mobile predators in freshwater and terrestrial ecosystems because they are capable of capitalizing on spatial and temporal variation in salmon-derived resources. Furthermore, within-population diversity in age composition stabilizes dynamics of individual populations. A richer appreciation of the tangible benefits of life history diversity implies that more explicit consideration of diversity maintenance should be incorporated into fishery management and conservation schemes.

New approaches for sustainable Pacific salmon fisheries in Canada

Jeffery Young, *Aquatic Biologist, David Suzuki Foundation*

Canadian Pacific salmon fisheries are changing. In most places, catches are lower as a result of reduced abundance and increasing conservation concerns. Uncertainty, from salmon behaviour and productivity to changing market and regulatory conditions, is a pervasive challenge and one that is likely to increase as a result of factors such as climate change. Recent science, along with increasing recognition of traditional ecological knowledge, is further identifying the principles of sustainable salmon management, from biodiversity protection to the use of incentives to support effective fisheries management. Based on this knowledge, and experience working in participatory management planning, the David Suzuki Foundation proposes key approaches for sustainable Pacific salmon fisheries in Canada. Key solution themes include effective implementation of the federal Wild Pacific Salmon Policy, improved clarity of management objectives, integrated regional planning, and regulatory structures that use objective-based incentives.

Tradeoffs between production and biodiversity in the Skeena salmon management system

Carl Walters, *Professor, University of British Columbia*

Using long term escapement trend and exploitation rate data, we have estimated variation in productivity among the stocks of all salmon species in the Skeena River watershed. The stocks show wide variation in sustainable exploitation rates, with some stocks declining toward extinction and others doing very well despite quite high mixed-stock exploitation rates. Likely most harvest of all species will continue to be taken in ocean and lower river fisheries where stocks cannot be selectively harvested at their best individual rates. This creates a tradeoff where the cost of maintaining biodiversity, measured as prevention of extinction of the weaker stocks, could mean considerable loss in overall catch and value; maintenance of all currently monitored stocks at above extinction levels would mean a loss of roughly 20% in average total harvest. It is questionable whether the value of maintaining and restoring biodiversity is that high, since most of the threatened stocks have little habitat potential for producing larger yields no matter what might happen to the currently productive stocks.

Growth and survival of salmon in response to competition at sea and climate change

Greg Ruggerone, *Consultant, Natural Resources Consultants, Inc.*, **Jennifer Nielsen,** *U.S. Geological Survey, Alaska Science Center,* **and Bev Agler,** *Alaska Department of Fish and Game*

Many hatcheries were built on the premise that the ocean has an unlimited capacity to support salmon, and some recent research suggests salmon consume a small fraction of available prey. However, a growing number of studies suggest competition between and among salmon species can influence salmon growth. Little information is available to evaluate whether reduced growth translates to reduced survival of salmon, in part, because the capacity of the ocean to support salmon is dynamic. Additionally, smaller adult size has been associated with great abundance, which infers high overall survival. We review evidence from recent studies suggesting that competition at sea can lead to reduced salmon growth and survival, and to potentially lower reproductive potential of survivors. We also provide evidence that increased early marine growth was a key mechanism influencing the doubling of sockeye salmon abundance in Alaska after the mid-1970s ocean regime shift. Increased early marine growth was followed by density-dependent growth during late marine life when size-related mortality was less likely. We conclude that growth of salmon at sea affects their survival and that competition at sea is an important yet controversial and elusive mechanism that affects both growth and survival.

Proportionate natural influence (PNI): a genetic risk management tool for salmon and steelhead hatcheries

Craig Busack, *Chief Fish Scientist, and Acting Division Manager, Fish Conseration Biology Unit, Washington Department of Fish and Wildlife*

Salmon and steelhead hatcheries have traditionally been operated without regard to the genetic impacts they impose on natural populations in and near the streams on which they are sited, even though in many cases gene flow may render the natural and hatchery production genetically indistinguishable, with significant fitness loss. A hatchery reform process in Pacific Northwest states is addressing this issue by challenging managers to clearly define management intent for hatchery programs and then to modify management accordingly. Gene flow between hatchery- and natural-origin fish is a key element in this process. Hatchery programs are classified either as segregated, in which gene flow between the production components is minimized, or integrated, in which gene flow is managed to specific levels. The major tool in management of integrated programs is the proportionate natural influence (PNI) statistic, a function of the gene flow rates that predicts the long-term trait means of the population. Although not a predictor of fitness, PNI allows a better appreciation of relative genetic risk, and better guidance for running integrated programs, than has been available previously. It also is a common currency for understanding risk, and forces managers into consideration of basin productivity and capacity as part of hatchery program planning.

Selective salmon fisheries in Washington State

John Long, *Statewide Anadromous Fishery Manager, Washington Department of Fish and Wildlife*

Washington State has been employing selective commercial and recreational salmon fishery methods for decades. Implementing selective fishing strategies helps maximize and/or preserve harvest opportunities while achieving conservation and ethical standards for non-target animals and stocks. Numerous techniques are available to managers including: time and area restrictions, gear modifications, species/origin selective restrictions and fish handling rules. This talk will describe a number of selective salmon fishery examples from Washington State.

Mass marking and mark-selective salmon fisheries in Washington State

Pat Pattillo, *Special Assistant to the Director, Washington State Department of Fish and Wildlife*

Currently, nearly all chinook salmon and coho salmon produced from Washington State hatcheries are "mass-marked" to provide a practical and cost-effective means of distinguishing these salmon from wild salmon, for stock assessment and selective harvesting purposes. Employing new "mark-selective fisheries as an alternative to mixed-stock harvesting, fishery managers have been able to increase or maintain fishing opportunity on hatchery stocks while reducing harvest rates on wild stocks needing protection. The Washington Department of Fish and Wildlife (WDFW) has developed new sampling and monitoring programs to collect key information that can be used to maintain the capability for scientific assessment of the impact of fisheries on wild stocks with these "mark-selective" fisheries in place. In addition, mass marking has provided a new tool for evaluating the potential effect of large hatchery programs on wild populations by enabling quantification of the rate of straying or mixing of hatchery populations with wild populations in natural spawning areas. The experience of WDFW with these programs implemented over the last decade may be valuable to other fishery and fish resource managers balancing objectives for harvest and conservation of wild populations.

Poster Session & Refreshments

The poster session is an important means to exchange ideas outside of the formal plenary sessions and to stimulate discussion and reflection among attendees.

Waterfront Ballroom Foyer, 5:00–7:00 pm

- Appetizers and cocktails will be provided
- Subtle live music will accompany the session
- Please refer to the poster abstracts on page xx.

Innovative Approaches to Applying Conservation Principles – Part Two

Examples of conservation principles in action: using case studies and stories from those working on each side of the North Pacific to inspire fresh thinking and widespread adoption of best practices.

Differentation of Asian populations of chum salmon (Oncorhynchus keta) *at microsatellite loci*

Lev A. Zhivotovsky, Konstantin I. Afanasiev, Galina A. Rubtsova, Marina V. Shitova, Tatiana V. Malinina, Tatiana A. Rakitskaya, Valentina D. Prokhorovskaya *Institute of General Genetics, Russian Academy of Sciences, Moscow, Russia,* **Igor A. Chereshnev, Larisa T. Bachevskaya, Vladimir A. Brykov, Michail Yu. Kovalev,** *Institutions of the Far East Branch of Russian Academy of Sciences,* **Evgeny A. Shevljakov, Ludmila K. Fedorova, Sergey I. Borzov, Victor P. Pogodin, Alexander M. Kaev, Svetlana V. Sidorova,** *Fish-and-Game organizations in the Russian Far East*

Populations: Samples were collected during spawning from the rivers and lakes in Sakhalin and South Kuril Islands, the Kamchatka Peninsula, Chukotka, and the Magadan region (for a total of 89 sites, each with a sample size, n, of approximately 50). Each population was evaluated using samples collected during a spawning run and/or during different years of study.

Markers: All the samples were typed with ten microsatellites: Ssa197, Ssa20.19, Ogo2, Oki1-1&2, Oke3, Oke11, One103, One109, and Ots3. Twenty-nine samples from Sakhalin and Iturup Islands were additionally typed with twelve allozymes: ESTD★, LDH-A1★, PEPB-1★, PEPLT★, sMDH-B1,2★, mMEP-2★, G3PGH-2★, PGDH★, ALAT★, MPI★, mIDHP-1★, and sAAT-1,2★.

Polymorphism: Mean number of alleles and allele diversity are 3.3 and 0.25, respectively, per allozyme locus and 12.5 and 0.67, respectively, per microsatellite locus. Genetic differentiation between Sakhalin and Iturup islands equals 6.23% at microsatellites versus 2.73% at allozyme loci. Microsatellites allow for statistically significant local differentiation, whereas allozymes do not.

Population structure revealed with mircrosatellites: Distinct large-scale geographic divergence (between populations from different geographic regions), local-scale differences (between populations from different rivers within a region), and ecological differentiation (between lake and river forms of chum salmon).

This research is supported in part by RAS grants "Molecular and Cell Biology" and "Biological Diversity" to LAZ.

Innovative approaches to assessing status of conservation units for Canada's Wild Salmon Policy

Carrie Holt, *Research Scientist, Pacific Biological Station, Fisheries and Oceans Canada*

The goal of Canada's Wild Salmon Policy (WSP) is to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada. To achieve that goal, the WSP requires that biological status be assessed for all geographically, ecologically, and genetically distinct populations, or Conservation Units (CUs). One component of that assessment is identifying quantifiable metrics of status and benchmarks along those metrics. The WSP is innovative, in part, because it is the first policy in Canada to prescribe a lower benchmark in status that ensures a buffer between that level and the level that would lead to the population being listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

This presentation describes our progress on assessing status and identifying benchmarks for the WSP. We propose a multi-criteria approach that uses information on current abundances, trends in abundance over time, distribution of spawners, and fishing mortality relative to stock productivity. That approach captures the multiple dimensions of population status that will be important to achieve WSP goals better than assessments based on abundances alone. We identify candidate benchmarks and evaluate them using a simulation model that estimates probabilities of recovery to a target and probabilities of extirpation.

Bayesian decision analysis for rebuilding a depleted salmon population and retrospective evaluations of assessment criteria for conservation status

Randall M. Peterman, *Professor and Canada Research Chair, Simon Fraser University*, **Lynsey R. Pestes, and Erin Porszt,** *School of Resource and Environmental Management, Simon Fraser University*, **Michael J. Bradford,** *Fisheries and Oceans Canada and Cooperative Resource Management Institute, Simon Fraser University,* **Chris C. Wood and James R. Irvine,** *Fisheries and Oceans Canada, Pacific Biological Station*, **and Nicholas K. Dulvy,** *Department of Biological Sciences, Simon Fraser University*

We used Bayesian decision analysis to evaluate recovery options for an endangered population of sockeye salmon in Cultus Lake (B.C., Canada) and to estimate trade-offs between recovery actions and economic revenue generated by harvesting other, more abundant co-migrating sockeye populations. We included uncertainty in an Allee effect and in deviations between targets and actual outcomes of management actions. Recovery objectives could be achieved with several harvesting guidelines. We will also show how much economic value of commercial harvests of co-migrating sockeye populations would be expected to decrease for a given increase in probability of recovery of the Cultus population. A separate research project retrospectively estimated the effectiveness of numerous criteria at correctly categorizing conservation status of sockeye salmon populations. We used historical data for 18 sockeye conservation units (CUs) in the Fraser River, B.C. to quantify how frequently conservation criteria would have been triggered (indicating a conservation concern), and how frequently the CU subsequently actually reached a state of concern. The widely used International Union for the Conservation of Nature (IUCN) criterion for percent decline in abundance over three generations did not perform well. It created fewer correct triggering events and more incorrect triggering events than criteria based on extent of decline from estimated historical baselines.

Building local economic and social-cultural ties to sustainable management

Greg Taylor, *Building local economic ties to sustainable management, Fisheries and Economic Development Advisor, Skeena Wild Conservation Trust*

First Nations in the Skeena watershed managed robust and sustainable salmon fisheries for thousands of years. However, in the last century, the marine mixed stock salmon fishery has caused overfishing of less productive stocks, thereby reducing biodiversity, ecosystem function and First Nation rights to fish. Numerous DFO reports, scientific articles, international bodies and commentaries have described the negative consequences of marine mixed stock salmon fisheries. Yet, problems persist because fisheries management continues to perceive that overfishing of less productive stocks is a necessary trade-off in order to generate socio-economic benefits.

The Skeena Watershed Selective Harvesters Association, Skeena Fisheries Commission and the Skeena Watershed Conservation Trust are working on several initiatives to promote a precautionary management regime and expand in-river selective fisheries. These initiatives include participation in advisory and multi-sectoral processes; advocating for stable annual allocations, certification and marketing of selective, fair-trade salmon, development of value-added salmon products, training in selectivity, fish handling and safety; and researching processing opportunities.

We contend that, within the context of a more precautionary management regime, expansion of the in-river selective fishery will provide significant economic and social-cultural benefits to northern communities, while at the same time reducing exploitation rates on less productive stocks.

Incentives and sustainable salmon fisheries management on Sakhalin Island to support a comprehensive salmon conservation initiative

Vladimir Smirnov, *Chairman, Smirnokhovsk Region Association of Cammercial Fisheries*

No abstract available.

Salmon monitoring approaches on Sakhalin Island to support a comprehensive salmon conservation initiative

Anatoly Semenchenko, *Monitoring Program Manager, Sakhalin Salmon Initiative Autonomous Noncommercial Organization*

Fast decline of conditions favorable for reproduction of different species of salmon in the Russian far east has been observed within the last several decades as a result of economic activities. The level of human impact on river ecosystems increases significantly after commercial logging, forest fires, mineral extraction, and during the laying of transregional oil and gas pipelines. As a result of all this activity, stocks of commercially valuable salmon species decline and the structure of fish communities changes. It is possible to use modern methodology such as the chemical analysis of spawning waters, hydrologic estimation of a river network, and remote sensing of geomorphologic structures in separate river basins using American software (e.g., NetMap) in order to track depth of changes occurring in salmon habitat.

Sakhalin Salmon Initiative project "Salmon Monitoring" has been launched in southern areas of Sakhalin on the rivers of Aniva Bay. In the next six years, it will be expanded to other ecoregions of Sakhalin Island. In the south of the island, pink salmon is one of the most valuable commercial species, and returns fluctuate in size significantly. Besides pink salmon, wild populations of chum, masu, white-spotted char, dolly varden, and Sakhalin taimen are of particular scientific interest. The six year monitoring program will allow estimation of the current condition of the key populations of salmon and their habitat, and also will inform major management objectives for the Sakhalin salmon fishery.

Importance of wild and hatchery-reared salmon to commercial pink and chum salmon stocks in the Sakhalin-Kuril region

Alexander M. Kaev, *Laboratory Head, Sakhalin Research Institute of Fisheries and Oceanography (SakhNIRO)*

The Sakhalin-Kuril Region is a critical area in Russia for Pacific salmon (pink and chum) hatchery rearing and catch. However, the contribution of wild and hatchery populations to commercial stocks remains unclear. This is an essential issue for planning further fisheries development.

Chum salmon: The program to improve chum salmon hatchery rearing has resulted in an increase in catch during the past ten years due mainly to increased survival of released fry. At present, the proportion of catch consisting of hatchery-reared stocks (about 90%) continues increasing even in spite of the improved state of some wild chum salmon populations.

Pink salmon: Statistical analysis indicated that decline or increase of pink salmon catch depended on changes in abundance of wild fish throughout the region (including in areas where hatchery fry composed as much as 40% of the population). At the same time, a trend of reduction in pink salmon escapement for spawning grounds that appeared in recent years is rather alarming.

Measures to maintain both pink and chum salmon fisheries must be developed in light of expected deterioration of marine salmon habitat. Further development of hatchery rearing may contribute to maintenance of the chum salmon fishery. However, maintenance of the pink salmon fishery requires improvement of spawning conditions.

Bringing the Future into Focus

The potential for building a pan-Pacific network of globally significant wild salmon ecosystems will be explored, including associated conservation strategies and actions. The concept intends to complement and add value to existing recovery, restoration, and management initiatives, using a special emphasis on protecting the best salmon ecosystems.

A process for establishing a network of salmon strongholds around the Pacific Rim

Gordon Reeves, *Research Biologist, Pacific Northwest Research Station, USDA Forest Service,* **Jeff Baumgartner,** *Wild Salmon Center*

Conservation organizations and government agencies around the north Pacific Ocean are expending tremendous efforts to conserve wild populations of salmonids, including establishment of areas where production and conservation of wild salmonids is emphasized. We used an optimization model, Marxan, to illustrate a process for identifying a potential network of freshwater strongholds based upon attributes such as representiveness, flexibility, irreplaceability, and complementarity and consideration of total abundance and number of species. Additionally, factors such as the presence of dams, hatcheries, and developed land were considered. We established sequential conservation goals based on the proportion of total abundance of salmonids in each ecoregion. The selection process was done in a step-wise manner. The foundation for the network was established by identifying catchments that are essential to conserving 80% of salmonid abundance in an ecoregion. Additional catchments were identified by setting progressively lower percentage goals to 50 and 30 percent. We believe that such a process has the potential to be the basis for development of a comprehensive Rim-wide network of strongholds that contributes to the long-term persistence and productivity of wild salmonids. Development of the final network will require a cooperative effort of the involved entities and the scientific community to establish the goals and objectives. Also, it will require consideration of factors such as climate change and environmental complexity.

Efficacy and selection of freshwater protected areas to conserve wild salmon

Jack Stanford, *Jessie M. Bierman Professor of Ecology and Director of the Flathead Lake Biological Station, University of Montana*

Marine protected areas show clear promise for long term protection of near shore assemblages of organisms, when accompanied by persistent, effective enforcement. The Wild Salmon Center is attempting to implement a similar strategy for a suite of salmon rivers of the North Pacific Rim with the main outcome idealized as sustaining a major portion of the production and biodiversity of wild salmon. My research group used remote sensing of riverine habitat to rank the intrinsic salmon productivity for 1200 rivers of the Rim. Rankings based on physical habitat values were relatively coherent with on the ground proxies of salmon productivity made by our Salmonid Rivers Observatory Network project. We related the remote sensing metrics to available stock-recruitment data with less success owing to unexplained variability in such estimates and very poor spatial coverage. The analysis also showed that rivers in the far north latitudes will be good salmon habitat as climate warms. But, available data strongly suggest that freshwater habitat per se is not a limiting factor for wild salmon, whereas harvest and competitive interactions in the ocean, especially related to cultured stocks, clearly are bottlenecks. A successful stronghold strategy for salmon rivers requires ongoing analyses of the effectiveness of protection and natural enhancement (greater spawning escapement) of the full array of stocks for each target river done in context with complex interactions between freshwater and ocean components of the salmon life history ecosystem. A reasonable hypothesis is that rivers with high biophysical complexity will be most resilient to oceanic and anthropogenic variation.

Use of spatially explicit models of Asian salmonids for their conservation

Michio Fukushima, *Researcher, National Institute for Environmental Studies*

Spatially explicit statistical models were used to assess the impact of dams and evaluate the efficacy of protected areas for two Asian salmonids, masu salmon *(Oncorhynchus masu)* and Sakhalin taimen *(Hucho perryi)* that predominantly inhabit rivers around the Sea of Japan. Generalized additive models were constructed to predict their occurrence probabilities throughout Hokkaido Island, Japan based on >7000 fish survey data collected over the last half century on the island. The models were then used to map the losses of the occurrence probabilities due to damming and the resulting habitat fragmentation. The same models were also used to rank the rivers and streams according to the average occurrence probabilities of the two salmonids. The comparison of the rank data between 32 protected river basins and the remaining river basins in Hokkaido revealed that masu salmon are adequately protected by the existing protected areas but that Sakhalin taimen are not protected. The spatially explicit models are an effective and efficient tool in management and conservation planning for commercially important or imperiled salmonid species such as masu salmon and Sakhalin taimen. Such models allow researchers and managers to visually grasp areas of impact, areas at risk if, for example, planned dams are constructed, and areas that need to be protected.

A Pacific Rim salmon conservation strategy

Guido Rahr, *Wild Salmon Center*

Guido will be giving an overview of the emerging network of wild salmon strongholds, emphasizing the work of partner organizations in the Pacific Rim countries. He will then discuss some strategies for accelerating this work, including the establishment of a virtual "learning network" of sites, employing common metrics for measuring success, piloting innovative approaches,and others.

Finally, Guido will discuss the need for the conservation science and conservation community to establish meaningful conservation design targets and goals to strive for in sites, regions and the entire North Pacific system to ensure the long term abundance and diversity of salmonids.