



HATCHERY VS. WILD SALMONID SYMPOSIUM

RESEARCH, MANAGEMENT, AND REFORM IN THE PACIFIC NORTHWEST

JANUARY 22-23, 2015
HILTON PORTLAND & EXECUTIVE TOWER

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HILTON PORTLAND & EXECUTIVE TOWER LAYOUT



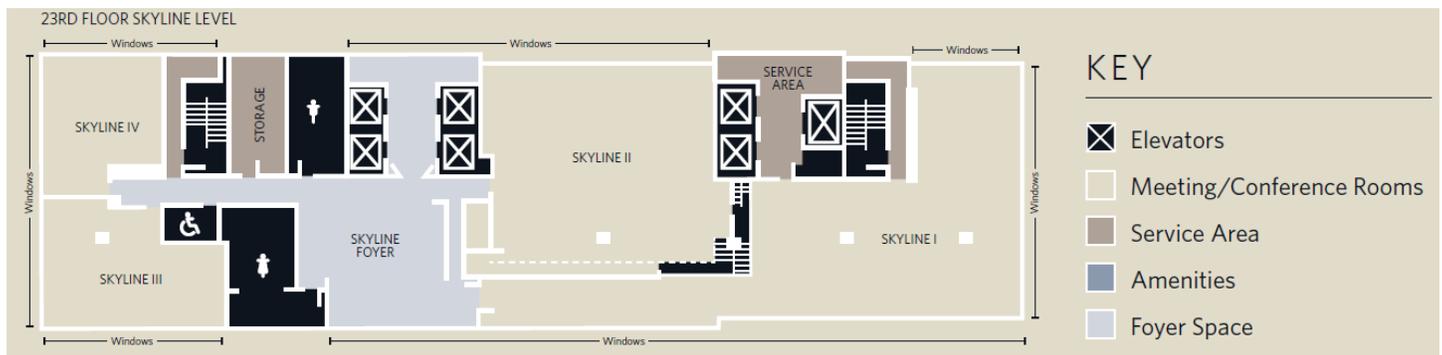
Symposium Venue

The Hilton Portland
 921 SW 6th Avenue
 Portland, Oregon 97204
 Ph: 503-226-1611

The Symposium will be held in the Pavilion Room at the Hilton Portland (left map). Registration will be held in the Plaza Foyer outside of the Pavilion Room.

Thursday Evening Reception

Join us in the Pavilion Plaza Foyer for the Thursday evening reception. The reception will include a complimentary beverages followed by a no-host bar, and appetizers. The reception is scheduled for 5 pm to 7 pm, but the room is reserved until 10 pm. Attendees may visit the Skyline II Room on the 23rd floor (bottom map) for a view of the city. Symposium attendees are encouraged to attend before enjoying dinner out in downtown Portland.



RESTAURANTS NEARBY THE HILTON PORTLAND & EXECUTIVE TOWER

Higgins Restaurant and Bar
 1239 SW Broadway
higginsportland.com

The Picnic House
 723 SW Salmon
picnicousepdx.com

Heathman Restaurant
 101 SW Broadway
heathmanrestaurantandbar.com

Flying Elephants Delicatessen
 812 SW park
elephantsdeli.com

Pastini Pastaria
 911 SW Taylor
pastini.com

Yard House
 888 SW 5th Avenue
yardhouse.com/OR/portland-restaurant

Rock Bottom Restaurant
 206 SW Morrison
rockbottom.com

Qdoba Mexican Grille
 505 SW Taylor
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Veggie Grill
 508 SW Taylor
veggiegrill.com

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UPCOMING ORAFS EVENT

WELCOME TO PORTLAND!

The Oregon Chapter of the American Fisheries Society invites you to experience the natural beauty of Oregon, as the American Fisheries Society (AFS) convenes its 145th Annual Meeting, August 16-20, 2015. Portland is an environmentally conscious and progressive city. In keeping with Portland's free-spirited way of life, as well as doing things a little differently than elsewhere, the 145th Annual Meeting will be theme-less. With a theme-less meeting, a diverse program will be available that will allow you to learn how freshwater and marine resources are managed, conserved, and restored globally.

Portland is known for its thriving downtown, outdoor activities and broad array of restaurants and food carts that contribute unsurpassed opportunities to meet and engage with fisheries professionals from around the world. We look forward to seeing you in Portland, the City of Roses!

For more information on the Portland meeting, please contact General Co-chairs Dave Ward (david.ward@hdrinc.com) or Neil Ward (neil.ward@qwconsult.com).



AMERICAN FISHERIES SOCIETY
PORTLAND
OREGON
145TH ANNUAL MEETING
AUGUST 16-20, 2015



2015 Hatchery vs. Wild Salmonid Symposium

SYMPOSIUM SCHEDULE

THURSDAY, JANUARY 22, 2015 (PAVILION ROOM)

700 am – 900 am	Registration in Pavilion Plaza Foyer
830 am – 835 am	Oregon Chapter AFS Executive Committee – Welcoming Remarks
835 am – 850 am	David L.G. Noakes, Oregon State University & Oregon Hatchery Research Center Key Note Address
	Session 1 - Hatchery Fish Performance and Genetics (Moderated by Ryan Couture – Oregon Department of Fish and Wildlife)
850 am – 910 am	Michael Blouin, Oregon State University An analysis of studies of relative reproductive success of early-generation hatchery salmon
910 am – 930 am	Barry Berejikian, NOAA Northwest Fisheries Science Center Selection on growth rate in hatchery steelhead depends on rearing practices
930 am – 950 am	Daniel Bingham, Rogue Biological Consultants Loss of genetic integrity in hatchery steelhead produced by juvenile-based broodstock and wild integration: conflicts in production and conservation goals
950 am – 1010 am	Christian Smith, U.S. Fish and Wildlife Service Genetic composition of the Warm Springs River Chinook salmon population maintained following eight generations of hatchery production
1010 am – 1030 am	Lance R. Clarke, Oregon Department of Fish and Wildlife Harvest and straying of two hatchery steelhead lines, one derived from the other by temporally selective broodstock collection
1030 am – 1050 am	Refreshment Break Registration in Pavilion Room Foyer
1050 am – 1110 am	Carl Schreck, Oregon State University and USGS Oregon Cooperative Research Unit Is juvenile migration phenotype established by recent stimuli or much earlier in life and can they be affected by hatchery practices?
1110 am – 1130 am	Cameron Sharpe, Oregon Department of Fish and Wildlife Performance of hatchery spring Chinook salmon released in the fall and spring
1130 am – 1150 am	Brian Beckman, NOAA Northwest Fisheries Science Center Variations in size, growth and survival of hatchery Columbia River Chinook salmon in the Northern California Current
1150 am – 1215 pm	Panel Discussion
1215 pm – 130 pm	Lunch on your own in Portland

Session 2 - Influence of Hatchery Fish on Wild Populations

(Moderated by Ian Tattam – Oregon Department of Fish and Wildlife)

- 130 pm – 150 pm** **Christine Kozfkay**, *Idaho Department of Fish and Game*
The use of hatchery fish to rebuild populations of Snake River Sockeye salmon in the Sawtooth Valley basin, Idaho
- 150 pm – 210 pm** **Peter Galbreath**, *Columbia River Inter-Tribal Fish Commission*
Use of hatchery stocks to reestablish natural populations of Upper Columbia River coho salmon
- 210 pm – 230 pm** **Ewann Berntson**, *NOAA Northwest Fisheries Science Center*
Reproductive success and phenotypic selection gradients in hatchery- and natural-origin Chinook salmon in Catherine Creek, Grande Ronde basin (Northeast Oregon)
- 230 pm – 250 pm** **Maureen Hess**, *Columbia River Inter-Tribal Fish Commission*
Supplementation with local, natural-origin broodstock may minimize negative fitness impacts in the wild
- 250 pm – 310 pm** **Tim Hoffnagle**, *Oregon Department of Fish and Wildlife*
Thirty-one years of the Imnaha River Chinook Salmon Supplementation Program: Is supplementation working?
- 310 pm – 330 pm** **Matt Falczy**, *Oregon Department of Fish and Wildlife*
Combining genetics and demographics in a viability model of hatchery-wild systems subject to environmental change
- 330 pm – 350 pm** **Refreshment Break**
Registration in Pavilion Room Foyer
- 350 pm – 410 pm** **Kathryn Kostow**, *Oregon Department of Fish and Wildlife*
A review of ecological risks of salmon and steelhead hatchery programs
- 410 pm – 430 pm** **Chris Tatara**, *NOAA Northwest Fisheries Science Center*
Intraspecific competition between hatchery and wild anadromous salmonids: rethinking hatchery practices to reduce ecological interactions
- 430 pm – 500 pm** **Panel Discussion**
- 500 pm** **Reception – Pavilion Plaza Foyer**

FRIDAY, JANUARY 23, 2015 (PAVILION ROOM)

700 am – 800 am	Registration in Pavilion Plaza Foyer
755 am – 800 am	Oregon Chapter AFS Executive Committee – Welcoming Remarks
	Session 3 - Managing Reality: Co-existing Wild and Hatchery Populations
	<i>(Moderated by Gary Vonderohe – Oregon Department of Fish and Wildlife)</i>
800 am – 820 am	Gabriel Temple , Washington Department of Fish and Wildlife Assessing and containing risks to indigenous fish taxa associated with salmon supplementation and reintroduction programs
820 am – 840 am	Jay Hesse , Nez Perce Tribe Conservation and consumption: Nez Perce Tribe duty and obligation
840 am – 900 am	Ed Bowles , Oregon Department of Fish and Wildlife Oregon's Coastal Plan: a walk on the wild (and hatchery) side
900 am – 920 am	Dave Fast , Yakama Nation Results after sixteen years of operation of an integrated spring Chinook hatchery on the Yakima River
920 am – 940 am	Peter Hassemer , Idaho Department of Fish and Game The evolution of Idaho's mitigation hatchery programs to conform to conservation and management of wild stocks
940 am – 1000 am	Panel Discussion
1000 am – 1020 am	Refreshment Break – Cabela's Gear Raffle
	Session 4 - Hatchery Reform: Where Do We Go From Here?
	<i>(Moderated by Gary Vonderohe – Oregon Department of Fish and Wildlife)</i>
1020 am – 1040 am	Doug Olson , U.S. Fish and Wildlife Service Hatchery reform and our Pacific Region National Fish Hatcheries
1040 am – 1100 am	Casey Baldwin , Colville Confederated Tribes The Chief Joseph Hatchery – a new hatchery designed and operated under Hatchery Reform Principles
1100 am – 1120 am	Brent Hall , Confederated Tribes of the Umatilla Indian Reservation Hatchery vs. Wild? It's not that simple - legal frameworks, hatchery reform and forgotten promises
1120 am – 1140 am	Brian Missildine , Washington Department of Fish and Wildlife Reform measures to minimize risk to wild steelhead populations from our hatchery steelhead programs in Puget Sound
1140 am – 1200 pm	Panel Discussion
1200 pm	Adjourn Meeting

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2015 Hatchery vs. Wild Salmonid Symposium

SYMPOSIUM ABSTRACTS

Session 1 - Hatchery Fish Performance and Genetics

An analysis of studies of relative reproductive success of early-generation hatchery salmon

Michael Blouin, *Oregon State University, Corvallis, Oregon*

We review studies on the reproductive success of fish in populations supplemented with hatchery-reared fish produced by local and predominantly wild-origin parents. Combining 49 estimates from six studies on four species, we found: (1) first-generation hatchery fish averaged only half the reproductive success of their wild-origin counterparts when spawning in the wild, and (2) all species show similar effects. If this reduced fitness is heritable, then even first-generation hatchery fish could decrease the fitness of wild populations. We review evidence for genetic versus environmental effects, and insights into possible mechanisms for the fitness decline. Finally, we also show that statistical power to detect differences in fitness is very low for sample sizes typical of these studies. These data suggest that reduced fitness of even first-generation hatchery fish is a general phenomenon. Future research should focus on determining the causes of those fitness reductions.

Selection on growth rate in hatchery steelhead depends on rearing practices

Barry Berejikian and **Chris Tatara**, *NOAA Northwest Fisheries Science Center, Manchester, Washington*

Fitness loss in steelhead trout has been demonstrated in a number of hatchery populations, including one population (Hood River) where a genetic (or cross-generational epigenetic) mechanism has been isolated. Mechanisms causing fitness loss in hatchery steelhead may include unintentional or relaxed breeding selection, or selection during early development and juvenile rearing or after release. All but a few hatchery steelhead programs rear and release yearling smolts, which is a year or more younger the modal age at smoltification in most natural populations. Yearling smolt programs may favor (select for) individuals that grow rapidly in the hatchery and have greater odds of migration and survival after release. We provide evidence that selection on body size in a yearling (S1) release hatchery program at the Winthrop National Fish Hatchery (WNFH) occurs to a greater degree than in a program that rears and releases juveniles to age-2 (S2) at the same hatchery. In most release years, a greater proportion of S1 steelhead failed to migrate downstream, and the effect was significantly correlated to fork length. In a controlled laboratory study, full-sib families were split and equal numbers allocated to a S1 and S2 rearing treatment. Seawater challenges conducted at age-1 and age-2 indicated significantly greater survival in the S2 treatment (99%) than in the S1 treatment (77%). Logistic regression analyses demonstrated a significant positive effect of body size on probability of survival. Preliminary analyses also indicate significant maternal effects on probability of surviving seawater challenges in the S1 treatment, and thus evidence for selection on maternal traits resulting from S1 rearing.

Loss of genetic integrity in hatchery steelhead produced by juvenile-based broodstock and wild integration: conflicts in production and conservation goals

Daniel M. Bingham¹, **Benjamin M. Kennedy**², **Kyle C. Hanson**², and **Christian T. Smith**²

¹*Rogue Biological Consultants, Vancouver, Washington*; ²*U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington*.

We examined whether a supplementation program for steelhead in southwestern Washington could produce hatchery fish that contained genetic characteristics of the endemic population from which it was derived and simultaneously meet a production goal. Hatchery fish were produced for three consecutive years by using broodstock comprised of endemic juveniles that were caught in the wild and raised to maturity, and then the program transitioned to an integrated broodstock comprised of wild and hatchery adults that returned to spawn. Importantly, some auxiliary conservation-based husbandry protocols were attempted (i.e., pairwise mating between males and females) but not always completed due to insufficient broodstock and conflict between production and conservation goals.

The hatchery met production goals in 6 of 9 years, but wild-type genetic integrity of hatchery fish was degraded every year. Specifically, we analyzed 10 microsatellites and observed a 60% reduction in the effective number of breeders in the hatchery (harmonic mean of hatchery, $N_b = 45$, compared with the wild, $N_b = 111$). Hatchery fish consequently displayed reduced genetic diversity and large temporal genetic divergence compared with wild counterparts. To ensure the benefit of conservation-based husbandry, spawning protocols should be based on scientific theory and be practical within the physical and biological constraints of the system. Finally, if conservation issues are considered to be the most important issue for hatchery propagation, then production goals may need to be forfeited.

Genetic composition of the Warm Springs River Chinook salmon population maintained following eight generations of hatchery production

Christian Smith¹, Rod French², Jens Lovtang³, David Hand⁴

¹U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington; ²Oregon Department of Fish and Wildlife, Mid-Columbia District, The Dalles, Oregon; ³Confederated Tribes of Warm Springs, Warm Springs, Oregon; ⁴U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington

Balancing the disparate objectives of fishery augmentation and conservation of an endemic population presents a substantial challenge. In the case of Warm Springs National Fish Hatchery (Warm Springs Hatchery), strategies for achieving both objectives included incorporation of natural fish into the hatchery broodstock and restricting proportions of hatchery fish on the spawning grounds. The hatchery has been more successful in implementing the latter, however, than the former. We analyzed seventy-six SNP markers in spring Chinook salmon collected from the Warm Springs River in 1976 to 1977 (prior to hatchery production) and 2001 to 2011 (post-hatchery) to examine whether the genetic characteristics of the endemic population had changed during that time. Pre- and post-hatchery collections clustered together when compared to Round Butte Hatchery (a nearby segregated program) and other Columbia River populations. Allele frequencies were similar in pre- and post-hatchery collections, but post-hatchery collections exhibited significantly lower heterozygosity (H_e). We observed some evidence of reduced effective size (N_e) and increased genetic drift in fish produced at Warm Springs Hatchery (relative to natural-origin fish), and even stronger evidence in fish produced at Round Butte Hatchery. We conclude that natural-origin fish returning to the Warm Springs River form a distinct group within the Interior Columbia Basin Spring-run lineage and have changed very little over the past eight generations. We further speculate that differences between hatchery- and natural- origin fish at Warm Springs Hatchery are expected to increase if hatchery operations remain static (little integration of natural-origin fish and incorporation of Round Butte Hatchery fish in broodstock).

Harvest and straying of two hatchery steelhead lines, one derived from the other by temporally selective broodstock collection

Lance R. Clarke¹, Michael W. Flesher¹, Shelby Van Sickle², William J. Knox³, and Richard W. Carmichael¹

¹Oregon Department of Fish and Wildlife, La Grande, Oregon; ²La Grande, Oregon; ³Deceased

Angling in October was used to selectively collect hatchery steelhead adults for broodstock to create a new hatchery line (hereafter the autumn line; AL). Because the AL broodstock returned to the Grande Ronde River basin of Northeast Oregon earlier than standard Wallowa Hatchery stock adults (hereafter SWS), which return from autumn through spring, adult progeny of the AL were expected to have an earlier return timing, which could reduce straying into cool tributary streams during warm summer months and provide greater contributions to autumn fisheries. Paired AL and SWS smolt releases occurred from 2005 to 2008. PIT tagged adult progeny from the AL were detected crossing Bonneville Dam on the lower Columbia River an average of 10 days earlier than SWS adults, and the return timing difference widened as the run progressed past upstream dams. Coded-wire tag recovery was used to compare smolt-to-adult survival (SAS) and straying. Across all years, SAS was not significantly different (AL = 1.84%, SWS = 1.80%). However, the AL strayed at a significantly higher rate (7.64%) compared to the SWS (5.01%). Due to their earlier return timing to the Grande Ronde River basin, creel surveys showed that nearly 55% of the AL adults were harvested from September through December, whereas 62.9% of the SWS were harvested in March and April. Therefore, continuation of the AL could alter monthly angling pressure, the fraction of steelhead in the river that are of hatchery origin, and angling impacts on the wild population. Creation of the AL improved fisheries but did not reduce straying. Selective breeding for run timing may be an appropriate tool for hatchery programs; however, to protect against adversely affecting the fitness of wild stocks we recommend removal of hatchery adults before they reach natural spawning areas.

Is juvenile migration phenotype established by recent stimuli or much earlier in life and can they be affected by hatchery practices?

Carl B. Schreck^{1,2}, E.J. Billman², J. Unrein², R. Chitwood², L.D. Whitman³, R.K. Schroeder⁴, C.S. Sharpe⁴, C. Kimmel⁵, N. McKibben⁵, B. Brignon⁶, A. Munakata⁷, and D.L.G. Noakes⁸

¹USGS Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, Oregon; ²Oregon State University, Corvallis, Oregon; ³U.S. Geological Survey, Oregon Department of Fish and Wildlife, Corvallis, Oregon; ⁴Oregon Department of Fish and Wildlife, Corvallis, Oregon; ⁵University of Oregon, Eugene, Oregon; ⁶U.S. Fish and Wildlife Service, Columbia River Fisheries Program, Vancouver, Washington; ⁷Sendai University, Sendai, Japan; ⁸Oregon Hatchery Research Center, Alsea, Oregon

Juvenile Chinook salmon *Oncorhynchus tshawytscha* in the Upper Willamette River, Oregon, USA display considerable variation in downstream-movement life history tactics. Fish reared in circular tanks self-sort into surface- and bottom-oriented groups starting just after *per os* feeding begins. Morphometric analysis suggests that the surface phenotype is similar in shape to wild fall migrants and parr from downstream sites. The benthic phenotype fish are similar to wild spring migrants and fish collected concurrently up-river. Bone structure analysis of the head suggests that these differences rest with the jaw. Plasma sodium, gill Na/K ATPase and boldness analyses also revealed early effects of rearing conditions. Behavioral tests found that minute (<0.5 °C) temperature decrease results in downstream movement by various species of anadromous salmonids. Similar downstream movement was displayed by surface-oriented laboratory Chinook in the fall (concurrent with timing of the fall outmigration of wild Chinook; bottom-oriented Chinook had significantly less movement at this time. We suggest that downstream movement of juveniles soon after emergence is associated with differentiation in the expression of life history variation. This contention is also supported by movement studies in large artificial streams and in a small tributary stream. Structure in rearing tanks also affects performance of bull trout. Fish reared with some simple structure had significantly larger brains, were more bold, and were better predators, like wild fish that were also tested, than fish reared in typical hatchery troughs.

Performance of hatchery spring Chinook salmon released in the fall and spring

Cameron S. Sharpe and David Hewlett, Oregon Department of Fish and Wildlife, Corvallis, Oregon

We review patterns of recovery of coded wire tags in adult and juvenile fish from Chinook salmon hatchery programs in the Upper Willamette River. The results suggest that two guiding principles for hatchery practices in the Upper Willamette – release fish that are ready to migrate and release fish that closely resemble wild fish – may sometimes be in conflict. Upper Willamette hatcheries release fish in the fall and spring and wild smolts emigrate in the fall and spring. However, hatchery fish released in the fall may pose additional genetic and ecological risks to wild fish compared to hatchery fish released in the spring.

Variations in size, growth and survival of hatchery Columbia River Chinook salmon in the Northern California Current

Brian R Beckman¹, Larissa Rohrbach^{1,2}, David Teel¹

¹Northwest Fisheries Science Center, National Marine Fisheries Service, 2725 Montlake Blvd E., Seattle, Washington 98112; ²School of Aquatic and Fisheries Science, University of Washington, Seattle, Washington

No matter what sub-basin, tributary or hatchery a smolt emigrates from, all successful Columbia River smolts initiate marine residence in the waters just off Astoria, Oregon. Individuals from every population and stock may inter-mingle and perhaps interact in this area. There is increasingly clear evidence that variable ocean conditions are directly responsible for large-scale variation in the return of adult Chinook salmon to the Columbia River. There is also accumulating evidence that variable marine mortality occurs soon after smolts enter the ocean. Finally, inter-annual variation in growth of smolts in the ocean is correlated with adult returns. However, it is not yet clear if and/or how differences in size and growth among smolts in the ocean may subsequently affect differential survival. In this talk we will present data showing differences in size and growth among yearling hatchery Chinook salmon smolts sampled off the Oregon/Washington Coast. We will also present data suggesting that relations between size and growth vary with ocean conditions. Together, these suggest that growth may be food limited in the ocean in some years and that smolts may vary in their ability to exploit food resources across years. The implications of these findings for hatchery rearing strategies and hatchery vs. wild interactions in the ocean will be discussed.

Session 2 - Influence of Hatchery Fish on Wild Populations

The use of hatchery fish to rebuild populations of Snake River sockeye salmon in the Sawtooth Valley basin, Idaho

Christine Kozfkay, *Idaho Department of Fish and Game, Eagle, Idaho*

The Snake River Sockeye salmon population was listed as endangered under the Endangered Species Act in 1991 when no fish returned the prior year. The conservation hatchery program was initiated, just prior to listing, with the collection and spawning of the four wild adults that returned in 1991. The immediate goals of the conservation program were to avoid population extinction using captive broodstock technology, conserve population genetic diversity and fitness, and increase the numbers of individuals in the population with future plans to recover and de-list the population and provide sport and treaty harvest. The captive broodstock acts as a live gene bank of the founding population, rearing multiple age classes of fish to maturity in captivity. The fish not utilized within the captive broodstock program are released into the natural environment under a variety of release options including: 1) eyed-egg releases to lake incubator boxes, 2) pre-smolt releases direct to the lakes, 3) smolt releases to outlet streams and to the upper Salmon River, and 4) pre-spawn adult releases direct to the lakes. Generally, the pre-smolts and smolts are marked with different tags or clips but tags can shed and there was no way to differentiate natural fish from those returning from an eyed-egg release strategy. Using a suite of microsatellite loci, every fish in the program has been parentage-based tagged and we can now determine the contribution of each release strategy to determine the best direction to re-build the wild component and recover Snake River sockeye salmon.

Use of hatchery stocks to reestablish natural populations of Upper Columbia River coho salmon

Peter F. Galbreath¹, Michael A. Bisbee, Jr.², Cory M. Kamphaus³ and Todd H. Newsome⁴

¹*Columbia River Inter-Tribal Fish Commission, Portland, Oregon*; ²*Nez Perce Tribe, Lapwai, Idaho*; ³*Yakama Nation, Peshastin, Washington*; ⁴*Yakama Nation, Toppenish, Washington*

Abundance of Pacific Northwest salmonids has been significantly reduced due to effects of agricultural development, timber harvest, mining, dam construction, urbanization, and overharvest. In some cases, however, populations were extirpated. The Columbia River treaty tribes have played a leading role in promotion and management of efforts to reintroduce several extinct stocks, including programs to reestablish coho salmon in the Yakima, Wenatchee, Methow, and Clearwater rivers. The programs were initiated in the late 1990s, with annual releases of juveniles from composite lower river hatchery stocks, typically following acclimation at available sites. Mature adults from these releases returned to their respective subbasins, with some successfully engaging in natural spawning. Returns have grown dramatically and each program has transitioned to collecting broodstock from among the returning adults; stocking with juveniles from the lower river hatcheries has ceased. Natural spawning is occurring over a progressively expanding range, aided in part by addition of release sites in upper basin areas and tributaries. As the portion of natural origin fish builds, these fish will be collected for use as broodstock in lieu of hatchery origin fish. The out-of-basin stocks used for these reintroductions had undergone 15+ generations of segregated hatchery rearing. Despite the magnitude of domestication that may have accrued, these stocks demonstrated that they retained sufficient genotypic and phenotypic potential to initiate new natural populations. Additionally, natural selective forces are no doubt acting to further reverse some of the negative domestication effects. As promising as initial results appear, however, it is also clear that growth of these nascent populations, as is restoration of other depressed extant populations, is constrained by many of the same habitat and hydrosystem issues that originally drove the populations to low abundance. Addressing these latter issues remains the primary roadblock to restoration of Columbia River salmonid populations to naturally abundant levels.

Reproductive success and phenotypic selection gradients in hatchery- and natural-origin Chinook salmon in Catherine Creek, Grande Ronde basin (Northeast Oregon)

Ewann Berntson¹, Eric Ward² and Paul Moran²

¹NOAA Northwest Fisheries Science Center, Port Orchard, Washington; ²NOAA Northwest Fisheries Science Center, Seattle, Washington

The relative reproductive success (RRS) of hatchery- and natural-origin fish in salmon supplementation programs has been shown to vary among species and locations. The reasons for this variation, however, are not entirely clear. We used pedigree analysis to measure RRS of hatchery and natural Chinook salmon spawning in Catherine Creek (Grande Ronde River), evaluated at multiple life stages: parr, migrants, and returning adults. Jack males and precocious parr both contribute to reproduction in this system, and were included in the analysis. The resulting pedigrees allowed us to compare RRS as well as differences in ecological characteristics that might be correlated with RRS: age and timing of smolt migration, return timing, size and age at return, spawning location, number of mates, number of offspring produced, etc. We observed similar reproductive success (RS) for adult-to-juvenile comparisons, but reduced RS when comparing adult-to-adult results for hatchery and wild individuals. We will continue monitoring these systems to document the genetic and demographic effects of supplementation and to better understand the drivers of differential reproductive success among families and hatchery-origin versus natural parents.

Supplementation with local, natural-origin broodstock may minimize negative fitness impacts in the wild

Maureen A. Hess¹, Craig Rabe², Jason Vogel², Doug Nelson², Shawn R. Narum¹

¹Columbia River Inter-Tribal Fish Commission, Hagerman Genetics Lab, Hagerman, Idaho; ²Nez Perce Tribe, Lapwai, Idaho

While supportive breeding programs strive to minimize negative genetic impacts to populations, case studies have found that certain programs can cause reduced fitness of wild fish. However, initial results from a supportive breeding program for Chinook salmon in Johnson Creek, Idaho, have shown minimal genetic effects to the wild population. These results are believed to be due to reduced potential for domestication selection in the hatchery environment since only natural-origin fish are used as broodstock each year. To further investigate relative reproductive success (RRS) of ongoing supplementation in this system, additional pedigrees of both natural and hatchery-origin fish from five broodyears were tracked over two generations with molecular markers. Results with all individuals taken into account show that hatchery-reared females had no difference in fitness relative to natural-origin females (overall RRS = 1.03, $p = 0.55$), but hatchery-reared males had lower fitness than their natural-origin counterparts (overall RRS = 0.84, $p = 0.04$; jack male RRS = 0.91, $p = 0.05$). Since individuals that do not produce returning adult offspring have no direct genetic effect on the population, we also compared RRS between the hatchery and natural-origin fish that contributed at least one offspring to the next generation and found that RRS was not significantly different for either sex (female RRS = 1.05, $p = 0.99$; male RRS = 0.96, $p = 0.79$; jack male RRS = 1.24, $p = 0.35$). Additionally, RRS of hatchery-reared fish (H) that mated with natural-origin fish (HxN matings) were equivalent (RRS = 1.00, $p = 0.71$) to those between two natural fish (NxN), with HxH matings having lower overall RRS of 0.85 that was not statistically significant ($p = 0.43$). Results suggest that supplementation with 100% local, natural-origin broodstock may be a practice that can successfully boost population size with minimal negative genetic impacts to wild populations.

Thirty-one years of the Imnaha River Chinook Salmon Supplementation Program: Is supplementation working?

Timothy L. Hoffnagle and Richard W. Carmichael, Oregon Department of Fish and Wildlife, La Grande, Oregon

Imnaha River Chinook salmon *Oncorhynchus tshawytscha* of Northeast Oregon are a unique spring/summer race that migrates and matures later than other Snake River populations in Oregon. The Imnaha River Chinook Salmon Supplementation Program has been operating since 1982, with annual means of 170 adults spawned, 267,997 smolts released, and 1,674 hatchery adults returning to the Imnaha River. We compared smolt and adult characteristics between hatchery and natural Imnaha River Chinook salmon to determine whether the Supplementation Program has been successful in accomplishing its life history goals. We also compared abundance and productivity of Chinook salmon in the Imnaha River with similar but unsupplemented Snake River Basin populations to evaluate whether abundance and productivity of the Imnaha River population have increased above what might have been expected without supplementation. We found that hatchery smolts are larger than natural smolts and that they return at a younger age and run and

spawn later in the spawn season than natural adults. Although there is complete overlap in spawning distribution, hatchery adults tend to spawn lower in the system and near the acclimation site, whereas natural salmon spawn further upstream. The hatchery recruit:spawner ratio is nine times that of naturally-spawning salmon, resulting in a substantial increase in total number of spawners in the Imnaha River. However, despite these large numbers of hatchery salmon spawning in nature, natural abundance has not increased and recruits:spawner has decreased relative to most of the unsupplemented streams. Mean recruit:spawner ratio for natural salmon has exceeded replacement for only 8 of 27 brood years since beginning supplementation, whereas productivity exceeded replacement for 19 of 33 years immediately prior to supplementation. It seems to be time to substantially modify the Imnaha River Chinook Salmon Supplementation Program, with changes in weir management, broodstock collection, hatchery rearing, and/or smolt release strategies.

Combining genetics and demographics in a viability model of hatchery-wild systems subject to environmental change

Matt Falcy, *Oregon Department of Fish and Wildlife, Corvallis, Oregon*

Hatchery-reared and naturally-produced (“wild”) salmonids experience different selective pressures. Rates of interbreeding between these two groups constrain adaptation to the natural environment. The processes affecting hatchery-wild dynamics have been studied by researchers interested in niche evolution of source-sink systems. I used an individual-based model originating from the theory of niche evolution to explore the effects of different proportions of hatchery fish spawning in the wild and wild fish spawned in hatcheries on long-term adaptation and persistence. The model uses a multi-locus quantitative trait to determine demographic performance of individuals, and relaxes assumptions made in previous continuous-state analytical models. I simulate change in the optimal phenotype of individuals spawning in the wild (i.e., environmental change) and record the persistence of wild-born individuals under different rates of interbreeding with hatchery fish, both in the hatchery and in the wild. Different probabilities of persistence were obtained from the same level of a *Proportionate Natural Influence* (PNI), suggesting that PNI alone does not predict persistence under certain conditions. Results are sensitive to rules about “mining” wild fish broodstock at low abundances, further suggesting a need to optimize the take of broodstock through time as a function of wild spawner abundance.

A review of ecological risks of salmon and steelhead hatchery programs

Kathryn Kostow, *Oregon Department of Fish and Wildlife, Clackamas, Oregon*

State and federal agencies in the Pacific Northwest annually release millions of hatchery salmon and steelhead into public waters. These hatchery programs can pose genetic and ecological risks to wild fish populations. Ecological risks occur when the presence of hatchery fish affects how wild fish interact with their environment or with other species and may affect whole species assemblages. Factors that contribute to ecological risks include the relative abundance of hatchery and wild fish in natural production areas, hatchery programs that increase density-dependent mortality, residual hatchery fish, some physical advantages that hatchery fish can have over wild fish, and life history characteristics that may make some species especially vulnerable to the effects of ecological risks. Many of these risk factors can be reduced by management strategies that lower the level of interactions between hatchery and wild fish. This presentation will review some of the factors contributing to ecological risks, and some strategies and guiding principles for reducing the risks.

Intraspecific competition between hatchery and wild anadromous salmonids: rethinking hatchery practices to reduce ecological interactions

Chris Tatara, *Barry Berejikian, NOAA Northwest Fisheries Science Center, Manchester, Washington*

Ecological interactions between hatchery and wild anadromous salmonids are of concern in the management and recovery of imperiled salmon and steelhead populations. Many studies have described the impact of hatchery and wild fish interactions and the factors affecting the likelihood of occurrence and the magnitude of effect. Although numerous studies have inferred density-dependent competition effects from the release of hatchery fish, few studies have provided data on the relative competitive ability of hatchery and wild fish. We reviewed published studies implementing substitutive experimental designs to test the relative intraspecific competitive abilities of hatchery and wild anadromous salmonids. Wild and hatchery fish generally exhibit similar competitive abilities measured by aggressive behavior, growth, and survival. Feeding behavior studies indicate a slightly greater competitive advantage for hatchery fish.

The lessons learned about ecological interactions between hatchery and wild salmonids from previous studies can inform hatchery management to reduce the likelihood of their occurrence. An example is the Winthrop National Fish Hatchery (WNFH), located on the Methow River, WA. The WNFH is transitioning from a yearling steelhead smolt program (S1) sourced from broodstock collected in the Columbia River to a local broodstock collected from the Methow River. The late spawn timing of natural local broodstock required a switch to producing two year old steelhead smolts (S2). Data from five release years indicates that the S2 program has several advantages that can reduce ecological interactions between hatchery and wild fish beyond reducing potential for genetic effects from hatchery introgression. Survival of S2 hatchery steelhead was greater or equal to S1 steelhead in 4 of 5 release years. Outmigration travel time of S2 smolts was faster than S1 smolts in all 5 release years. Size selection against small nonmigrant steelhead was more prevalent in the S1 program. Fewer immature male S2 steelhead were produced than male S1 steelhead in 2 of 4 release years. Indices of residualism indicated that S2 and S1 steelhead residualize at a similar rate. Average size at release explained significant variation in many of these performance measures and this relationship may be useful in managing to reduce ecological interaction between hatchery and wild salmonids.

Session 3 - Managing Reality: Co-existing Wild and Hatchery Populations

Assessing and containing risks to indigenous fish taxa associated with salmon supplementation and re-introduction programs

Gabriel Temple, *Washington Department of Fish and Wildlife, Olympia, Washington*

Persistent declines in salmon and steelhead population numbers throughout the Columbia River region has propagated the establishment and/or continued operation of several artificial production programs intended to facilitate recovery of these populations. Recent reviews and recommendations provided by the Hatchery Scientific Review Group (HSRG) for integrated and conservation hatchery programs throughout the Columbia Basin include many ideals of ecosystem based management: one being that hatchery practices should minimize adverse ecological interactions between hatchery and natural origin fish, and another to minimize effects of hatchery facilities on the ecosystem. We interpret these recommendations to include that hatchery practices should not inadvertently impact other fish taxa during their operation. Monitoring and managing risks to species that are not the target of enhancement should be an important consideration when judging the success of artificial production programs. In this case study, we monitor and evaluate the status of indigenous fish taxa during the operation of a Spring Chinook salmon supplementation program, and coho salmon reintroduction program that began in the mid-1990s in the Yakima River, Washington. Our experience suggests that rigorous pre-implementation planning coupled with cost effective risk containment monitoring can be adopted to provide one method to evaluate salmon and steelhead artificial production programs in an ecosystem context.

Conservation and consumption: Nez Perce Tribe duty and obligation

Jay Hesse, *Nez Perce Tribe*

Respecting and caring for (managing) salmon is a cultural cornerstone for Pacific Northwest Native Americans, including the Nimiipuu (Nez Perce Tribe). The relationship between salmon and tribes is so strong that tribal leaders were careful to reserve the right to take fish at all usual and accustomed places when negotiating the treaties of 1855 with the United States. Human actions have, and continue to, alter the Columbia River ecosystem that once supported incredibly abundant and diverse returns of salmon – drastically impacting the tribes. The tribal treaty right to harvest salmon at all usual and accustomed fishing places is an empty promise if there are no fish to catch. As salmon populations continued to decline, hatcheries that were constructed to mitigate for impacts of human development (dam construction and habitat destruction) and provide fish for harvest have evolved to meet both conservation and consumption objectives. Action steps the Nez Perce Tribe, in conjunction with co-managers, have taken to achieve these objectives include implementing sliding scales that balance hatchery and harvest actions relative to adult return sizes. Hatchery origin fish contribution to natural origin production is increased at low natural-origin returns levels and decreased as natural origin run size increases. Likewise, harvest rates (including natural-origin retention) are adjusted relative to natural-origin run size. We should not expect, however, that implementing sliding scales and other best hatchery management principles will single-handedly recover salmon. The Snake River is home to spring/summer Chinook salmon populations, which inhabit pristine spawning and early rearing habitat and are void of hatchery program influences yet are below minimum abundance thresholds and not able to support meaningful harvest opportunities. With the reality of continued human impacts to “natural” ecosystems and ongoing hatchery production to mitigate those impacts, is it possible

to move beyond the conservation and consumption balance toward recovery? We believe the restoration of natural-origin Snake River fall Chinook to a 10 year geometric mean abundance of over 8,000 (nearly 3 times NOAA's minimum abundance criteria) demonstrates that there is hope. The Tribe's expectations remain fixed on achieving generationally sustainable broad sense recovery, in a manner that achieves conservation and consumption. However, the existence of divergent expectations and legal mandates begs the question "how good is good enough"? The answer will rely on input from science, policy, and legal perspectives.

Oregon's Coastal Plan: A walk on the wild (and hatchery) side

Ed Bowles, *Oregon Department of Fish and Wildlife*

Oregon's coastal watersheds have numerous healthy wild salmon and steelhead populations, many of which support robust fisheries. This characteristic is somewhat unique in the contiguous United States. Oregon also maintains numerous hatchery programs that augment and diversify coastal fisheries. These wild and hatchery fisheries are vital to coastal and inland economies and culture. Oregon's Native Fish Conservation Policy requires establishing and maintaining a platform of conservation that sustains healthy wild native species, upon which hatchery and wild fisheries are provided consistent with this conservation platform. This policy is being implemented for much of Oregon's coast through the Coastal Multi-Species Conservation and Management Plan (Coastal Plan), which was developed through a comprehensive science and stakeholder process and recently adopted into law by the Oregon Fish and Wildlife Commission (June 2014). The Coastal Plan assessed the status of wild populations; developed strategies to shift at-risk populations to viable status and further enhance existing viable wild populations; established a portfolio of wild and hatchery fish emphasis areas; and solidified a research, monitoring and evaluation program to track implementation, gauge success and provide feedback for adaptive management. Successful implementation of the Coastal Plan will ensure conservation of wild fish species and their habitats and provide a robust and diverse blend of wild and hatchery supported fisheries. Oregon believes this management approach allows for responsible conservation of wild populations while also providing successful fisheries based on both wild and hatchery fish.

Results after sixteen years of operation of an integrated spring Chinook hatchery on the Yakima River

David Fast, *Yakama Nation*

The Cle Elum Supplementation and Research Facility in the Yakima River Basin (Washington State, USA) is an integrated spring Chinook salmon *Oncorhynchus tshawytscha* hatchery program designed to test whether artificial propagation can increase natural production and harvest opportunities while keeping ecological and genetic impacts within acceptable limits. The first wild broodstock were collected in 1997 and age-4 adults have returned to the Yakima River since 2001. An unsupplemented population in the adjacent Naches watershed provides a reference for evaluating environmental influences. The program has been comprehensively monitored from inception. Results indicate that supplementation increased harvest, redd counts, and spatial distribution of spawners; natural-origin returns were maintained; straying to non-target systems was negligible; natural origin females had slightly higher breeding success (production of surviving fry) in an artificial spawning channel, while behavior and breeding success of natural- and hatchery-origin males were similar; hatchery-origin fish showed differences in morphometric and life history traits; high rates of hatchery age-2 (mini-jack) production were reported but observed proportions of outmigrating juvenile and adult (ages 4 and 5) returning males were comparable for hatchery and natural-origin fish; hatchery smolts did not affect levels of pathogens in natural smolts; and, ecological interactions attributed to the program were within adopted guidelines. Additional study is required to assess long term impacts to natural production and productivity.

The evolution of Idaho's mitigation hatchery programs to conform to conservation and management of wild stocks

Peter Hassemer, *Idaho Department of Fish and Game, Boise, Idaho*

The Idaho Department of Fish and Game's (IDFG) long-range goal of its anadromous fish program is to recover and preserve Idaho's salmon and steelhead runs to provide benefits for all users. IDFG emphasizes protecting and maintaining populations of wild, native stocks of salmon and steelhead. Impacts from the development of the hydrosystem in the Snake River resulted in the establishment of large mitigation hatchery programs on what was once a wild fish-only landscape. For nearly the past two decades, the mitigation hatcheries have provided the only anadromous salmon and steelhead fishing opportunities in Idaho. Over the last decade the management of hatchery programs has changed substantially to support the dual objectives of protecting wild fish and meeting hatchery fish return objectives to support fisheries. Idaho has long-managed large geographic areas for wild fish only by not introducing

hatchery fish into those areas. New theories and technologies are being employed in managing the hatchery programs to improve the management of both the wild and hatchery fish resources. The talk will review the evolution of management for both the wild fish resources and the mitigation hatchery programs.

Session 4 - Hatchery Reform: Where Do We Go From Here?

Hatchery reform and our Pacific Region National Fish Hatcheries

Doug Olson, *U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington*

Conflicts between harvest goals and conservation goals have raised questions regarding the benefits and risks of hatcheries. To address these conflicts and to address the future role of our Pacific Region hatcheries, the U.S. Fish and Wildlife Service completed a review of 24 federal hatcheries, including fifteen National Fish Hatcheries and nine state-operated hatcheries administered through the Lower Snake River Compensation Plan. The reviews and reports for 53 individual programs took place from 2005 through 2011, were modeled after the Hatchery Science Review Group process, and culminated with a final report in 2013 on Region-wide Issues, Guidelines and Recommendations. Our Region-wide final report identified 17 issues surrounding hatchery program management, protocols and procedures, data management, and research; also included were a suite of 27 Best Management Practices. The concepts of hatchery reform can be described as strategic hatchery management and must be integrated with habitat conservation. The goal of Strategic Habitat Conservation (and Strategic Hatchery Management) is to make natural resource management agencies more efficient and transparent, thereby making them more credible and wide-reaching in effect. The principles of Strategic Hatchery Management and the challenges of implementing hatchery reform will be addressed. The developing role of conservation hatcheries, new technologies such as dual drain recirculating aquaculture systems, and reintroductions of fish into historically occupied habitats will also be touched on.

The Chief Joseph Hatchery - A new hatchery designed and operated under Hatchery Reform Principles

Casey Baldwin, *Colville Confederated Tribes, Birch Coulee Dam, Washington*

The Chief Joseph Hatchery (CJH) is the fourth hatchery obligated under the Grand Coulee Dam/Dry Falls project. Leavenworth, Entiat, and Winthrop National Fish Hatcheries were built and operated as mitigation for salmon blockage at Grand Coulee Dam since the 1940s, but the fourth hatchery was not built and the obligation was nearly forgotten. Planning of the hatchery began in 2001, and it received its first broodstock in 2013. The CJH design, operation and monitoring are structured under integrated recommendations from the Congressional Hatchery Reform Project and recommendations from the Hatchery Science Review Group since planning and design began. A science-based and adaptive management approach was institutionalized at the first Steering Committee meeting. The hatchery was reviewed under the Northwest Power and Conservation Council's (NPCC's) 3-Step Master Plan process and from the Independent Scientific Review Panel. Accordingly, the project has well-defined objectives; operations, data collection protocols and analytical and reporting processes that span fish culture and research activities. Integration with the other H's (habitat, hydro-system, and particularly harvest) was key in planning and implementation of the program. Selective removal of hatchery fish and the release of most natural origin fish in terminal fisheries are considered critical to the long-term viability of the population.

The primary objective of the CJH program is to meet trust obligations to the Colville Confederated Tribes for ceremony, subsistence, health and cultural purposes in a manner consistent with conservation of the natural fish populations. However, the CJH will also increase harvest opportunity for all anglers throughout the Columbia River, estuary, and ocean. Additionally, the Colville Tribes and other salmon co-managers have worked with the mid-Columbia Public Utility Districts to meet some of their hydro-system mitigation through hatchery production at CJH. The program is implemented in a manner that restores the abundance and life history characteristics of the historical Okanogan River population of naturally-spawning salmon. At full program the facility rears up to 2 million summer/fall Chinook and 900,000 spring Chinook. The summer/fall Chinook program has an integrated component for conservation and harvest purposes that meets high standards for natural origin fish influence on the genetic structure of the combined natural and hatchery population. If the natural population cannot support the integrated hatchery program in a given year, then hatchery production will be reduced or eliminated to minimize effects to the natural origin spawners. The segregated program is a "stepping stone" program, using only first generation returns from the integrated program to provide increased harvest opportunity for all user groups. The Spring Chinook program also has two components, a segregated program at CJH and a reintroduction program in the Okanogan River. The segregated program originates from unlisted Leavenworth stock spring Chinook. The reintroduction program

utilizes within-ESU origin spring Chinook from the Methow River under the ESA 10(j) “non-essential experimental” population designation. Research, monitoring and evaluation and data analysis in the natural and hatchery environment are coupled with run forecasts and presented at an annual program review (APR) designed to adaptively manage the program.

Hatchery vs. Wild? It's not that simple - legal frameworks, hatchery reform and forgotten promises

Brent Hall, *Confederated Tribes of the Umatilla Indian Reservation, Office of Legal Counsel, Pendleton, Oregon*

The majority of presentations at this conference will examine issues related to effects of hatchery rearing on natural productivity of salmonids, from a biologist's perspective. Understanding these interactions between hatchery fish and those reared in the wild is indeed a key piece to the puzzle of how to rebuild listed populations. Often lost in this scientific debate about these interactions and effects, however, is the existence of the additional puzzle of how best to manage regional fisheries, for which there is a legal framework that influences or mandates hatchery production, and the legal requirements with which hatchery operations must comply. This presentation will examine the tension between the scientific rationale for hatchery reform efforts and the associated legal framework, including Treaty requirements, Congressionally-mandated mitigation, the Endangered Species Act, and federal regulations.

Reform measures to minimize risk to wild steelhead populations from our hatchery steelhead programs in Puget Sound

Brian Missildine, *Washington Department of Fish and Wildlife, Olympia, Washington*

The co-managers have implemented substantial additional risk reduction measures for early winter hatchery steelhead programs since the hatchery and genetics management plans (HGMPs) were first submitted in 2004. The risk reduction measures were developed around the principles and recommendations of the co-managers' Resource Management Plans. Across the Puget Sound Distinct Population Segment (DPS), these risk reduction measures included a >50% reduction in hatchery releases of early winter steelhead; >65% reduction in release locations; elimination of cross-basin transfers, off-station releases, adult recycling, and fry releases into anadromous waters; volitional smolt releases to minimize natural origin fish interactions; hatchery broodstock collection by January 31st to enhance separation between hatchery and natural origin fish; establishment of a network of wild stock gene banks; and genetic monitoring of hatchery strays to natural spawning areas. We have developed a monitoring plan that will compare baseline introgression (old practices) to current (new practices) and future introgression rates to determine effectiveness of our risk reduction measures.



2015 Hatchery vs. Wild Salmonid Symposium

SYMPOSIUM SPEAKER BIOGRAPHIES



DAVID L. G. NOAKES

Professor & Senior Scientist, Fisheries & Wildlife Department and Oregon Hatchery Research Center, Oregon State University Corvallis, Oregon – David.Noakes@oregonstate.edu

Since 2005, David has been a Professor and Senior Scientist in the Fisheries and Wildlife Department and Oregon Hatchery Research Center, Oregon State University. Prior to his current position, he was Assistant, Associate, Full Professor and Acting Chair, Zoology. David has also served as Director of the Axelrod Institute of Ichthyology, University of Guelph, Canada.



MICHAEL BLOUIN

Oregon State University, Department of Zoology, Corvallis, Oregon – blouinm@science.oregonstate.edu

Michael Blouin completed his Ph.D. training at Florida State University, where he studied the genetics of growth and development in tree frogs. He followed his PhD with post-doctoral work at the University of Florida, where he evaluated population genetics of parasitic nematodes. Mike has been at OSU for 19 years. His current areas of interest include how fish adapt to hatcheries, and genetic mapping of snails to identify genes make them resistant to parasitic trematodes.



BARRY BEREJIKIAN

NOAA Northwest Fisheries Science Center, Behavioral Ecology, Seattle, Washington - Barry.Berejikian@noaa.gov

Barry Berejikian received his Ph.D. from the University of Washington in 1995. Since that time he has worked for NOAA's Northwest Fisheries Science Center at the Manchester Research Station, where he currently leads the Behavioral Ecology Team's research efforts. His team focuses on understanding the genetic and environmental bases of behavioral differences between wild and hatchery salmon, steelhead and marine fish. His team has completed studies of reproduction, sexual selection, competition, predation, feeding and migratory behavior, and evaluations of conservation hatchery programs.



DANIEL BINGHAM

Rogue Biological Consultants, Vancouver, Washington - bingham@roguebio.com

Dan Bingham completed his graduate training at the University of Montana where he was co-advised by Fred Allendorf and Robb Leary. Prior to starting Rogue Biological Consultants, Dan was employed with several state and federal agencies where he completed genetic studies on native and introduced trout in the Columbia River and Missouri River drainages, and managed several genetics-based projects on steelhead, salmon, and trout. He founded Rogue Biological Consultants, a genetics-based consulting firm that works with various government agencies, tribes, and power providers in the Pacific Northwest.



CHRISTIAN SMITH

U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington – christian_smith@fws.gov

Christian Smith has a Ph.D. in biology from the University of Victoria, where he studied salmon and sturgeon genetics in Ben Koop's Laboratory from 1996-2002. After graduate school, he worked as a geneticist for the Alaska Department of Fish and Game for 4 years, and then for the U.S. Fish and Wildlife Service for the past 8 years. He is presently serving as the Regional Geneticist for the USFWS Pacific Region.



LANCE R. CLARKE

Oregon Department of Fish and Wildlife and Eastern Oregon University, La Grande, Oregon – Lance.R.Clarke@state.or.us

Lance R. Clarke has spent the past seven years leading two projects focused on the monitoring and evaluation of ODFW hatchery salmon and steelhead programs in Northeast Oregon. This work includes studies to improve survival, reduce straying, and reduce early male maturation of hatchery fish. He completed his undergraduate coursework at Colorado State University and he has a M.S. and Ph.D. from the University of Idaho.



CARL SCHRECK

Oregon State University - Fisheries and Wildlife, USGS Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, Oregon – carl.schreck@oregonstate.edu

Carl Schreck completed his Ph.D. in Physiology and Biophysics and Fisheries Science. Carl joined the Oregon Cooperative Fish and Wildlife Research Unit through the U.S. Fish and Wildlife Service as assistant leader and an Assistant Professor at Oregon State University in 1975. Two years later he became the Leader of that Unit and continues to serve in that capacity for the Biological Resources Division, U.S. Geological Survey where he is a Senior Scientist. He is also a Full Professor in the Department of Fisheries and Wildlife at OSU. His research has been on a variety of species including lamprey, sturgeon and a variety of teleosts, particularly salmonids. He applies environmental physiology and behavior to address environmentally relevant questions.



CAMERON SHARPE

Oregon Department of Fish and Wildlife, Corvallis Research Lab, Corvallis, Oregon - cameron.sharpe@oregonstate.edu

Cameron Sharpe is a research biologist with ODFW at the Corvallis Research Lab. He is the manager of the Hatchery Research, Monitoring, and Evaluation Project guided by the Willamette Biologic Opinion (<http://oregonstate.edu/dept/ODFW/willamettesalmonidrme/home>).



BRIAN BECKMAN

NOAA Northwest Fisheries Science Center, Seattle, Washington – Brian.Beckman@noaa.gov

Brian Beckman is a research biologist with the Northwest Fisheries Science Center, National Marine Fisheries Service in Seattle. He has a B.S. from Oregon State, a M.S. from the State University of New York, Stony Brook and a Ph.D. from the University of Washington. He has worked on growth and smolting of juvenile coho and Chinook salmon throughout the Pacific Northwest and has relatively recently transitioned into the study of the marine growth of juvenile salmon.



CHRISTINE KOZFKAY

Idaho Department of Fish and Game, Eagle, Idaho - christine.kozfkay@idfg.idaho.gov

Christine Kozfkay completed her M.S. degree from the University of Idaho. Chris began her professional career jointly at the Idaho Department of Fish and Game and University of Idaho. In 2006, Chris became a full-time fisheries biologist with the Idaho Department of Fish and Game where she worked on a variety of projects focused on hybridization between rainbow trout and cutthroat trout and genetic population structure of salmon and trout. Chris is currently supervising two research programs relating to the monitoring and evaluation of the Snake River Sockeye Salmon Captive Broodstock program and captive rearing of Salmon River Chinook salmon.



PETER GALBREATH

Columbia River Inter-Tribal Fish Commission, Portland, Oregon – galp@critfc.org

Peter Galbreath completed his Ph.D. at Washington State University. Prior to joining CRITFC in 2004, Peter worked 8 years at Western Carolina University researching sex and ploidy manipulation of brook trout, and identification of indigenous brook trout populations within the southern Appalachians. Since joining CRITFC, he has worked on issues related management of artificial production programs and use of genetics analyses to assess relative natural productivity of hatchery stocks and wild populations.



EWANN BERNTSON

NOAA Northwest Fisheries Science Center, Conservation Biology Division, Port Orchard, Washington – ewann.berntson@noaa.gov

Ewann Berntson earned her B.S. in Zoology from the University of Washington and her Ph.D. in Biological Oceanography through the MIT/Woods Hole Oceanographic Institution Joint Program. Her scientific background includes the molecular evolution of corals and anemones, deep-sea and hydrothermal vent ecology and marine conservation biology. She joined the NWFSC's Conservation Biology Division in October, 2000, where her primary focus is hatchery-wild interactions in Chinook salmon and steelhead salmon in the Snake River basin. She also dabbles in the genetics of deep-sea corals.



MAUREEN HESS

Columbia River Inter-Tribal Fish Commission, Hagerman Genetics Lab, Hagerman, Idaho - hesm@critfc.org

Maureen Hess completed her M.S. degree in the School of Aquatic and Fishery Sciences at the University of Washington. She is currently a conservation geneticist with CRITFC where she uses pedigree reconstruction for evaluation of relative reproductive success of natural- and hatchery-origin fish for supplementation and reintroduction programs. She also coordinates parentage-based tagging baselines for steelhead and Chinook salmon in the Columbia River basin, which can be used for monitoring harvest of hatchery stocks, identifying the origin of hatchery strays and kelts, and evaluating the effectiveness of hatchery integration programs.



TIM HOFFNAGLE

Oregon Department of Fish and Wildlife, East Region Fish Research, La Grande, Oregon – timothy.l.hoffnagle@state.or.us

Tim Hoffnagle has B.S. degrees in Fisheries Resources and Wildlife Resources from the University of Idaho, M.S. in Biology from Murray State University, and Ph.D. in Biology from the University of North Dakota. Tim worked for seven years studying native fishes in the Grand Canyon before joining ODFW (Supervising Fish and Wildlife Biologist) in 2000. He currently conducts research and monitors hatchery supplementation programs for Chinook salmon in the Grande Ronde and Imnaha basins.



MATT FALCY

Oregon Department of Fish and Wildlife, Salem, Oregon - matthew.r.falcy@state.or.us

Matt Falcy completed his Ph.D. in Ecology and Evolutionary Biology at Iowa State University. He has been a fish conservation biologist at ODFW since 2010. Matt is currently using demographic and statistical models to address conservation concerns. He is interested in how population dynamics emerge from the relationship between evolved individual behaviors and habitat heterogeneity.



KATHRYN KOSTOW

*Oregon Department of Fish and Wildlife, Ocean Salmon and Columbia River Programs
Clackamas, Oregon - Kathryn.E.Kostow@state.or.us*

Kathryn Kostow has been with Oregon Department of Fish and Wildlife for twenty-five years, working in wild fish conservation and management. Her areas of emphasis include hatchery and harvest risk assessment, population status assessment, and fish biodiversity and biogeography. She holds degrees from the University of Minnesota and the College of Idaho.



CHRIS TATARA

*NOAA Northwest Fisheries Science Center, Behavioral Ecology, Seattle, Washington -
chris.p.tatara@noaa.gov*

Chris Tatara is a research fisheries biologist on the Behavioral Ecology Team at NOAA's Northwest Fisheries Science Center. He completed a Ph.D. in Ecology/Toxicology from the University of Georgia in 1999. Dr. Tatara conducts field and laboratory research on the behavioral ecology of steelhead, including differences between hatchery and wild populations, ecological interactions between hatchery and wild fish, and the environmental and genetic mechanisms that account for differences and influence interactions. He collaborates on two research projects studying the effectiveness of steelhead hatcheries; the first using conservation hatcheries for the recovery of threatened steelhead populations in Hood Canal, Washington, and the second using a two year rearing cycle to improve survival and reduce fitness loss in steelhead smolts at the Winthrop National Fish Hatchery.



GABRIEL TEMPLE

Washington Department of Fish and Wildlife, Ellensburg, Washington - Gabriel.Temple@dfw.wa.gov

Gabe Temple has been a member of the Washington Department and Fish and Wildlife's Ecological Interactions Team based out of Ellensburg, Washington since 1998. Much of the work he has contributed to includes evaluations of salmon supplementation projects in central Washington State. One of his professional research interests relevant to this symposium include studies of species interactions associated with hatchery programs and evaluations of native species reintroductions.



JAY HESSE

Nez Perce Tribe – Lewiston, Idaho – jayh@nezperce.org

Jay Hesse is the Director of the Research Division for the Nez Perce Tribe's Department of Fisheries Resources Management. Mr. Hesse graduated from Michigan State University with a Bachelor of Science and Master of Science Degrees in Fisheries and Wildlife. He has worked for the Nez Perce Tribe for 20 years. He manages the Tribe's fish population status and trend monitoring and hatchery evaluation projects. Mr. Hesse has expertise in anadromous fish population dynamics, hatchery effectiveness research, strategic planning, effective communications and multi-entity collaboration. He provides technical and management representation of Nez Perce Tribe in multiple Columbia River basin fisheries co-management forums, including the Recovery Implementation Science team (RIST).



ED BOWLES

Oregon Department of Fish and Wildlife, Salem, Oregon - ed.bowles@state.or.us

Ed Bowles has led the fish side of ODFW for the last fourteen years. Some accomplishments include developing and implementing key policies directing native fish conservation and hatchery management, lower Columbia River harvest reform, federal ESA recovery planning, and helping ensure the Federal Columbia River Power System meets their fish conservation and recovery responsibilities. On the marine side, Ed oversees the agency's Marine Program and was the State's lead on developing a system of marine reserves and marine protected areas. Ed represents the west coast as an advisor to the Obama Administration on the National Ocean Policy. He also represented the Governor on the Ocean Policy Advisory Council and is a Commissioner on the Pacific States Marine Fisheries Commission.



DAVID FAST

Yakama Nation, Toppenish, Washington - fast@yakama.com

David Fast is currently a Senior Research Scientist for the Yakima/Klickitat Fisheries Project (YKFP) for the Yakama Nation in Toppenish, Washington. Dr. Fast has developed and implemented research programs for restoration of spring and fall Chinook, coho, and steelhead in the Yakama and Klickitat basins, including the Cle Elum Supplementation and Research Facility (spring Chinook), the supplementation program for fall Chinook at the Prosser Hatchery complex, coho reintroduction studies throughout the Yakima watershed, and steelhead kelt reconditioning and reproductive success evaluations. Dr. Fast has a Ph.D. in Fisheries Science from the University of Washington.



PETER HASSEMER

Idaho Department of Fish and Game, Anadromous Fish Manager, Boise, Idaho - pete.hassemer@idfg.idaho.gov

Peter Hassemer received a M.S. degree in Fisheries Resources from the University of Idaho in Moscow, Idaho. After completing graduate work on kokanee in north Idaho lakes, he taught fisheries, hatchery and marine biology programs at Sheldon Jackson College in Sitka, Alaska. He returned to Idaho in 1990 to work for the Department of Fish and Game and have been involved in anadromous salmon and steelhead, Columbia River basin and West Coast issues and management processes while with IDFG.



DOUG OLSON

U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington - doug_olson@fws.gov

Doug Olson graduated from the University of Washington and has worked for various fisheries management and research agencies in the Columbia River Basin for 30 years. For the last 20 years, Doug's primary area of interest has been working with others on planning and assessment for our National Fish Hatcheries in the Columbia River. Recent focal topics include clarifying the benefits and risks of hatchery production, conducting research on the ecological interactions between hatchery and wild fish, and investigating emerging science and technologies for hatchery production and conservation.



CASEY BALDWIN

Colville Confederated Tribes, East Wenatchee, Washington - casey.baldwin@colvilletribes.com

Casey Baldwin is a Senior Research Scientist in the Colville Confederated Tribes Fish and Wildlife Department. He has a M.S. degree in Fisheries from Utah State University and was a Research Scientist with the Washington Department of Fish and Wildlife for 14 years before coming to the Colville Tribes 3 years ago. Casey has worked on fish management and research projects in both resident and anadromous fisheries with emphasis on harvest monitoring, salmon and steelhead recovery, habitat restoration, population monitoring, and ecological modeling.



BRENT HALL

Confederated Tribes of the Umatilla Indian Reservation, Office of Legal Counsel, Pendleton, Oregon – BrentHall@ctuir.org

Brent H. Hall is an attorney in the Office of Legal Counsel of the Confederated Tribes of the Umatilla Indian Reservation. His current practice focuses on treaty rights, environmental, and natural resource matters. Brent represents the Umatilla Tribes in federal, state and tribal courts in cases involving the exercise and protection of treaty reserved rights and resources, including tribal First Foods. He has also has negotiated and implemented agreements with federal and state agencies related to Columbia River basin hydro system operations, Indian and non-Indian harvest, hatchery operations and habitat restoration.



BRIAN MISSILDINE

Washington Department of Fish and Wildlife, Olympia, Washington – Brian.Missildine@dfw.wa.gov

Brian Missildine is a Natural Resource Scientist with the Washington Department of Fish and Wildlife and is the lead for the Hatchery Evaluation Assessment Team. Previous to joining WDFW in 2012, Brian spent five years in the consulting field and before that spent 10 years as a Fish and Wildlife Biologist with the U.S. Fish and Wildlife Service working on bull trout conservation and Endangered Species Act issues. Brian started his fisheries career working at a private hatchery on the Satsop River in Washington State. He earned both his B.S. and M.E.S. from The Evergreen State College where he studied salmon toxicology and salmon management. Brian is also heavily involved in the American Fisheries Society and is transitioning from the Washington British Columbia Chapter President to the role of Past President.



Oregon Chapter of the American Fisheries Society

ACTIVITIES

- Chapter hosted technical workshops
- Annual Meeting with average of 500 attendees, 150+ technical sessions, 30+ posters, socials, workshops, student-mentor socials, raffle/auction, vendors, and awards
- Annual native fish workshop hosted by committee
- Quarterly newsletter
- Social networking, Facebook page, Twitter, Webpage, and Listserv to disseminate information to members
- Student-Mentor Program to connect professionals and students
- AFS Certification Scholarships for members
- Grants awarded annually to K-12 teachers for fisheries related travel and supplies.
- Sponsor partners and related events

ACCOMPLISHMENTS

- National Outstanding AFS Chapter Award Winner 11 times since 1994
- Western Division Outstanding Chapter Award Winner 12 times since 1981
- Active Role in State and Federal Legislatures
- Active Student Subunit
- Awards \$13,000 in Student Scholarships Annually

CHAPTER AWARDS

- Award of Merit
- Fishery Worker of the Year
- Fishery Team of the Year
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