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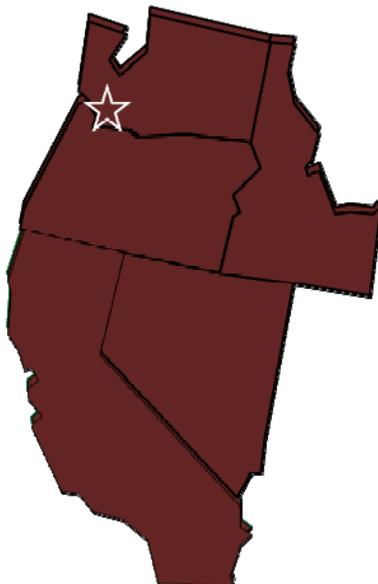
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Rapid Response Genetics



Chinook salmon trapped migrating up the Sacramento River.

Photo: Jennifer Von Bargaen



A Chinook salmon is captured at Keswick dam on the Sacramento River in California, and biologists need to know whether it is a member of an endangered species which should be held and spawned at a conservation hatchery, or a member of another species which should be released to spawn on its own. The species are difficult to distinguish by looking at them, and field identifications are often incorrect. If the fish is a member of the species which should be released to spawn on its own, then holding it for too long could be detrimental.

Meanwhile, five adult bull trout are captured at the base of Cabinet Gorge Dam on the Clark Fork River in Montana, and biologists need to know whether each originated above the dam (and thus should be passed) or below the dam (and should be left there). Allowing these fish the opportunity to return to their natal populations to spawn is necessary for the continued existence of those populations. The biologists need to decide what to do quickly, as

holding the fish for an extended period will be detrimental.

On the North Fork of the Lewis River in Washington biologists have stretched a net across a segment of the historic Lewis River channel looking for bull trout. Like the Clark Fork River, this patch of river is flanked with hydroelectric dams that prevent bull trout from returning to their spawning streams. Today they catch three adult bull trout and need to know where each of these fish is headed. Was it headed back to one of the spawning tributaries above the upper dam or is it just a bull trout that was feeding and belongs to the spawning tributary in the reservoir below this patch of river?

Many laboratories conduct genetic analyses on fish and wildlife species, and some of these will process occasional samples within a day or two to facilitate in-season or real-time management. Genetic analysis is most efficient when samples are handled in large batches, and when processing is planned for in advance, so most laboratories only conduct real-time analysis a few times per year. Information needs such as the three scenarios outlined above are fairly common for the FWS and several of our partners, and our laboratory at AFTC has become somewhat unique in that we provide one-day turnaround on multiple projects for eight months out of the year.

Laboratory staff refer to this type of work as “rapid-response”, and have developed a series of protocols to increase the speed with which samples are processed and analyses are conducted, and to ensure that laboratory equipment can be most efficiently prioritized for this type of work. In recent years, we have conducted rapid response analyses to address information needs shared between our agency and Avista Corporation, Pacificorp, NOAA Fisheries, Bureau of Reclamation, Confederated Salish Kootenai Tribes, Kalispel Tribe of Indians, Pend Oreille Public Utility District, and with the states of Oregon, Idaho, Montana, and California.

AFTC Program Highlights

Administration/Facilities

Jim Lowell and Jeff Poole consulted with project leader Mary Bayer on a planned construction project at Warm Springs NFH. They will be assisting the NFH with pur-

Staff:

Administration & Facilities

Center Director, Vacant
Patty Crandell, Acting Center Director
Vince Bocci, Administrative Officer
Steve Dyer, Administrative Assistant
Mark Hack, IT Specialist
Facilities Operations Specialist, Vacant
Jeff Poole, Water Treatment Plant Operator
Jim Lowell, Maintenance Worker

Conservation Genetics

Christian Smith, Regional Geneticist
Pat DeHaan, Conservation Geneticist
Matt Smith, Conservation Geneticist
Justin Bohling, Conservation Geneticist
Jennifer Von Bargaen, Lab Geneticist
Brice Adams, Conservation Geneticist
Mikki Brinkmeyer, Biological Science Technician
Ben M. Prom, Biological Science Technician

Physiology & Nutrition

Kyle Hanson, Regional Physiologist
Ann Gannam, Regional Nutritionist
Richard Glenn, Microbiologist
John Holmes, Fish Biologist
Ron Twibell, Fish Nutritionist
James Barron, Fish Biologist
Kelli Hawke, Biological Science Technician
Kieslana Wing, Contractor

Quantitative Ecology & Technology

Doug Peterson, Senior Scientist
Ben Kennedy, Fish Ecologist
Will Simpson, Fish Ecologist
Kurt Steinke, Electronics Engineer

Program Highlights— continued

chasing materials for and setting up a formalin building. They will be making a list of components to be purchased. The work will be completed before next spring and is expected to take 3-4 days.

Doug Peterson and Kyle Hanson acted as AFTC Deputy in May and June, respectively.

A \$600,000 Bonneville Power Administration (BPA) funded project to study differences between natural and hatchery origin Abernathy Creek steelhead has been renewed for CY17.

New Budget and Administration ARD, Kevin Bumatay, brought Nancy Hegel, Heidi Buzikowski, Matt Thies, Jessica Douglas, and Travis Peake to tour AFTC. Their all day visit included learning about AFTC's research projects as well as a picnic table lunch and afternoon ice cream.

Doug Peterson investigated potential solutions to meet near-term staffing needs for biological technicians at AFTC. The alternatives evaluated included AmeriCorp-related programs (WCC and WSC) and the Student Conservation Association (SCA) which has a blanket internship agreement with FWS. SCA proved to be the best choice, and Doug Peterson, Kyle Hanson, and Ann Gannam interviewed SCA applicants for three one-year positions. The process was fairly efficient and one laboratory specialist and two biologists were selected from many qualified students applicants.

Students from Mt. Hood Com-

munity College aquaculture program came to AFTC on their annual visit. The students got a tour and learned about the mission of the FWS as well as future job opportunities.

AFTC researchers were interviewed by Diana Zimmerman of the Wahkiakum County Eagle. Reporter Zimmerman was interested in changes that have occurred since AFTC quit producing salmon for mitigation and about ongoing science conducted at the facility. The visit gave AFTC the opportunity to communicate the FWS' conservation mission to a local audience. The Wahkiakum County Eagle's article about AFTC is available online: <http://www.waheagle.com/story/2016/06/30/news/abernathy-fish-lab-1-of-7-in-the-country/11650.html>

Conservation Genetics

Jennifer Von Bargaen, Brice Adams, Mikki Brinkmeyer and Ben Prom completed twenty four rapid-response genetic analysis events across three different projects aimed and recovering ESA-listed species. The first was working with PacifiCorp to facilitate passage of bull trout in the Lewis River, WA, the second was working with Avista Power to facilitate passage of bull trout in the Clark Fork River, MT, and the third was working with Livingston Stone NFH to select broodstock for the Sacramento River Winter-Run Chinook Salmon program.

Justin Bohling worked with the WDFW and the CITFC to analyze

RAD sequencing data in bull trout. The objective of this work is to develop a range-wide panel of single nucleotide polymorphism markers to use in this species, which will be used by all three agencies to monitor this species.

Matt Smith analyzed genetic data in Deschutes Basin steelhead as part of a collaborative study with Oregon Department of Fish and Wildlife (ODFW) to evaluate the reproductive success of hatchery and wild fish in that basin.

Jennifer Von Bargaen coordinated installation of a new 3730 DNA sequencer in the genetics laboratory. This instrument will allow AFTC staff to continue to meet information needs for monitoring steelhead and for bull trout passage.

All members of the Applied Program in Conservation Genetics participated in the Coastwide Salmonid Genetics Meeting in Astoria, Oregon from June 7-9. The Coastwide is a biennial meeting in which geneticists from agency, tribal, academic and private sector laboratories meet to share advances in the field of salmonid genetics. AFTC staff moderated four of the meeting's eight technical sessions, participated in data standardization and analysis sessions, and presented five papers.

Physiology & Nutrition

For the project "Natural Reproductive Success and Demograph-

Program Highlights— continued

ic Effects of Hatchery-Origin Steelhead in Abernathy Creek, Washington", the last two releases of winter steelhead smolts (funded by BPA) occurred in May. The day before each release, Richard Glenn, Ben Kennedy, and Kelli Hawke collected gill biopsies to determine seawater preparedness of hatchery produced smolts. Combined with the first release in April a total of 17,500 smolts were released into Abernathy Creek in 2016. In total, 84 natural-origin, 34 hatchery-origin, and 27 out of basin-origin strays comprised the winter steelhead spawning run captured at AFTC this year. Seventeen natural-origin and 30 hatchery-origin adults were retained for broodstock, with 19 families were produced. There is a projected production of 7,000 smolts to be released in the Spring of 2017.

For fish feed quality control sampling (FFQC), three feed samples were received from the hatcheries in May and six samples were re-

ceived in June. As part of the routine analyses, feeds were checked for rancidity. Ann Gannam wrote the feed memos which were sent to the hatchery and the feed mill. Ann also wrote a FFQC statement of work for the Lower Snake River Complex Plan.

As a continuation of the Chelan PUD lamprey project, James Barron is maintaining the lamprey in the grow-out portion of the study. In May, he moved the lamprey to the new lamprey culture system and rebuilt the old tank system in preparation for the future studies. As part of the Chelan PUD cooperative project, James Barron is preparing lamprey feed by crumbling and sizing Otohime A for our cooperators at NOAA and Yakama Nation Fisheries. They will be conducting a feeding trials using different sizes of the feed typically fed to the lamprey in studies done by the group.

James Barron, Kelli Hawke, Ann Gannam, and Ron Twibell stocked

Pacific lamprey and steelhead for the lamprey polyculture study funded through FONS. Lamprey are being raised in outflow water from steelhead tanks to see if the ammocoetes



Lamprey polyculture system 6-2016.
Photo: Ann Gannam.



Lamprey stocking for FONS. Photo: Ann Gannam.

Publications

Twibell, G. R., J. M. Barron and A. L. Gannam. 2016. Evaluation of dietary lipid sources for the juvenile Lost River sucker. *North American Journal of Aquaculture* 78: 234-242.

Smith C.T., B. Adams B, M. Bartron, M.K. Burnham-Curtis, E. Monroe, J.B. Olsen, W.D. Wilson, A. Williams, M.J. Millard, M.A.H. Webb, and J.K. Wenburg. 2016. Comment on Haig et al. (2016): the conservation genetics juggling act: integrating genetics and ecology, science and policy. *Evolutionary Applications* 9: 635-637.

Bohling, J. H., J. Dellinger, J. M. McVey, D. T. Cobb, C. E. Moorman and L. P. Waits. 2016. Describing a developing hybrid zone between red wolves and coyotes in eastern North Carolina, USA. *Evolutionary Applications*, 9: 791-804.

Sağlam, İ. K., J. Baumsteiger, M. J. Smith, J. Linares-Casenave, A. L. Nichols, S. M. O'Rourke, and M.R. Miller. In press. Phylogenetics supports an ancient common origin of two scientific icons: Devils Hole and Devils Hole pupfish. *Molecular Ecology*.

Program Highlights — continued

can utilize nutrients from the effluent. This would benefit future culture programs by reducing the amount of feed required to grow lamprey and partially filtering out nutrients from salmon effluent. Lamprey ammocoetes were provided by our cooperators at Yakama Nation Fisheries.

Ron continues to work on the BPA feed trial photographing, measuring hepato-somatic index, and sampling fish tissues for histology. Fish samples from the BPA low lipid feed study were analyzed for proximate composition (protein, lipid, moisture, and ash) as well as fatty acids. The data are being analyzed and interpreted by Ron Twibell in preparation for the end of the year report and for a presentation to be given to WDFW in July.

Ron completed his portion of the Hagerman NFH recirculating aquaculture system (RAS) project analysis and submitted his report to the team running the trial (Hagerman NFH and

the Idaho FWCO). His section of the study involved analyzing steelhead sampled from the RAS tanks and comparing them to the fish sampled from standard raceways. The fish were analyzed for proximate composition to determine if the rearing method had an effect on body composition, specifically focusing on protein and lipid. These data provides additional biochemical information to supplement the findings of the larger RAS evaluation. The project was funded by Hagerman NFH.

Richard Glenn has been working with Mary Bayer, Hatchery Manager at Warm Springs NFH, to design a study to monitor the temperatures of transfer containers during egg and milt shipments between Little White Salmon NFH and Warm Springs NFH. The study is de-

signed to provide quantitative data on transfer conditions to relate to post-transfer mortality and hatching rates.

Kyle Hanson analyzed stress hormone concentrations in steelhead fry for Oregon State University as part of a project looking at domestication in hatchery fish.

Quantitative Ecology & Technology

Doug Peterson is working with Malheur NWR on a reimbursable agreement with Harney County Watershed Council to estimate the biomass of common carp that will promote recovery of submerged aquatic vegetation in Lake Malheur.

Doug Peterson and Will Simpson attended the Fisheries-Refuges meeting where Will gave a presentation on use of electro-fishing to reduce recruitment of common carp in Malheur Lake.

Meetings and Conferences

Kyle Hanson served as a representative from the Pacific Region at the National Practitioners' Forum on Climate Change Adaptation held at NCTC. The desired outcome from the Forum is a set of recommendations to guide agency actions that consider the impacts of a changing climate and it's interactions with other stressors on trust resources.

James Barron, Ann Gannam, and Kyle Hanson met with partners Mary Moser, NOAA, and Ralph Lampman, Yakama Nation Fisheries, to discuss cooperative lamprey project funded by Chelan PUD and the lamprey polyculture FONS project funded this year.

James Barron, Kyle Hanson, and Kelli Hawke attended the Columbia River Estuary Conference (CREC) meeting in Astoria, OR.

Steven Dyer completed OSHA 6000 training as part of his role as a collateral duties safety officer for federal agencies.

Ann Gannam, Ron Twibell and James Barron attended the International Symposium on Fish Nutrition and Feeding in Idaho, June 5-10th.

South Dakota Soybean Association (22 members) visited June 21st to see what we do in the way of feed manufacture and ingredient testing

Ben Kennedy represented Abernathy at a meeting of the Lower Columbia River Intensively Monitored Watershed's Technical Oversight Group.

Program Highlights — continued

Ben Kennedy, Doug Peterson, and Will Simpson coordinated with WDFW to monitor movement of steelhead smolts captured at a rotary screw trap at the mouth of Abernathy Creek.

Will Simpson continued to work on a manuscript about results of an experiment to test survival of common carp embryos to different electrical field intensities and waveforms.

Will Simpson and Kurt Steinke used PIT (Passive Integrated Transponder) packing survey (mobile PIT tag antenna arrays) to assess entrainment and potential mortality of ESA-listed steelhead smolts entrained into irrigation canals from the Umatilla River.



James Barron with flat fish. Photo: USFWS



Native plants in full bloom.

Photo: USFWS

Outreach

Jennifer Von Bargaen gave a lesson in conservation genetics to over 60 eighth-grade students at Griffin Middle School in Olympia, WA.

James Barron provided two year old lamprey ammocoetes to Sean Connolly, Pacific Region RO, to use for outreach at World Fish Migration Day and the Tualatin NWR Bird Festival.

AFTC Pollinator Garden

Our garden planted by the Youth Conservation Corps (YCC) is in full bloom this year! Thanks to Judith Gordon, YCC and Watershed Gardens.



Pollinator garden. Photo: USFWS

Ongoing Projects

Water Velocity Effects on Salmon as Reared in Recirculating Systems. *Management Need:* Determine the effects of water velocity on composition, growth, condition, and performance of juvenile PNW salmon as applied to recirculating systems in support of hatcheries in the Pacific Region considering the use of recirculating systems. *Partners:* Pacific Region National Fish Hatcheries, Fishery Resources Program via Fisheries Operations and Need System (FONS).

Diet development for Lost River and short nose suckers in the Klamath River Basin. *Management Need:* Determine dietary needs of listed populations to assist in recovery. *Partners:* Klamath Tribes, Klamath Falls FWO, California/Nevada FHC.

Development of diets and rearing techniques for the culture of Pacific lamprey, *Entosphenus tridentatus*. *Management Need:* Assist Tribal partners in developing methods for the artificial propagation of Pacific lamprey, a species of concern. *Partners:* Yakama Nation; Fishery Resources Program via FONS.

Assessing the effects of multiple tagging methods on Pacific lamprey ammocoetes. *Management Need:* Assist Tribal partners in developing methods for the monitoring and evaluation of this species of concern. *Partners:* Yakama Nation; Fishery Resources Program via FONS.

The physiological response of white sturgeon to handling stress in captivity. *Management Need:* Determine if the stress from catch and release angling is detrimental to survival of white sturgeon, a species of concern. *Partners:* Dalhousie University; Carleton University.

Pacific Region's Fish Feed Quality Control (FFQC) Program. *Management Need:* The FFQC Program, the only one of its kind in the FWS, provides quarterly monitoring of the quality of the commercially produced fish feeds used at Pacific and Pacific

Southwest Regions' NFHs. Information is compiled on an annual basis and used in the development of the Pacific Region fish feed contract. *Partners:* Pacific and Pacific Southwest Region's NFHs, Oregon, Washington, Idaho, and Tribal fish hatcheries.

Effects of dietary lipid source and ultraviolet radiation on sunburn and steatitis in Steelhead, *Oncorhynchus mykiss*. *Management Need:* Provide information regarding the potential relationship between fish nutrition and sunburn in steelhead. *Partners:* Pacific Region National Fish Hatcheries

Evaluation of thermal exposure of adult Chinook salmon during the migration to Warm Springs National Fish Hatchery. *Management Need:* Determine if Chinook salmon migrating to Warm Springs National Fish Hatchery experience thermal stress. *Partners:* Warm Springs National Fish Hatchery, Lower Columbia Fish Health Center, Confederated Tribes of Warm Springs.

Natural reproductive success and demographic effects of hatchery-origin steelhead in Abernathy Creek, WA. *Management Need:* Provide information to help managers minimize differences between NOR and HOR fish. *Partners:* Bonneville Power Administration; Washington Department of Fish and Wildlife.

Climate change vulnerability assessments of Pacific Region National Fish Hatcheries. *Management Need:* An understanding of the anticipated habitat changes under different climate change scenarios provides managers with information to proactively respond to these conditions and their impact on NFHs. *Partners:* Pacific Region NFHs; Mid-Columbia River FRO; Fishery Resources Program via FONS.

Ongoing Projects—continued

Fish Suppression of common carp in Malheur Lake using electrofishing to target eggs and embryos.

Management Need: Determine the feasibility of using electrofishing to kill eggs and embryos for control of invasive common carp in Malheur Lake. *Partner:* Malheur NWR.

Antenna design for the Biomark IS1001 PIT tag reader. *Management Need:* Provide expert level engineering and technical assistance to partners monitoring species of interest using new technologies while reducing biologist time spent in design and troubleshooting. *Partners:* NOAA Fisheries, USFWS Green Bay.

Entrainment and bypass of ESA-listed salmon at irrigation diversions on the Umatilla River. *Management need:* Determine what environmental factors influence the magnitude of fish entrainment into irrigation canals and if captured fish are successfully screened and returned to the Umatilla River using PIT tag technology. *Partner:* Bureau of Reclamation

Aquatic organism passage (AOP) at remediated stream road crossings. *Management Need:* Assess the efficacy of genetic, direct capture, and remote sensing methods to verify fish passage through remediated culverts. *Partners:* US Forest Service, Trout Unlimited.

Mekong River fish ecology and sustainable development. *Management Need:* Assess the scientific capacity and data needs for resource managers in Laos and Cambodia to address hydroelectric development on the mainstem Mekong River. *Partners:* USGS, US DOI International Technical Assistance Program (ITAP)

Effectiveness of transitioning to a locally-sourced steelhead broodstock at Winthrop National Fish Hatchery. *Management Need:* Determine if hatchery improvement programs and actions are achieving the expected biological performance objectives. *Partners:* USFWS Mid-Columbia WW and NOAA Fisheries.

Stress response of juvenile steelhead salmon to electrofishing and tagging under different thermal regimes. *Management need:* To understand how fish respond to capture and handling under conditions experienced in late summer. *Partners:* USFWS Directorate Fellows Program.

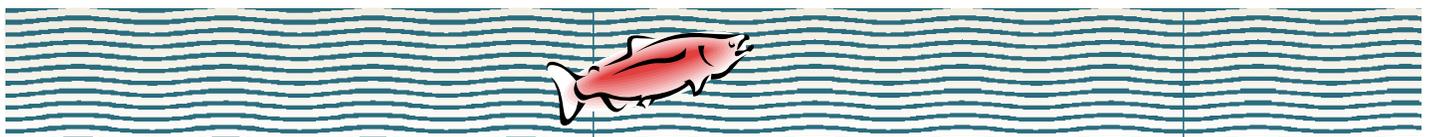
Evaluation of the spatial and temporal distribution of juvenile Chinook Salmon in the Entiat River. *Management Need:* Use genetic data to improve our understanding of the distribution of spring and summer run Chinook Salmon juveniles and thus improve our ability to prioritize restoration projects targeting spring Chinook Salmon recovery. *Partners:* USFWS Mid-Columbia FWCO

Design and installation of a PIT tag array to monitor outmigration of juvenile Pacific lamprey in the Umatilla River. *Management need:* Determine entrainment rates of juvenile lamprey as they move downstream through the Umatilla River. *Partners:* NOAA-Fisheries, US Bureau of Reclamation

Rapid response genetic analysis of threatened bull trout collected below dams in the Clark Fork River, MT. *Management Need:* Provide data to inform upstream fish passage decisions for listed bull trout. *Partners:* Avista Corporation; Confederated Salish Kootenai Tribes; Idaho Fish and Game; Kalispel Tribe of Indians; Montana Fish Wildlife & Parks; Montana Ecological Services Field Office; Pend Oreille Public Utility District; Pennsylvania Power & Light, MT.

Genetic identification of endangered winter-run Chinook salmon in the Sacramento River, CA. *Management Need:* Rapid response broodstock identification for spawning of listed species. *Partners:* Livingston Stone NFH; Red Bluff FWO; NOAA Fisheries.

Genetic analysis of bull trout in the Lewis River system. *Management Need:* Facilitate passage of bull trout past hydroelectric facilities. *Partners:* Washington FWO, Columbia River FPO, PacifiCorp, US Forest Service, Washington Department of Fish and Wildlife.



Ongoing Projects—continued

Relative reproductive success of hatchery and wild steelhead in the Deschutes River basin. *Management Need:* Develop genetic markers to monitor genetic diversity of listed populations. *Partners:* Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, Columbia River Intertribal Fish Commission.

Genetic needs assessment for endangered Lost River and shortnose suckers of the Klamath River Basin, OR. *Management Need:* Develop genetic markers to monitor genetic diversity of listed populations. *Partners:* Klamath Falls FWO; U.S. Geological Survey.

Use of restriction-associated DNA sequence data for single nucleotide polymorphism detection in listed Devil's Hole pupfish. *Management Need:* Develop genetic markers to monitor genetic diversity of a listed population held in refugia. *Partners:* Sacramento FWO; University of California, Davis.

Genetic profiles of broodstock at Pacific Region National Fish Hatcheries. *Management Need:* Determine impacts of hatchery origin fish (HOR) on naturally occurring fish (NOR) and monitor the effects of aquaculture practices on HOR populations. *Partners:* Pacific Region NFHs; Fishery Resources Program via FONS.

Genetic run assignment of juvenile Chinook salmon from the American River. *Management Need:* Assess accuracy of length-at-date method for distinguishing Spring run (ESA listed) from Fall run (unlisted) Chinook salmon smolts. *Partner:* Pacific Southwest Regional Office.



South Dakota Farmers' at AFTC. Photo: AFTC



Biologists take a genetic sample from a Chinook salmon trapped during its migration up the Sacramento River. If the genetic results reveal that it is spring run or fall run then it must be returned to the river to spawn on its own.

Photo: Christian Smith



Bull Trout captured on the Lewis River being transported to holding facility before genetic assignment. The section of the river where these fish were captured is isolated from the spawning regions by dams, and genetic assignment data will be used to learn which population each individual came from.

Photo: Brice Adams

