Science Of The Service

Columbia-Pacific Northwest & Pacific Islands Regions

April 21-22, 2020 ~ Portland, Oregon

LINKS TO PRESENTATION RECORDINGS

April 21- "Ecology of Surprise" Presentation
https://www.youtube.com/watch?v=5_Gy-eBINhM

May 6- Science Briefs

https://www.youtube.com/watch?v=85I7irJu9As

May 13- A Tale of Three Understories: Do Upland Avian Communities Differ by Degree of Crested Wheatgrass Invasion of Sage-steppe Habitat?

https://www.youtube.com/watch?v=CurEWkAEbks

May 20- Palmyra Atoll Coconut Control Project Update

https://www.youtube.com/watch?v=SlNNdS8PLrQ

May 27- Forecasting Spring Chinook adult returns within a management decision context

https://www.youtube.com/watch?v=vYe6PYSq8Ss

June 3- Application of advanced DNA sequencing techniques to monitoring of bull trout

https://www.youtube.com/watch?v=5wG1sl9PfPI

June 10- Herding the fish: Streamlining the storage, analysis, and distribution of National Fish Hatchery data with the adoption of a single database

https://www.youtube.com/watch?v=kHMps6LfPhQ

June 17- Impacts of ration size on growth and sexual maturation in YY Brook Trout: Implications in the biological eradication of an invasive species

https://www.youtube.com/watch?v=OklENXn4CUw

June 24- Juvenile mussel caging studies as a tool to evaluate the feasibility of restoring Western Pearlshell Mussels to western rivers

https://www.youtube.com/watch?v=MOOGV1qd_Fs

July 1- Peaks and valleys: A decade of innovative conservation in the heart of Kaua'i's watershed

https://www.youtube.com/watch?v=i1B7ejUykeg

Welcome to

SCIENCE OF THE SERVICE

April 21-22, 2020
Portland, Oregon
~ event cancelled due to the SARS-CoV-2-induced (COVID-19) pandemic ~

Sponsored by the
Science Coordination Team
Columbia-Pacific Northwest & Pacific Islands Regions
U.S. Fish & Wildlife Service

Science Of The Service Planning Team (in alphabetical order): *Mike Green (Migratory Birds & Habitat), Paul Heimowitz (Ecological Services), Kevin Kilbride (National Wildlife Refuge System), David Leonard (Ecological Services), Alexa Martinez (National Wildlife Refuge System), Tim Mayer (National Wildlife Refuge System), Mari Reeves (Ecological Services), Tim Whitesel (Fish & Aquatic Conservation).*

Front Cover (left to right)*:* Juliana Merluccio and Lorenz Sollmann (Washington Maritime National Wildlife Refuge Complex) collecting and recording data on an invasive European Green Crab (*Carcinus maenas*) captured at Dungeness National Wildlife Refuge.

Photo Credit: *College of the Environment (University of Washington)*

Back Cover: *A complete list of Science Coordination Team members from the Columbia-Pacific Northwest & Pacific Islands Regions.*

I am drafting this introduction at my kitchen counter or as I refer to it now, “my office.” The counter is the right height for me to stand while I work. All of us are experiencing alterations to our work spaces and our lives and trying to find some rightness. As we grapple with the COVID-19 pandemic, it is important to remember that each of us is experiencing it differently. Many folks are concerned about staying safe, keeping our family and loved ones healthy and safe, and helping our kids learn online and have normal experiences. In the best of circumstances, this situation that we find ourselves in is awkward and stressful. As we navigate our way through these unprecedented times, it is important to show up with compassion, empathy, and understanding and to be as adaptable as possible.

At no time in recent memory has science been more important. The world is relying on science to discover the origins of the pandemic, find a cure, map the spread, and predict the future. At the Service level, our science has been integral in assessing risk and developing protocols for working in this new agency environment. There is comfort in knowing that our long history of using the best science to inform our decisions is helping to keep the public, volunteers, partners, and our people safe.

But you’ve opened this publication for a reason, to discover some of the best science the Service has to offer. The Science Applications program supports science across the Service and with partners. Nationally and regionally, we are working with states to share science capacity in order to address wildlife disease and we’re collaborating on species of greatest conservation needs, data management and geospatial support tools.
We are also coordinating with IRTM to update the FWS Data Management Policy, which will help keep all of our data safe and accessible for the next generation of Service scientists. In the West, we are prioritizing work with forest landowners and invasive species management.

I am particularly proud of our efforts to advance diversity and inclusion in the Service. Science Applications is supporting 17 Directorate Resource Assistant Fellows Program (DFP) students in the Science Application program across the country and we’re allocating funding to each region to partner with universities on opportunities for both undergraduate and graduate students to gain experience in our agency and work on some of our priority science challenges.

I came to work in the Science Application program because I saw tremendous opportunity to integrate shared science priorities across programs and with partners and to promote a more welcoming agency culture. We are always better when we can bring people together — be connectors. Several years ago, the Service adopted the principles of Strategic Habitat Conservation and those tenants are more relevant today. In times of tight budgets and increasing stressors on the lands and species we manage, we must collaborate to create the future we envision and adapt as we plan our course to that future.

That future looks a bit uncertain as I write this. What is certain though is that we are a great conservation organization. Not just for work that we do, but for the commitment we make to each other. I feel fortunate every day to work for an agency that prioritizes the wellbeing of its people. Now more than ever, we need to take care of each other. It is what makes the Service just right. Thank you for what you do every day.

Author: *Dr. Deborah Rocque (Assistant Director, Science Applications, Headquarters, U.S. Fish & Wildlife Service)*

Overview: The mission of the U.S. Fish & Wildlife Service (Service) is working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Sound science and relevant data are essential to inform management decisions. Excellence in science is thus critical to the mission and is a hallmark of the Service. A primary goal of the Service is to strengthen the agency's tradition of scientific excellence in the conservation of fish, wildlife, plants, and their habitats. As outlined by the *Science Excellence Initiative* (http://www.fws.gov/science/), to accomplish this goal, there is a commitment to:

- Expand the capacity to acquire, apply, and communicate scientific information;
- Promote active involvement of employees in the scientific community;
- Encourage strengthened partnerships with other scientific organizations; and
- Grow the next generation of scientists.

Purpose: In the spirit of the Service's mission and to strengthen our conservation efforts through scientific excellence, staff gather annually to share and discuss the science of the Columbia-Pacific Northwest and Pacific Islands Regions (Regions 9 & 12, respectively). The 2020 event would have been the 5th annual gathering. The purpose of Science Of The Service is to enhance the awareness and understanding of the scientific information, findings, techniques and approaches being conducted, produced or applied. This will, in turn, highlight the role of science in decisions, promote efficiency and effectiveness of activities, improve the quality of outcomes and products, increase the appreciation of what and how the science is being used, as well as help justify a continued commitment to and investment in the science of the Service. The essence of who we are and all that we do is driven by the Service's commitment to conducting, producing and applying sound science.

Final Disposition: Abstracts from the scheduled presentations were compiled into these proceedings. The proceedings will be posted online at *https://doimspp.sharepoint.com/sites/fws-FF01D00000/SitePages/Past-Presentations.aspx*

PROGRAM

Salutation & Introduction –

The Fish and Wildlife Service is charged with the responsibility of managing natural resources across the world. We manage our own lands on National Wildlife Refuges and Monuments as well as at National Fish Hatcheries and we provide oversight and support to our partners (public as well as private) on other lands and waters. This responsibility needs to be based in the best and most up to date science. We gather this basic information that informs our decisions in a variety of ways, one of the most productive being scientific meetings where we can exchange ideas and build partnerships with other scientists. We need these opportunities to learn, sometimes across disparate scientific disciplines, in order to best serve the American public and the natural trust resources for which we're responsible. And, happily, some of the best research and information is produced by our own staff.

In recognition of the valuable scientific work done by our FWS staff and as an easy and productive way to share this information, Interior Regions 9 & 12 annually celebrates the importance of science in our daily work. We do this through the Science Of The Service program, an opportunity for staff across our two Regions to report on important information and findings they have accumulated over the years. It is the one place where botanists hear about statistical methods they might employ from fish geneticists and NW Refuge managers gather new information on current population dynamics and new invasive species control approaches that could affect their daily management strategies. In short, it is an opportunity for staff to share important scientific findings on their work and that of their partners to strengthen the continuous improvement of our natural resource management.

In 2020, as part of our responsibility to maintain safe social distances to protect our staff and the public at large, the Science Of The Service will not take place in person or as a virtual event. Instead, we will provide an easily accessible and very productive collection of scientific information produced by our staff through some remote presentations and through a collection of scientific abstracts. I encourage you all to avail yourselves of the webinars and abstracts compendium that will provide you with an opportunity to gain new information from your fellow FWS scientists. This incredible opportunity to share your knowledge will help all of us continuously improve the conservation and protection of our natural trust resources and meet our goal to fully serve the American people.

Authors: *Robyn Thorson [1] & Mary Abrams [2] ([1] Regional Director, [2] Deputy Regional Director, Columbia-Pacific Northwest Regional Office)*

Keynote Address –

The Ecology of Surprise: Ecology and Environmental Ethics in an Old Growth Forest

A thought-provoking conversation with Dr. Michael Paul Nelson, professor of environmental philosophy and ethics at Oregon State University, for a discussion of the Long Term Ecological Research program that he leads at the H.J. Andrews Experimental Forest. Dr. Nelson will share surprising scientific discoveries, and present a new way to see science, or some science, as a novel way into ethics.

Author: *Michael Paul Nelson (Professor, Department of Forest Ecosystems & Society, Oregon State University)*

[Michael Paul Nelson delivered his keynote, "*About The Ecology of Surprise: Ecology and Environmental Ethics in an Old Growth Forest*", via a webinar on April 21st. Dr. Nelson used decades of research at the H.J. Andrews Experimental Forest in Oregon which have yielded surprising discoveries, upended sacred ecological cows, and reveal ethical insights. The recorded presentation can be viewed here on the Service's internal YouTube channel. You can learn more about Dr. Nelson here.]

Abstracts

(in order of scheduled presentation, by type)

Panel Presentations

Managed relocation in the face of our changing climate: The state of the science for informing the policy and ethics behind this adaptation action

Consideration of our changing climate has become more important in recent years as the U.S. Fish & Wildlife Service (Service) continues to manage species under its authority. As a result of the current and projected effects of our changing climate, impacts to species' abundance, distribution, and connectivity are likely to continue. One adaptation action being discussed and considered for the conservation and protection of a number of species is managed relocation, or the translocation of species outside their historic native range. For example, translocations have been implemented for native birds in Hawaii and bull trout in Glacier National Park in response to threats directly associated with our changing climate. There are a number of biological, policy and ethical questions that have arisen associated with this climate adaptation action (e.g., Will the target habitat support the transplanted species? How will the transplanted species impact the existing target ecosystem? Does current policy support managed relocation? Is new policy needed? How does a potential urgent need to act affect our ability to adequately address these question?). This panel will identify and address some of those questions through presentations that share case studies of managed relocation (including the science that was known and learned, successes and failures), existing policy that both supports and encumbers this action, and the ethical considerations that our agency and partners will continue to encounter. Should the Service proceed with wider implementation of this adaptation action, it will be important that it is scientifically sound. Presentations and the following discussion will provide the opportunity to identify existing and needed science to inform the biological, policy and ethical hurdles present and anticipated as the Service considers the use of managed translocation as an adaptation action in the face of the increasing threat of our changing climate.

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How science, policy, ethics, politics, and urgency are factored into a risk-management decision. Highlighting urgency of threats in the Pacific Islands

“Endangered Species Capitol of the World.” It is not a moniker we are proud of in the Pacific Islands Office, but it is one we are burdened with. Add the effects due to climate change added to the long list of threats we deal with and managed translocation beomes an increasinbgly important tool we have, and will continue, to use. It is important we understand the nature of climate change in the Pacific Islands and how the changing climate sets limitations on the potential for managed relocation. For instance, hotter, drier novel climate regimes will occur in Hawaii at low leeward elevations. No native species are known to be able to adapt to these novel climates. Researchers have independently reported on nighttime respiratory stress on plants at higher elevations—presumably the cooler habitats for managed relocation. A more detailed understanding of the climate changes and the potential for plant adaptation is needed as a guide to effective translocations. Rising temperatures are allowing moquitoes carying bird diseases to move to higher and higher elevations. Rising sea levels are already inundating low islands and will limit coastal habitats sooner rather than later, especially when combined with more frequent and more intense storm surges. Nonnative plants, animals, and diseases that are established in the islands but have not yet become invasive, may start being invasive as climate changes. Already invasive species may spread into novel ecosystems. Hawai‘i, in particular, will more likely host climate refugees from around the Pacific. The land available for conservation may shrink as land needed to house, water, and feed the human population grows. An influx of people not familiar with or who care little about native Hawaiian biota, having lost their’s, may dilute the public‘s intrest in preserving native, let alone, threatened and endangered species.

Author: *Gregory A. Koob (U.S. Fish & Wildlife Service)*

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The Nihoa Millerbird Project: a case study in translocation planning and implementation

In addition to following established general guidelines for translocations, detailed planning to account for unique circumstances and intensive post-release monitoring to document outcomes and guide management are essential components of managed relocation projects. Translocation of the critically endangered Nihoa Millerbird (*Acrocephalus familiaris kingi*) provides an example of this planning, monitoring, and adaptive management. The Nihoa Millerbird is a passerine bird endemic to Nihoa Island in the remote Northwestern Hawaiian Islands. The closely related, ecologically similar Laysan Millerbird (*A. f. familiaris*) went extinct on Laysan Island in the early 20th century when the island was denuded by introduced rabbits. To reduce extinction risk, we created a second population by moving 50 adult Nihoa Millerbirds more than 1,000 km by sea to Laysan, which has recovered substantially owing to decades of sustained restoration efforts and has ample habitat and a rich prey-base for millerbirds. The translocations (2011, 2012) were supported by five years of intensive background research and planning, including development of husbandry techniques, fundraising, and regulatory compliance. In each of the two translocation years, birds bred successfully during their first year on Laysan. At the conclusion of continuous, year-round monitoring in September 2014, 37 of the translocated birds were known to survive, and the population was estimated at 164 birds. Subsequent annual monitoring documents a growing population. The reintroduction of millerbirds contributes to ecosystem restoration on Laysan Island and to a growing knowledge base on using translocation to establish new populations of endangered species.

Authors: *Holly Freifeld [1], Sheldon Plentovich [1], Chris Farmer [2], Robby Kohley [3], Peter Luscomb [4], Thierry Work [5], Daniel Tsukayama [2], George Wallace [2], Mark MacDonald [6] and Sheila Conant [7] ([1] U.S. Fish & Wildlife Service, [2] American Bird Conservancy, [3] Pacific Rim Conservation, [4] Pacific Bird Conservation, [5] U.S. Geological Survey, [6] University of New Brunswick, [7] University of Hawaii)*

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Overview of ESA and other policy considerations (including treatment of environmental emergencies)

Abstract not available.

Author: *Rollie White (U.S. Fish & Wildlife Service)*

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Assisted Colonization in light of USFWS Policy

The Biological Integrity, Diversity, and Environmental Health (601 FW 3) or BIDEH underpins all our work to achieve Refuge Purposes and the National Wildlife Refuge System Mission. The 1999 Fulfilling the Promise Document emphasizes the Refuges core value of restoring habitats to conditions that existed there "before the advent of civilization." The BIDEH policy directs us to maintain ecosystems that *were present prior to substantial human related changes to the landscape.* In 2006 the BIDEH policy was amended to change the language about genetically modified organisms. The BIDEH policy does not allow the introduction of species on refuges outside their historic range unless such introduction is essential for the survival of a species and prescribed in an endangered species recovery plan. Managing for an anticipated future state of the world is referred to in the 2010 FWS Strategic Plan for responding to accelerating climate change called "Rising to the challenge" as *Realignment Restoration*. These ideas suggest that restoration can have multiple goals. For some degraded ecosystems, we might restore current or historical conditions to build and maintain resistance and resilience, while at the same time we should implement realignment measures to move the systems toward anticipated future conditions. While the USFWS BIDEH policy does not explicitly recommend assisted colonization, it does leave the door open to its use in cases where due to a species' limited geographic distribution, insular habitats, or limited dispersal capabilities it may not be able to shift geographic range as the conditions necessary for their survival shift on the globe due to climate change or human encroachment. In these cases, species may be candidates for assisted colonization or moving them to areas that may be favorable for their survival as part of larger landscape-scale conservation actions rather than more local ones.

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When recovery creates conflict: Some state perspectives on moving species.

Assisted migration (translocation, reintroduction) of wildlife species was one of the first management actions undertaken by federal, state, and private organizations to introduce or restore “desirable” wildlife species. One of the earliest active management actions of the fledgling United States Fish and Wildlife Service (U.S. Commission on Fish and Fisheries) was to introduce a variety of fish species across the continent to enhance recreational and commercial fishing opportunities. Dozens of fish species were distributed across the country with little or no regard to potential problems including competition with native species, hybridization, hitch hiking diseases and parasites, and habitat impacts. Not to be out done, wildlife managers introduced and reintroduced several non-native and native game species. Reintroductions of locally extirpated game species continues to be an important activity of state fish and wildlife agencies. Considerable effort to restore native populations of bighorn sheep, Rocky Mountain goats, Columbian sharp-tailed grouse and reestablish elk populations in eastern states represent a few recent successful efforts. Introductions of non-native species have also continued. A nationwide effort to establish wild turkey population in and outside native range was strongly embraced by most state fish and wildlife agencies. States response to assisted migration and reintroduction of threatened or endangered species or at risk species has varied. States have welcome reintroductions of some species such as fishers, mountain caribou, and lynx, but have opposed reintroductions of more controversial species like wolves and grizzly bears.

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Poster Presentations

(# denotes student author and contact)

The influence of reintroduced beavers on sediment processes in post-wildfire headwater streams, Methow River, Washington #

Washington State has experienced increasingly frequent, and intense wildfire activity, in part as a result of climate change. For example, all of the largest fires on record for Okanogan County have occurred in the past five years. This region includes the Methow River (MR), a main tributary to the Columbia River from the North Cascades. The MR is also the site of an ongoing beaver reintroduction program that has transplanted over 300 “problem beavers” to headwater streams over the past decade. Historically, beavers were abundant in the area, but populations were decimated by fur trapping in the 1800’s. Previous work documented how dam building by reintroduced beavers can rapidly influence the hydrology, ecology, and biogeochemistry of MR riparian ecosystems. Our project expands upon this research to investigate the effects of beavers in stream sites that burned in recent wildfires. We studied the streambed sediments in low order, headwater streams in wildfire-burned and unburned areas of the MR. Half each of the burned and unburned sites were also beaver reintroduction locations, with intact dams and ponds. At each site we collected streambed sediments upstream and downstream of the dams and took 10 cm cores from pond sediments. We sieved all samples to establish grain size distributions. Since fine sand to clay sized sediments can be harmful to aquatic organisms such as macroinvertebrate larvae and salmonids, we combined these size classes. We also studied the mineralogy and angularity of cobbles to understand sediment supply and transport. The stream sites were highly heterogeneous, which complicated interpretations of the relative strength of beaver and wildfire effects on streambed sediments. In general, there were less fine-grained sediments downstream versus upstream of beaver dams, and more fine-grained sediment in the burned sites, regardless of beaver presence. There was also less carbon content in burned areas than in unburned areas, with beavers increasing carbon content.

Authors: *Amanda Foster [1], Kena Fox-Dobbs [1], Peter Wimberger [1], Kent Woodruff [2] ([1] University of Puget Sound, [2] U.S. Forest Service)*

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How restoration efforts affect macroinvertebrate food webs and stream function #

Aquatic systems around the world have been highly impacted by human modification such as channelization, dam installation, agriculture, deforestation and urban pollution. To combat this prevalence of degraded aquatic and riparian systems, stream restoration has become a focus of many environmental organizations including federal, state, private and non-profit agencies. While the target of restoration is often to promote a single species or group of species, the effects ripple through multiple trophic levels and across ecosystem boundaries. This study aims to identify how restoration actions in Meacham Creek (Umatilla Country, Oregon) have affected habitat heterogeneity, invertebrate communities and stream function within the stream itself as well as the adjacent riparian areas. Habitat heterogeneity was assessed using seven metrics: habitat type (aquatic or terrestrial), vegetation type, vegetation density, riparian cover, water depth, velocity and substrate type. Three different types of sampling methods were used to capture aquatic macroinvertebrate community structure. Benthic samples, drift nets and emergence traps were all used to collect aquatic macroinvertebrates across different habitat types and life stages. Finally, terrestrial spiders in the riparian area were also collected. Initial observations show a higher level of habitat heterogeneity at restored sites. Data analysis for complete habitat metrics and macroinvertebrate community structure is ongoing.

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Coeur d'Alene Basin NRDAR: Utilizing monitoring information to conserve clean feeding habitat for waterfowl

For most of the 20th century, mining wastes in the Coeur d'Alene Basin were discharged into the Coeur d'Alene River and its tributaries resulting in widespread contamination throughout the Coeur d'Alene River and floodplain, as well as in lakes and wetlands. As a result, this contamination, extensive injury to natural resources has and continues to occur including annual waterfowl mortality. Long-term monitoring of waterfowl use within the Coeur d'Alene Basin is used to understand patterns of relative use and abundance, as well as, potential exposure to lead contaminated sediment. Ingestion of contaminated sediment is the principal exposure pathway of migratory waterfowl to lead in the Basin. Approximately 95% of the available waterfowl habitat in the Basin contains lead concentrations above the remedial action goal of 530 mg Pb/kg. Lead residues in blood and liver tissues of waterfowl using the Basin exceed both clinical and severe poisoning thresholds, and lead toxicosis has been shown to be the leading cause of waterfowl mortality within the Basin. Increasing clean waterfowl feeding areas with sediment lead concentrations less than the site-specific cleanup level of 530 mg Pb/kg has been identified as a priority action in the Coeur d'Alene Basin Restoration Plan to achieve a major restoration plan goal of reducing sediment toxicity and waterfowl mortality in palustrine and lacustrine habitats. Understanding Basin waterfowl use, abundance, and mortality within the Basin is crucial to identifying and prioritizing areas for future remedial, restorative, and/or management actions. The USFWS as a Natural Resource Trustee, identified priority areas for wetland remediation and restoration based on waterfowl monitoring information. Some of the areas identified with the highest potential for remedial/restoration opportunities were located on private agricultural lands. In partnership with Ducks Unlimited, EPA, and the Inland Northwest Land Conservancy the USFWS was able to conserve nearly 700 acres of agricultural property that will be converted to clean wetland habitat for waterfowl.

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Comparison of avian and mammalian Predators in Sage-Grouse core and non-core areas of Wyoming #

Greater Sage-Grouse (*Centrocercus urophasianus*: hereafter Sage-Grouse) abundance and distribution in North America has declined over the last century. Many factors have contributed to this decline, including habitat loss and fragmentation from human development with an associated potential for increased predation rates from avian and/or mammalian predators. While human development influences Sage-Grouse demographic rates and habitat selection, it provides an increased number of perch and nesting structures used by avian predators. Development has also been attributed to increases in mammalian generalist predators because they thrive in human-influenced environments. Wyoming's Sage-Grouse Core Areas were developed to add protections to important Sage-Grouse habitat by reducing development within Core Areas. Core Areas have maintained higher Sage-Grouse trends compared to Non-Core Areas, which could be explained by reduced predation rates. However, we lack a study comparing predator abundance within and outside Core Areas. In total, we performed 2,157 avian point counts along 400 8.05-km transects throughout the Wyoming Basin during the 2017 and 2018 summers. Human structures were noted at each location, which will be added to human disturbance data previously calculated. In 2018, we deployed 117 trail cameras on scent stations and performed 176 500-m scat and badger burrow transects to survey for mammalian predators. Scent stations and all transects were stratified between Core and Non-Core Areas. Preliminary results will be presented assessing (1) what habitat or structural factors are associated with higher predator density and abundance and (2) if avian and mammalian predator abundance differs between Core and Non-Core Areas.

Authors: *Claire Revekant and Jonathan B. Dinkins (Oregon State University)*

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Streaked Horned Lark 2019 reproductive monitoring at the Willamette Valley National Wildlife Refuge Complex, Oregon [#]

Streaked Horned Larks (*Eremophila alpestris strigata,* hereafter SHLA or Lark) are a federally threatened subspecies of horned lark endemic to the Pacific Northwest. Due to regional losses of open grassland habitats from human development, intensification of agriculture, and the incursion of trees, shrubs, and non-native invasive species, the SHLA breeding range has contracted – current distribution is limited to scattered sites in the south Puget lowlands, the outer coast of Washington, the lower Columbia River, and the Willamette Valley in Oregon. In 2013, critical habitat was designated at portions of the three refuges (Baskett Slough, Ankeny, and William L. Finley NWRs) that comprise the Willamette Valley NWR Complex (Complex). SHLA habitat at these refuges consists largely of agricultural fields with short, sparse vegetation. These same agricultural fields provide important overwintering green forage and wetland habitats for Dusky Canada Geese (*Branta canadensis occidentalis*) and other migratory waterfowl. Among many competing management objectives, the Complex is committed to producing suitable SHLA breeding habitat. Standardized SHLA breeding pair surveys have been conducted at the Complex since 2015; these surveys provide indices of SHLA abundance and distribution, but lack valuable information regarding nest success and other detailed reproductive metrics. In 2019, the Complex implemented a pilot SHLA nest searching and monitoring effort. Two interns monitored 22 nests at Baskett Slough NWR during May-Aug 2019. Seven of the 21 nests with determined nest fates fledged ≥ 1 fledgling, for an apparent nest success of 33%. Mayfield nest-survival estimates for daily (0.914; 95% CI = 0.870-0.957) and interval (0.114; 95% CI = 0.036-0.347; 24 days) periods were lower than apparent nest success, although had wide confidence intervals. Mayfield estimates likely were negatively biased by the several nests that failed late in the nestling period, as well as the disproportionate number of successful nests that were discovered close to their fledging dates. Nest depredations were somewhat greater than expected, but SHLA productivity at the study sites corroborated later-season observations of Lark fledglings. The Complex will continue to implement management activities to provide breeding habitat for SHLA, and hopes to continue Lark nest monitoring in 2020. This poster will (1) discuss the results from the Complex's pilot reproductive monitoring effort and (2) describe the work experiences of the USFWS Directorate Fellow (CR) who was tasked with implementing this pilot monitoring effort.

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Double-crested Cormorant western population status evaluation

The U.S. Army Corps of Engineers developed the Double-crested Cormorant Management Plan and Final Environmental Impact Statement in 2015 to "…to reduce cormorant predation in the estuary to Base Period levels (no more than 5,380 to 5,939 nesting pairs on East Sand Island)." This reduction of predation on ESA-listed juvenile salmonids was called for in the National Marine Fisheries Services' 2014 Supplemental Federal Columbia River Power System Biological Opinion. The Management Plan includes coordination with the U.S. Fish & Wildlife Service and States to implement the Pacific Flyway Council Monitoring Strategy annually through 2019. A dual-frame methodology of sampling and analysis was used. Effort was concentrated on the largest, active colonies to ensure the majority of the population was sampled. The number of active nests counted at selected colonies provides an index to estimate the population. Surveys were completed to estimate peak number of breeding Double-crested Cormorants, through nest counts. The Service assembled and processed all colony information and derived estimates of the Western Population. The Astoria-Megler Bridge hosted the largest colony in 2019, with 3,542 breeding pairs. Other large colony complexes were in Washington, Idaho, and Utah. The observed 2019 peak for the East Sand Island colony was 350 breeding pairs. There was an overall shift in the size of colonies from larger to smaller. The 2014-2019 preliminary estimated population size ranged from 22,164 - 37,454 breeding pairs. The estimated population size was smaller in 2019 compared to 2014, 2015, and 2016 ($p<0.01$). Estimates were higher than predicted by the Double-crested Cormorant Western Population Model. The Service uses these data to support federal Migratory Bird Permit decision-making.

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Experimental clutch removal fails to find renesting in Red Phalarope (*Phalaropus fulicarius*) breeding near Utqiaġvik, Alaska [#]

Renesting is thought to be uncommon for Arctic-breeding shorebirds because breeding seasons are short and energy constraints may limit birds to a single clutch. However, the only study to experimentally assess renesting through clutch removal found high rates of renesting by the monogamous Dunlin (Gates et al. 2013). We used a clutch removal experiment to assess renesting propensity on the sequentially polyandrous Red Phalarope (*Phalaropus fulicarius*), allowing us to compare renesting in a species with a different mating system and explore factors affecting renesting near Utqiaġvik, Alaska. None of 23 males whose nests we experimentally removed or had been abandoned/depredated were known to renest in our study area. We could only confidently conclude that 4 males did not renest as 19 males left our study area prior to the end of the laying period and may have renested elsewhere. The Operational Sex Ratio was strongly male-biased when most males lost their clutches, so opportunities to renest at our study site were likely limited. Had we conducted our clutch removal experiment in a year with an earlier and longer breeding season, it is possible that some males would have renested. Future studies designed to study renesting in phalaropes will need to be able to track and monitor the behavior of individuals across large distances after experimental or natural clutch loss.

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Bald Eagles and seabirds: New evidence reveals predation events on an endangered alcid, the Marbled Murrelet (*Brachyramphus marmoratus*), and other species along the central Oregon Coast [#]

Marbled Murrelet populations have declined across much of their range, especially in the Pacific Northwest, and the species is currently listed as endangered according to the IUCN. This elusive seabird forages in nearshore waters and nests in adjacent mature forests, yet the role of contemporary mortality agents on adults are poorly understood. Raptors (e.g. Bald Eagles [*Haliaeetus leucocephalus;* hereafter "eagles"] and Peregrine Falcons [*Falco peregrinus;* hereafter "falcons"] are known to prey on seabirds, and therefore have the potential to impact local populations. During the 2017-2019 breeding seasons, we captured 190 adult Murrelets off the central Oregon Coast and attached VHF-telemetry tags to monitor inland movements to nest sites and marine space use. Most Murrelet mortalities we documented (51.5%, 17 of 33) were suspected to be caused by raptor predation because of a combination of physical damage to carcasses (e.g. plucked feathers and flesh) and because tags from missing Murrelets were tracked close to eagles/falcons perched sites and nest areas. This was the case in 2017 and 2018 when four out of 12 and nine out of 15 raptor-induced Murrelet mortalities, respectively, were suspected. In 2019, tags from four out of six confirmed mortalities were tracked to four distinct eagle nests, prompting us to collect prey remains in August. We found that 85% of the prey items recovered in and adjacent to eagle nests were identified to seabirds (91% Common Murres [*Uria aalge*]) followed by mammals (6%), shellfish (6%), and fish (3%). Given marked increases in coastal eagle populations and direct observations of eagles taking adult Common Murres at colonial nest sites, we hypothesize that raptor predation pressure on Murrelets and other seabirds along the Oregon coast may be substantial and that additional research is needed to better understand the dynamics of "seabird-raptor" interactions and their impact on seabird demography.

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Landbird response to cottonwood restoration in riparian habitat at the McNary National Wildlife Refuge

McNary National Wildlife Refuge has historically supported cottonwood gallery forests along the Walla Walla Delta in southeastern Washington. However, in the early 2000s these gallery forests were degraded due to a combination of catastrophic wildfires and altered water level hydrology, which exacerbated lack of natural recruitment in the area. Due to the rarity of these habitats and their overwhelming importance to multiple guilds of birds, the refuge has put a significant amount of investment into large scale restoration of these cottonwoods. In 2005, McNary National Wildlife Refuge initiated a cottonwood restoration project to enhance structure and diversity of riparian habitat, and monitor landbird response to restoration efforts. We implemented a passive restoration project to establish cottonwoods at varying time intervals, resulting in three stand age classes (established, mid-seral, and early seral). We established three point count plots in each stand class, and, beginning in 2018, conducted point count surveys for breeding landbirds. We assessed abundance, species composition, and species diversity by stand age class and year, and grouped species into nesting guilds to examine relationships between nesting substrate and stand age association. These surveys will allow refuge staff to determine which age class(es) support(s) the highest species diversity, as well as which stand(s) are most beneficial to priority species, and will ultimately increase refuge capacity to provide resources to breeding and migratory landbirds.

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Population biology of the invasive Asian clam *Corbicula fluminea* in the Columbia River #

The Asian clam, *Corbicula fluminea*, was introduced into the U.S. in the Columbia River in the 1930's and is now found in 46 states. *C. fluminea* can outcompete native clams, as well as clog aquatic infrastructure, causing extensive damage. We measured *C. fluminea* individual growth rates in the Columbia River, to provide insight into its ecology that may aid in its control. Over three summer growing seasons (2017, 2018, and 2019), clams were collected bi-weekly from two locations on the Columbia river near Vancouver, WA. Individual clams were weighed and measured with digital calipers. Individual growth rates were determined through modal progression analysis, using the FAO-ICLARM Stock Assessment Tool (FiSAT). Clam abundance was highly variable at each location between years, however in 2017 the clams were on average smaller and younger (<6mm) than in 2018 and 2019. This was likely due to colder temperatures and higher water levels in the Columbia River during 2017. Moreover, negative growth rates were observed for large adult clams (>25mm) in all years, possibly as a result of size selective predation. This knowledge may aid in management Asian clams, as well as other invasive bivalves that are anticipated to invade the region in the near future (e.g., zebra and quagga mussels).

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Patterns of genetic diversity in the Columbia Basin Project [#]

Increased development, agriculture, and large irrigation projects have strongly impacted aquatic ecosystems by contributing to habitat fragmentation and altered environmental conditions. Understanding impacts on biotic communities requires research that incorporates population genetics and landscape ecology, preferably over multiple time scales to capture historical and current eco-evolutionary processes. We have focused our study on the pelagic invertebrate *Daphnia pulicaria*, which produces resting eggs (ephippia) that survive in sediments for decades. Our study system includes the lakes and canal system of the Columbia Basin Project (CBP) in southeast Washington State, which built 6 dams and >480 km of canals for irrigation, flood protection, and power. As one of the earliest (c. 1945) hydrological development projects, it provides the opportunity for historical comparison of native *Daphnia* populations, which occur throughout the region. We collected sediment cores from 22 lakes within and 8 outside of the boundaries of the CBP for our analyses. Sediment cores from two lakes, one from within and one from outside of the CBP, were submitted to an independent laboratory for ^{210}Pb dating to determine a timeframe for sediment deposition. The upper 4 cm of sediment reflects our contemporary populations. Preliminary population genetic analysis consisted of microsatellite genotyping of contemporary populations from 4 lakes within, and 3 outside of the CBP. I will discuss results for the contemporary populations as well as future work analyzing historical DNA. Contemporary populations are more similar when connected by water flow at more proximal distances, while still exhibiting priority effects driven by reproductive mode. Population genetic analysis combined with environmental data collected from the study lakes will enable us to infer eco-evolutionary patterns in this system.

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Noisy nights in east Idaho: A bat community inventory at Camas National Wildlife Refuge

Bats are an ecologically significant taxonomic group whose beneficial services include the consumption of large quantities of nocturnal insects, many of which are forest and crop pests. Today, they face unprecedented threats, including wind power development, habitat loss, climate change, and most recently White-nose Syndrome. The development of effective conservation strategies requires an understanding of each species' distribution and use of the landscape. However, this information is relatively sparse for the bats of the northern Intermountain West. Camas National Wildlife Refuge (Refuge) in east Idaho encompasses wetland, riparian, and shelterbelt assemblages believed to be important foraging and roosting habitat for bats in the Snake River Plains. But the composition and phenology of the bat community here was undescribed. Therefore, in 2012, we conducted a two year acoustic inventory to identify bat species occurrence on the refuge. In 2014, we expanded with a five year study acoustically monitoring bat use of different habitats within the refuge boundaries. We found that the Refuge hosts a diverse bat community comprised of 11 of the 13 species known to occur in Idaho; that 6 species are common and widespread on the Refuge; that all habitat types were dominated by little brown myotis (*Myotis lucifugus);* and that the shelterbelt site hosts the greatest species diversity and reported the highest average activity rate among the sampled sites. These studies provide valuable baseline data for the bat community within the Snake River Plains of east Idaho. Furthermore, the dominant presence of little brown myotis, a species with a known vulnerability to White-nose syndrome, may make this site an effective location to surveil for declines indicative of White-nose syndrome in east Idaho.

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Applying emergency management concepts to model the risk of hybridization between native and introduced salmonids #

One of the primary goals in emergency management planning is to minimize the impact of catastrophic events and improve the resiliency of those systems that are impacted. This is accomplished through an integrated approach that takes a system-wide perspective. Emergency planning is a cyclical process that begins with the analysis of hazards and vulnerabilities. The same approach can be applied in the management of risks to threatened or endangered species. When assessing the risk of hybridization between native and introduced salmonid species, the temporal and spatial use of spawning habitat, combined with the spatial distribution of habitat types associated with different salmonid life stages, and species distributions can be used to categorize hybridization risk. Risk can be further defined by understanding how other ecosystem components may influence the occurrence of hybridization. Our approach uses geospatial analysis of current species distribution data and habitat use based on species life history, combined with stream characteristics, to model hybridization risk between a threatened native species, Bull Trout (*Salvelinus confluentus*), and an introduced species, Brook Trout (*S. fontinalus*), in the state of Oregon. We are presenting the preliminary modeling results of hybridization risk based on the distribution of native Bull Trout and introduced Brook Trout, combined with life-stage specific habitat use by native Bull Trout. Long-range project goals include the development of tools that can be used to aid integrated management efforts focused on improving the resiliency of native Bull Trout populations facing threats from introduced species.

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Beavers buffering blazes: The potential role of *Castor canadensis* in mitigating wildfire impacts on stream ecosystems #

Beavers (*Castor canadensis*) are considered ecosystem engineers due to the influence of their dam-building activities on abiotic and biotic characteristics of stream ecosystems. However, beaver populations remain far below historical levels. Beaver reintroduction has been used as a restoration tool to reverse stream incision, store groundwater, restore riparian vegetation, and create wildlife habitat. It has been suggested that beaver reintroduction could also help mitigate the effects of wildfire on stream ecosystems, but studies examining this interaction between beavers and wildfires are lacking. In this study, we examined the impact of wildfire on stream ecosystems with and without beavers using benthic macroinvertebrates as indicators of water quality. We collected macroinvertebrates and recorded abiotic stream characteristics above and below beaver dams in burned and unburned areas in the Methow Valley, Washington. Macroinvertebrate community composition varied across sites types, with higher numbers of sensitive taxa (Ephemeroptera, Plecoptera, and Trichoptera) generally found unburned areas and below dams in burned areas, and lower numbers found above dams in burned areas. Above-dam burned areas tended to have higher amounts of fine sediments, and overall showed greater variability in stream characteristics. These findings provide preliminary support for the hypothesis that beaver dams mitigate the impacts of wildfire on downstream ecosystems. Beaver reintroduction may therefore present a viable method of climate change adaptation.

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Formalin-free fish at Eagle Creek NFH in Estacada, Oregon

Formalin (formaldehyde) is the only FDA approved chemical for use in salmon culture to treat fungal growth (*Saprolegnia*) on eggs. While formalin has been shown to be effective, it poses a human health risk and may negatively affect immune system development of treated salmon. An alternative to treatment is hand picking dead eggs during relatively stable times of development and removing any dead organic material. We hypothesized that there would be no significant difference in survival to eye up of untreated eggs when compared to formalin treated eggs. In BY (Brood Year) 17, 25% of the spawned eggs were not treated with formalin and were handpicked during the 140 to 150 degree day window; in BY18 this trial was repeated with 50% of the eggs being untreated. In BY17, treated eggs had a 94% survival rate to eye up while untreated had a 95% survival rate. In BY18, treated eggs had a 96% survival rate to eye up, while untreated had a 94% survival rate. For BY17 and BY18 the difference in survival to eye up was regarded as negligible relative to the benefits of going formalin free. In BY19 we have gone to 100% untreated eggs, however they have not reached eye up as of the day of this report.

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Unexpectedly high genetic diversity in a rare and endangered seabird in the Hawaiian Archipelago #

Seabirds in the order of Procellariiformes have one of the highest proportions of threatened species of any avian order. Species undergoing recovery may be predicted to have a genetic signature of a bottleneck, low genetic diversity, or higher rates of inbreeding. The Hawaiian Band-rumped Storm-Petrel (ʻAkēʻakē; *Hydrobates castro*), a long-lived philopatric seabird, suffered massive population declines resulting in its listing under the Endangered Species Act in 2016 as federally Endangered. We used high-throughput sequencing to assess patterns of genetic diversity and potential for inbreeding in remaining populations in the Hawaiian Islands. We compared a total of 24 individuals, including both historical and modern samples, collected from breeding colonies or downed individuals found on the islands of Kauaʻi, Oʻahu, Maui, and the Big Island of Hawaiʻi. Genetic analyses revealed little differentiation between breeding colonies on Kauaʻi and the Big Island colonies. Although small sample sizes limit inferences regarding other island colonies, downed individuals from Oʻahu and Maui did not assign to known breeding colonies, suggesting the existence of an additional distinct breeding population. The maintenance of genetic diversity in future generations is an important consideration for conservation management. This study provides a baseline of population structure for the remaining nesting colonies that could inform potential translocations of the Endangered *H. castro*.

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Community-driven habitat restoration on an urban river corridor: Approach and initial results #

The Intermountain Bird Observatory, Golden Eagle Audubon Society, Treasure Valley Native Plant Network, Boise State University, College of Western Idaho and the Idaho Department of Fish and Game initiated habitat restoration along a 22 acre stretch of the Boise River in 2018. With the intent to determine the most successful restoration practices, 45 experimental plots were planted with 2,070 seedlings of 22 native shrub and forb species using three distinct treatments. To facilitate planting such a high number of seedlings, a volunteer planting day was organized in early October of 2018 that engaged over 150 community members. During the summer of 2019, weekly watering and weeding was performed to encourage seedling growth and data was collected on seedling survival. A similar volunteer planting in October 2019 occurred resulting in 1,630 seedlings of 26 species being planted by 112 volunteers. Here we present data on overall survival between three different experimental treatments and key findings of species-specific survival variation among treatments and individual plots. These results will inform future restoration decisions at this site as well as a network of other restoration sites along the Boise River corridor, and this effort will continue to engage and expand a community of volunteers interested in local urban habitat restoration.

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The beginnings of mussel research at the Abernathy Fish Technology Center

Little research has been done with Pacific Northwest mussels to understand their physiology, behavior and nutritional needs. The Abernathy Fish Technology Center (AFTC) has begun laboratory studies to investigate mussel physiology in relation to environmental stressors using non-lethal sampling methods, to study mussel behavior as it is affected by water temperatures, to understand the production of glochidia, the species specific host fish relationship to the mussel and the culture needs of larval mussels and to gain a better understanding of native mussel nutrition including the composition as well as the particle size of the food consumed. The laboratory work concerning environmental stressors can be applied to field work to investigate the extent and cause(s) of the mussel die offs. Additionally, the AFTC can use the analysis of mussels for nutrient content to gain information about their health status in an effort to determine the cause of mortalities found in the field. Currently the AFTC is working exclusively with the Western Pearlshell Mussel (*Margaritifera falcate*) collected from Abernathy Creek.

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Science Briefs

Midway seabird protection project: the final countdown

The U.S. Fish & Wildlife Service (Service) will be implementing a plan to remove invasive mice from Sand Island, Midway Atoll National Wildlife Refuge. This removal is necessary to protect the largest colony of albatross in the world as well as 29 other species of birds that rely on Midway Atoll. On more than 500 other islands worldwide, similar invasive rodent removal campaigns successfully resulted in long-term benefits to native species and outweighed the limited, short-lived negative impacts from an eradication operation. The effort on Midway has many challenges including endangered non-target species, extensive infrastructure and a community of 50 people that live on the island. This presentation will provide an update on scientific data collected to support the project and how monitoring and data collection are interwoven throughout the project. The lessons learned from these research and monitoring projects can be applied to rodent eradication efforts across the world.

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Getting the BIG PICTURE on BAER: An effort to consolidate data on post-fire habitat rehabilitation treatments at Hanford Reach National Monument

Wildfires on National Wildlife Refuges can cause significant damage to infrastructure and natural resources. The interagency Burned Area Emergency Response program (BAER) provides funding, on a competitive basis, for measures aimed at stabilizing and restoring affected ecosystems. Treatments to mitigate damage and habitat degradation may include invasive plant control and re-establishment of native species. Though each BAER project requires that a final accomplishment report be submitted documenting all of the actions taken, it can be difficult to get a complete picture of all treatments that have been implemented over time. Such information however is critical in understanding both the current condition of the landscape and determining which management actions are most effective at rehabilitating systems after fire. We sought to overcome this issue by compiling all data for BAER treatments conducted at Hanford Reach National Monument from 2002 through 2018 and uploading those data to the USFWS Region 3 Management Actions Database (R3MAD). The R3MAD is an ArcGIS Online-based tool that provides a robust framework for storing and analyzing geospatial data for a variety of treatment types, including chemical and mechanical weed treatment as well as seeding and planting of native species. Once entered these data can be easily shared with managers, planners, and fire management staff in a variety of formats such as ArcGIS Web Maps and Story Maps. In this brief presentation, we will demonstrate the types of data that have been compiled and how they may be used to foster better management of refuge resources.

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A plethora of plovers: species comeback on the Oregon Coast

The western snowy plover is a petite, cryptic shorebird that breeds along the Pacific Coast in California, Oregon, Washington, and Mexico. Loss of habitat, predation pressure, and human disturbance have caused their numbers to decline and they were listed as threatened in 1993. At that time, plovers were known at only 6 sites within Oregon and their numbers were dwindling. European beachgrass reduced the amount of open sand available for nesting plovers and allowed predators to creep in closer. Dogs and their humans enjoyed recreating on plover nesting grounds. Ravens and crows were attracted to the trash left by beach goers and helped themselves to plover eggs and chicks as well. However, actions implemented in the past two decades by land managers have turned this around. Protecting and restoring open sand habitat, cordoning off parts of the beach to prevent disturbance, and predator management in strategic areas have all combined to turn the tide on plover numbers. Over the past twenty years, breeding plover numbers have increased from less than 100 birds along the coast of Oregon to over 430 nesting plovers. Winter numbers have seen similar increases. These numbers exceed the USFWS Recovery Plan targets for Oregon.

Plovers have a team of dedicated staff behind them. But this success is also due to a willing and engaged public. Oregonians have shown their willingness to keep Spot on a leash and to staying on the wet sand to allow their feathered fellow beach goers to prosper. Western snowy plovers are a “conservation reliant” species and climate change impacts are going to increase that management need. However, with continued partnerships, we are up for that challenge.

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Distribution, relative abundance, and size of sculpins in the Elwha River watershed following the removal of two large dams

Dam removal is becoming a common river restoration activity that is intensively studied and shows positive affects for many charismatic fish species. In contrast, the direct and indirect impacts to less notable species are not well documented. The Elwha River, WA had two large dams removed from 2011 to 2014, which resulted in the loss of two reservoirs. Because of glacial history, the Elwha system has a depauperate fish fauna including just two sculpin species (coastrange sculpin [*Cottus aleuticus*] and prickly sculpin [*C. asper*]). Both sculpin species exhibit a similar life history strategy, which includes a planktonic larval stage that drifts downstream to a nursery area (e.g., lake, large river, or estuary), followed by an upriver movement pattern that may last the rest of their life. Due to these characteristics, dam removal in the Elwha River may have important effects on these two sculpin species, but to date has not been documented. We sampled sculpin with longitudinal electrofishing surveys in 2018 and 2019 to evaluate their current distribution, size, and relative abundance. These metrics were generally similar to other river systems in the Pacific Northwest, with fewer and larger sculpin upstream. Analysis of historic data indicate sculpin were further upstream in the basin, had greater relative abundance, and a wider range of size classes prior to dam removal. This suggests the overall distribution of sculpins in the Elwha has likely been reduced from dam removal, but it is unclear how indirect effects may influence the two species. This study identifies previously overlooked effects of Elwha River dam removal, and provides a baseline to monitor sculpin population changes in the future.

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Behind the bulrush: The first two hundred days of swan tracking in the Greater Yellowstone Ecosystem

Within the Intermountain West, the tristate area of Idaho, Montana, and Wyoming supports the U.S. segment of the Rocky Mountain Trumpeter swan population. Over the last two decades, the growth of this segment appears to be driven by steady increases in the Wyoming and Montana flocks. By contrast, the Idaho flock has shown no significant trend in annual growth and concerns are mounting that we may be witnessing the onset of a decline. Each year, an estimated 50-75% of Idaho flock nesting attempts occur at three refuges within the Southeast Idaho NWRC. Initial investigations cited insufficient cygnet survival but subsequent banding efforts have also drawn into question rates of adult and fledgling overwinter survival and site fidelity. We know very little about the off-refuge movements, survival, and site fidelity of Refuge swans, which confounds our ability to identify factors contributing to flock decline. Therefore, we seek to better understand whether the disappearance of refuge swans is due to mortality or emigration through collecting information on wintering locations, survival, and nesting/molting site fidelity. In July 2019, we deployed four Ornitela GSM-GPS tracking collars at each of four refuges in the Greater Yellowstone Ecosystem to test whether this technology will provide the battery life and data upload frequencies necessary to gain insight on these conservation questions. During the first two hundred days of deployment, we have observed regular upload frequencies and good battery health from three of the four collars. We will continue to monitor these birds for collar-associated swan mortality, battery health, and upload frequencies throughout the winter. If they perform acceptably, we aim to deploy more collars in the near future.

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Using technology to enumerate lamprey passage

To promote the passage of adult Pacific Lamprey *(Entosphenus tridentatus)*, dam passage modifications are being installed across the Columbia River Basin. In 2014 passage deficiencies were identified at Warm Springs National Fish Hatchery. Due to this, in 2017, a Lamprey Passage Structure was constructed to ameliorate these deficiencies. Scientist have had difficulties enumerating lamprey populations through these passages in the past due to their nocturnal movement and the limits of commercially available video monitoring systems. Biologists at the Columbia River Fisheries Program Office have designed a custom monitoring system that allows us to capture high quality video of lamprey as they pass through the LPS. This design records infrared footage so as not to disturb or deter lamprey from passing. It also can be accessed remotely, allowing for easy download of video from a remote location. Using a backup infrared camera set to run continuously we were able to verify all 28 lamprey detections during 2019's run. Of these detections 3 lamprey were tagged and detected by a PIT tag array attached to the effluent of the LPS. This system has proven effective at Warm Springs and ideally will work in similar situations.

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Quagga 2.0: invasive mussel updates

“Reboot” your invasive mussel knowledge! Quagga mussels (*Dreissena rostiformis*) and zebra mussels (*Dreissena polymorpha*) are two species of freshwater bivalve mollusks in the Family Dreissenidae that are invasive in North America. Originally transported to the United States via ballast from large transoceanic cargo ships, zebra mussels were first discovered in Lake St. Clair in 1988; quagga mussels in Lake Erie in 1989. Since these introductions, both species have invaded freshwater drainages, aided by many pathways including water-based recreation. Since their introduction and invasion, extensive amounts of literature have been published documenting environmental and economic impacts, and control methods. Genomic research has transformed our understanding of *Dreissena* natural history and biology. Initiatives to prevent further spread of invasive mussels and other aquatic invasive species are aggressive and ongoing. This presentation will summarize recent research including control methods, prevention activities, and ongoing national and regional initiatives related to invasive Dreissenid mussels.

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Wetlands status and trends

The Wetlands Status and Trends project comprises the monitoring component of the National Wetlands Inventory (NWI) program. This project along with the NWI geospatial dataset, which comprises the mapping component, provide complementary information on wetland and deepwater habitat type, location, and trends to best support a broad array of decision support needs. Wetlands Status and Trends reports provide critical information on recent and historical changes in wetland and deepwater habitat type and acreage. The historical database that the Service has developed through Status and Trends provides visual evidence of wetlands and deepwater extent, as well as land use, dating back to the 1950s. This provides an accurate record to guide the development of new U.S. aquatic resource policies, and determine the effectiveness of current policies and management strategies.

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Traditional Oral Presentations

Providing measurable habitat for a displaced bat population

Bat habitat selection across Western North America is largely unknown. When large artificial roost sites for bats are found, biologists have the ability to learn valuable information about these species. PacifiCorp's Oneida hydroelectric development, completed in 1920, includes an abandoned residential complex known for years to have structures occupied by bats. Early attempts at evicting bats from these structures had resulted in unwanted bat occupation of the dam's nearby powerhouse. In 2017, PacifiCorp reached out to partners inquiring about how best to provide an alternative roost structure for the bats while ultimately remediating the site. The team, made up of experts from across the United States, took a scientific approach at identifying some key characteristics of the existing habitat in hopes of recreating them in the proposed alternative structure. An architectural firm was contracted to incorporate the best materials for providing the climate characteristics that were expressed in the residential complex habitat. The new habitat, which is called a bat condo, was built and placed on site in early 2019 prior to bats returning to the site. By May, bats had moved into the condo and by summer it was identified as a Yuma myotis (*Myotis yumanensis*) maternity roost, one of the larger roosts in Idaho. In light of White-nose Syndrome (WNS), a disease that affects hibernating bats, Idaho's WNS surveillance is critical to understanding the progression and impact it may have on bat species, including the Yuma myotis. Success of the condo will allow biologists to better define the habitat needs of the Yuma myotis during pup rearing and also provide a long-term monitoring locations for WNS.

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Palmyra Atoll coconut control project update: Seabirds as natural partners in maximizing island ecosystem resilience to climate impacts

Seabirds play an important connectivity role for terrestrial and marine ecosystems through allochthonous nutrient transfer. Here, we present a conservation intervention leveraging a seabird-driven land-sea connection to enhance an atoll's resilience to climate impacts. In April 2019, The Nature Conservancy, U.S. Fish and Wildlife Service, and Island Conservation initiated the Palmyra Atoll Rainforest and Reef Resilience Project to maximize the quantity and distribution of seabird-derived nutrients subsidizing primary productivity on land and in nearshore marine habitats. Palmyra Atoll, an incorporated, unorganized U.S. territory supports the only protected rainforest in the region. This conservation action entails replacing the atoll's estimated 27,000 coconut palms (covering > 40% of forested land) with native tree species preferred by seabirds as roosting and nesting habitat. Research conducted at Palmyra shows a significant relationship between seabird-derived nutrients (guano) and primary productivity in both terrestrial and coral reef systems. We report on the current status of the control efforts and our evolving monitoring techniques using Unmanned Aerial Systems (UAS) and other standard monitoring methods to measure change in seabird distribution and abundance in response to rainforest realignment along with repeat measures of nutrient concentrations in submarine groundwater discharge to track change in seabird-derived nutrient subsidies to the marine environment. With this conservation intervention, we hope to establish a climate adaptation tool for other seabird islands previously converted to copra plantations.

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Species status assessments in a data poor world

Species Status Assessment (SSA) reports now provide the scientific foundation for most status decisions under the Endangered Species Act. The SSA process follows a specific framework by which we assess the viability of a listable entity based on resiliency, redundancy and representation. The dearth of available information on many of the species the Service must review makes these status assessments particularly challenging. By looking at examples from completed SSAs, this presentation will illustrate how SSAs incorporate available scientific information, address data gaps and other scientific uncertainty, and engage subject matter experts in an effort to understand a species current and projected future status. The presentation is intended to enhance understanding of the constraints on SSAs and how the analysis differs not only from the way the Service previously reviewed a species' status, but also from status reviews and conservation assessments developed by other Federal, state, and non-governmental agencies.

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A tale of three understories: Upland avian communities differ by degree of Crested Wheatgrass invasion of sage-steppe habitat

Sagebrush-steppe is among the most imperiled ecosystems in the western United States, challenged by fundamental alterations to ecosystem function, including invasion with non-native grasses. Crested Wheatgrass (*Agropyron cristatum*) is one of the most widespread non-native grasses, occupying > 26,000 square miles in the West. In spite of its prevalence, the influence of crested wheatgrass on wildlife is not well understood. We sought to compare the upland avian communities associated with varying degrees of crested wheatgrass invasion at Camas NWR in east Idaho in order to determine if and how restoration of crested wheatgrass monocultures might impact native landbirds. Between May and July of 2014-2016, we conducted point-counts within the following three habitat types: crested wheatgrass monoculture, sagebrush with crested wheatgrass understory, and sagebrush with native understory. We compared baseline avian species richness, community composition, and individual species abundance among these habitats, and then predicted how the avian community would respond to restoration. These results suggest that restoration of crested wheatgrass monocultures back to sagebrush will improve habitat value for much of the sagebrush bird community whether or not the understory can be converted to primarily native grasses. The Brewer's Sparrow (*Spizella breweri*), a sagebrush species of concern, occupied both shrub habitat types at similar abundances, and could serve as a metric of intermediate restoration success. However, Sagebrush Sparrow (*Artemisiospiza nevadensis*) and Sage Thrasher (*Oreoscoptes montanus*), which were significant indicators of sagebrush with native grass, will likely benefit most from restoration of a native herbaceous understory. Grassland associated birds like Horned Lark (*Eremophila alpestris*) and Grasshopper Sparrow (*Ammodramus savannarum*) were most abundant at Crested Wheatgrass-dominated sites and may not benefit from restoration back to shrubland.

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Herding the fish: streamlining the storage, analysis, and distribution of National Fish Hatchery data with the adoption of a single database

Fourteen National Fish Hatcheries (NFHs) and four Fish & Wildlife Conservation Offices (FWCOs) exist within the U.S. Fish & Wildlife Service's Columbia-Pacific Northwest Region. Staff from those facilities collect a wide range of salmonid data. Most of those data are stored in multiple databases and a large variety of spreadsheets that lack a standardized, unified structure that makes data aggradation and synthesis time consuming and inefficient. Only one of those repositories provides real-time access to data, and individuals interested in acquiring NFH data must contact local data managers instead of accessing information through an Internet portal.

In 2018, a decision was made to adopt the Fish Inventory System (FINS) on a region-wide basis to address the aforementioned issues. Several activities are being undertaken to facilitate the adoption of that Internet-based database. In 2019, an implementation plan was developed with the goal of identifying specific activities that will lead to the successful use of the FINS. Six NFHs started using that database in 2018 or 2019, and staff at those facilities are receiving module-specific training sessions designed to build proficiency with entering data into the FINS. New functionalities that can be incorporated into the FINS to better address the Service's data analysis and reporting needs are being identified. And NFH and FWCO staff are collaboratively developing templates that will be used to summarize data in a more uniform manner. These and several additional activities that will be implemented in the coming years will collectively enhance the Service's ability to store, analyze, and distribute NFH data in a more efficient, robust fashion, and facilitate sharing those data with partners in the Pacific Northwest that co-manage salmonid resources.

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Sound metrics matter - characterizing sounds used in wildlife impact analysis

The Service evaluates sound in a number of contexts. Sound analysis is complex, and the science is constantly evolving. Whether evaluating the impact of sound on listed species, designing research projects, or implementing recovery and conservation actions, it is important to use the appropriate sound metrics to describe and compare sounds. An animal may perceive a sound of 92dBArms very differently than a sound with the same numerical value, but measured as 92dBApeak. The two are not directly comparable. Appropriate characterization of sounds in both in-air and underwater sound analyses is necessary for accuracy and defensibility. Mischaracterization of sounds can lead to an under- or overestimate of impact, and lessens the defensibility of our analyses. This presentation will provide biologists the knowledge necessary to understand the implications of various sound metrics on impact analyses. Attendees will gain a working knowledge of how to use, cite, and compare common sound metrics and descriptors including frequency weighting, reference pressure, peak pressure, and sound exposure level. We will identify the best metrics for characterizing impulsive sound compared to continuous sound, and in-air sound compared to underwater sound. This information is applicable to conducting impact assessments for a wide variety of fish and wildlife species including Northern Spotted Owl, Marbled Murrelet, and Bull Trout.

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Teaming up to protect MacFarlane's Four-o-clock (*Mirabilis macfarlanei*): How strong conservation partnerships are guiding recovery of this threatened plant species

To say finding a MacFarlane's Four-o-clock plant is difficult would be an understatement. First, many of the populations (scattered along the Salmon, Snake, and Imnaha river canyons in west-central Idaho and northeast Oregon) are remote and not easily accessible. Second, it is extremely rare, only known from 13 populations. Given the vast amount of habitat, it can be like looking for a needle in a haystack. But when you do see this plant it is an extraordinary sight. The showy, bright magenta flowers and mounds of emerald green leaves light up the surrounding dry canyon grasslands. Unfortunately, recruitment of new plants has rarely if ever been observed, and despite years of surveying, no additional populations have been located. To complicate survival more, non-native plants are one of the primary threats. Fortunately, a team of committed partners has been actively working together to implement a multifaceted approach to conservation and recovery of this species. Although long-term monitoring indicates an overall stable population trend, the lack of apparent recruitment is concerning. Therefore, an important part of the recovery strategy is augmentation of existing, and creation of new populations. Previous reintroduction efforts have involved the successful transplanting of Macfarlane's four-o-clock rhizomes collected from existing populations. However, the use of seedlings would be a less intrusive approach and is currently being pursued. In order to design and implement reintroduction projects thoughtfully and effectively, we undertook a variety of studies including a genetic analysis, soil study, propagation studies, and habitat modeling. In addition to these results, additional conservation actions such as testing UAVs to survey in remote locations and biological control agents to help control noxious weeds, will be presented.

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Juvenile mussel caging studies as a tool to evaluate the feasibility of restoring Western Pearlshell Mussels to western rivers

Western Pearlshell (*Margaritifera falcata*) are long-lived freshwater mussels native to the western United States and Canada. They are considered an imperiled species, with significant population declines throughout their historical range, and reduced abundance and recruitment documented in many populations. Many rivers within the species' historic range are impacted by numerous stressors, including water level fluctuations from hydropower operations; reduced nutrient inputs; poor water quality/contamination; and invasive species. There is growing interest in restoring dwindling or lost populations of Western Pearlshell in some of their native watersheds, and researchers have made great strides in recent years in the science of captive propagation of this species. However, there is much to be learned about successful transition of hatchery-reared juveniles to the wild if restoration efforts are to succeed. We conducted a field caging study to evaluate survival and growth rates of juvenile Western Pearlshell over a range of suitable habitats types with various environmental stressors. We observed the highest mortality at all sites for the first few weeks of the study, suggesting an acclimation period to the new habitats. Over the three-month study period survival was 68-88%. Growth was reduced at sites with more stressors compared to sites with fewer stressors. These findings suggest that while growth rates may be slower at some sites, restoration of mussels is potentially feasible at any of the sites we studied. Although more research is needed to evaluate longer term survival and growth, particularly over a range of temperature and flow extremes, this study represents an important preliminary step to restoration planning.

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Bull Trout abundance and population structure in a glacial headwater stream

Bull Trout (*Salvelinus confluentus*), listed as threatened under the Endangered Species Act, are difficult to sample, resulting in limited population level information throughout much of their range, despite abundance remaining a key evaluation metric in species recovery. Common sampling challenges include low capture efficiency, turbidity, dynamic flow, gradient, and access to key habitats. Glacial headwater streams accentuate all of these challenges and therefore generally lack bull trout abundance information. To fill this information gap, we censused Fryingpan Creek, a glacial headwater tributary to the White River, WA in 2019. We implemented an intensive mark-recapture sampling regime utilizing PIT-tagging and a series of PIT arrays to garner a precise estimate of Bull Trout abundance, and inform population structure. We installed a series of PIT arrays in Fryingpan Creek in June to divide the approximately 3 km of available habitat into equal sections. We completed four continuous backpack electrofishing events in the entirety of the available habitat for a multiple pass mark-recapture population estimate in July. We captured 427, PIT-tagged 159 (>100mm), and recaptured 39 Bull Trout during the four sampling occasions. Immigration and emigration from the sampling area based on the continuously operated PIT arrays was minimal during July. Multiple marks (fin clip and PIT tag) allowed estimation of tag retention, which was >95% overall. This information validated crucial model assumptions and allowed precise abundance estimates for three size classes (100-150, 151-200, and >200 mm) of Bull Trout in Fryingpan Creek. This study provides novel information on abundance and population structure of Bull Trout in a highly dynamic glacial headwater stream, and provides a roadmap for future monitoring and management actions of this listed species.

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Experimental removal of Barred Owls to benefit Northern Spotted Owls: preliminary results and management options

Competition from non-native Barred Owls was identified in the Recovery Plan as a primary cause of the current rapid decline in populations of the Northern Spotted Owl (Spotted Owl). The impact has reached a level where the long-term persistence of Spotted Owls is in question without additional management intervention. Based on a successful pilot study in California, the U.S. Fish & Wildlife Service initiated a Barred Owl removal experiment, with the U.S Geological Survey, to determine if Barred Owl removal would improve the population dynamics of spotted owls at a larger scale. The experiment, initiated in 2013 on the Hoopa Reservation in California, now includes four study areas from across the range of the northern spotted owl in Washington, Oregon, and California. With three to six years of removal completed, we present preliminary information on the effectiveness of the removal experiment, and how this information will be incorporated into the development of a Barred Owl management strategy.

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Online tool provides managers and planners with potential future ranges of all Hawaiian plants

Plant ranges are strongly defined along Hawaii's extreme rainfall and temperature gradients. Consequently, ongoing changes in climate are shifting where these native species can grow. These shifts will interact with topography and other factors to change how vulnerable species are to extinction. We developed an ArcGIS Online tool designed to help land managers, conservation practitioners, and others plan for the potential impacts of climate change on native Hawaiian plant species. Because Hawaii's climate is already changing, historical ranges of plants are not reliable guides for the future. In previous research, changes in range, together with habitat metrics and life history traits, were used to calculate climate change vulnerability scores for each species. Using an interactive map in the online tool, users can define an area of interest in several ways, then export range data on each plant species that could occupy the area of interest under current conditions and under three climate projections for the year 2100 (A1B, RCP4.4, RCP8.5). The tool also provides area-specific vulnerability scores for the species under each future scenario. This presentation will discuss the derivation of the underlying range projections and the vulnerability scores and include a live demonstration of the tool.

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Impacts of ration size on growth and sexual saturation in YY Brook Trout: implications in the biological eradication of an invasive species

Tyee Springs in south central Washington is the main source of water for Carson National Fish Hatchery (CNFH) and is inhabited by invasive Brook Trout (*Salvelinus fontinalis*). There are concerns that these Brook Trout could enter CNFH and be stocked into streams along with spring Chinook salmon (*Oncorhynchus tshawytscha*) produced at the hatchery. As physical eradication of these Brook Trout has failed, other methods are being considered. One such method is to introduce YY Brook Trout into Tyee Spring as a means of biological eradication. YY Brook Trout possess two Y chromosomes (YY) and when mated with a female (XX) would produce only male progeny (XY).

As part of this effort, Abernathy Fish Technology Center is rearing YY Brook Trout to examine the effects of ration size on sexual maturation for possible stocking in Tyee Springs. YY Brook Trout fed rations of 1.5, 2.5, 3.0 or 3.5% of their body weight were assessed for sexual maturation by measuring gonad size, milt production and plasma 11-ketotetosterone. The results of this diet trial may be useful to other hatcheries and facilities that are considering rearing YY Brook Trout for purposes of eliminating invasive Brook Trout.

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Peaks and valleys: a decade of innovative conservation in the heart of Kaua‘i’s watershed

Protecting one of the wettest spots on earth comes with its own unique challenges. Kaua‘i’s primary watershed lies in the rugged and mountainous interior of the island and is often shrouded in cloud cover and rain. These wet forests are essential habitat for endangered forest birds, seabirds, plants and invertebrates. Feral ungulates and invasive plant species are the primary threats to the wet forests and bogs. Public-private partnerships along with persistent efforts since 2005 have led to the protection of more than 8,000 acres of montane and lowland wet forest and 60 acres of unique lowland bog from ecosystem-altering invasive species in the heart of Kaua‘i’s watershed. Funding from the Partners for Fish and Wildlife and Recovery Programs played a key role in developing new technologies to address threats. The Kaua‘i Watershed Alliance utilized a system of game cameras and Foward Looking Infrared (FLIR) aerial mapping to estimate ungulate densities across the landscape. Feral pigs were captured via a networked “super trap” which was monitored and operated remotely as well as by traditional hunting and snaring. High definition vegetation mapping enabled treatment of individual invasive plants using aerial based technologies over thousands of acres. During the past decade several miles of fence have been installed, and, 195 pigs, 49 goats and six black-tailed deer have been removed from three management units. Vegetation monitoring results indicate ground cover recovers in proportion to pig rooting within five years of ungulate exclusion and vegetation cover increased in response to animal removal. Ten years of vegetation monitoring data will be presented.

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Wind energy and the Marbled Murrelet

In July of 2019, the Service approved the first Habitat Conservation Plan for a wind power project within the range of the Marbled Murrelet. The Skookumchuck Wind Energy Project is located within southwestern Washington, in a flyway for Marbled Murrelets commuting between their marine foraging habitat and terrestrial nesting habitat. Little information is available about how wind turbines affect Marbled Murrelets, though we know that at least one Marbled Murrelet carcass has been found beneath a wind turbine at a project in British Columbia. In this presentation, I will present the modeling approach the Service and the applicant agreed upon to predict the Marbled Murrelet mortality rate at the turbines, as well as the agreed-upon approach to fatality monitoring after the project becomes operational. The fatality monitoring is of particular interest because we expect that Marbled Murrelet carcasses will be difficult to detect, so the failure to detect a carcass is not strong evidence of zero fatalities. The monitoring plan includes additional data collection and statistical methods to help account for this bias toward underestimating fatalities. Throughout the process, there were numerous questions about how to deal with uncertainty, in light of the existing scientific information and Service regulations and policies. Although the Service has used various methods to predict and monitor wind energy fatalities for other species, this is the first time any of these methods have been used for Marbled Murrelets.

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Application of advanced DNA sequencing techniques to monitoring of Bull Trout

Rapid advances in DNA sequencing technology are dramatically changing the way geneticists study fish and wildlife. Methods that use these technologies are becoming increasingly accessible and provide improved resolution over previous types of genetic markers while being more cost-effective and reproducible. Here I will describe progress our lab at Abernathy Fish Technology Center has made in developing a novel genotyping panel for bull trout (*Salvelinus confluentus*). Since bull trout are a major focal species for our lab, developing a new genotyping panel has the potential to add efficiencies and data compatibilities to our workflow. For our initial step, we generated genomic-level data from 24 bull trout populations distributed range-wide. From these data we selected a subset of genetic regions to test for panel development. We then tested a technique called Genotyping-in-Thousands by Sequencing (GTseq) to genotype large numbers of samples at the new panel. Then we compared the new GTseq genotypes with previous genetic data generated for those samples. We found that the GTseq panel provided ample resolution to make inferences while reducing the burden to process the genotypes. It also had novel applications, such as hybrid species detection and sex identification. There are enormous benefits of this new approach in terms of cost efficiencies and data generated with this panel are directly compatible across labs, allowing the accumulation of large range-wide datasets. This panel has the potential to effectively implement large-scale genetic monitoring of bull trout and answer a variety of questions relevant to the recovery of the species.

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Forecasting Spring Chinook Salmon adult returns within a management decision context

Fishery managers are often faced with making decisions under uncertainty. Pre-season adult return forecasts are used by managers to set pre-season harvest levels and hatchery broodstock collection plans, however forecast models often have wide prediction intervals around the forecast, indicating a high level of uncertainty. We used a retrospective analysis approach to assess different forecast models for hatchery and wild Spring Chinook Salmon (*Oncorhynchus tshawytscha)* returns to the Deschutes River, OR. Within the Deschutes River basin, Warm Springs National Fish Hatchery produces Spring Chinook Salmon for Tribal harvest and distribution to tribal members of the Confederated Tribes of the Warm Springs Reservation of Oregon. Fish produced from the hatchery also contribute to sport harvest opportunities. Additionally, a culturally and ecologically important run of wild Spring Chinook return to the Warm Springs River. Based on the retrospective analysis, the four "best" performing models for hatchery and wild returns are used to produce pre-season forecasts. We have developed additional forecasting tools to assist managers in their decision making. These tools are based upon management decision points, such as broodstock collection needs and minimum escapement goals for wild fish, and provide a probability of the salmon return being above or below a particular management decision point. Additionally, we provide weekly in-season run updates, based on PIT tag detections at Bonneville Dam, that allow managers to make near real-time adjustments to their management plans. We continue to assess forecast models and coordinate with managers in the basin to provide information that can be used within a decision context.

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Conclusion & Valediction –

With my first taste of Science Of The Service in 2019, I have been excited all winter to get together again this April and check in with each other on the progress of science in the Pacific Northwest and Pacific Islands. I'm sure you're like me and a bit disappointed that we will not be able to gather and discuss the great accomplishments since our last meeting.

I want to thank Paul Heimowitz and the rest of the Science Of The Service team for their efforts to salvage parts of this year's meeting. Although we're not getting together this year and we were unable to pull off a full virtual conference, this year's program is now out and includes the abstracts and some messages from leadership. We will also provide some webinars for some of the abstracts, so watch for announcements.

For me Science Of The Service is a great way to visit with my peers and learn about the important work being done across our vast Region. Much of that information comes from one on one conversations in the hallway or at the reception. I hope you will take the time to look at the program and glean some snippets of the work people are doing and that you will call or email the authors and collaborate with your peers one on one. I know I'm going to miss hearing updates on the Region's diverse wildlife and management projects. So for now, I'll be watching seminars and reading reports and looking forward to the spring of 2021 and being able to assemble and share our science in a more traditional way. Please take care of yourselves and your family and I'm looking forward to seeing you soon.

Author: *James Unsworth (Assistant Regional Director, Columbia-Pacific Northwest Regional Office, Science Applications)*

Workshop *(cancelled)* **-**

Have a question about genetics? Ask a geneticist!

Over the past several decades, genetics has emerged as a fundamental component of conservation science, providing a wealth of tools to monitor and conserve biodiversity. Despite its importance to conservation, many biologists receive limited training in genetics, Furthermore, the rapid rate at which the field advances can make this training feel obsolete. This can impact the ability of our agency to interpret, evaluate, and assess genetic research. Our goal with this workshop is to provide a forum for our colleagues to seek technical support from the Service's own geneticists. We want you to bring the questions to us: if you have a particular study, project, or topic you would like assistance with, we are here to help. To prepare for the discussion, we ask attendees to send relevant study plans, papers, or particular topics of interest to us prior to the workshop via the contact information below. We will also review commonly asked questions and discuss latest advances in the field. Our hope is that this workshop will provide an opportunity for our colleagues within our region to utilize the internal technical capacity that exists related to genetics.

Author: *Justin Bohling (Conservation Geneticist, Abernathy Fish Technology Center, Fish & Aquatic Conservation)*

The world can be viewed as a single, interconnected organism.

(Alexander Von Humboldt, 1769-1859)

Science Coordination Team
from the Columbia-Pacific Northwest & Pacific Islands Regions

Increasingly complex natural resource issues and their associated challenges of scientific uncertainty, declining budgets and renewed interest in holistic science-based decision-making in the Columbia-Pacific Northwest and Pacific Islands Regions elevated the need to enhance cross-program science coordination and collaboration to ensure that policy and management decisions were informed by the best science available. To address this need, Science Coordination Team (SCT) provides cross-program leadership and coordination that enhances the production, acquisition, availability, dissemination, integration, quality and use of scientific information within the Regions. Responsibilities of the SCT include providing oversight to the Science Of The Service Planning Team.

Current members of the SCT are: *Don Campton (Fish & Aquatic Conservation, RO), Patty Crandell (Fish & Aquatic Conservation, AFTC), Jesse D'Elia (Ecological Services, RO), Bridgette Flanders (National Wildlife Refuge, RO), Dave Hopper (Ecological Services, IFWO), Kevin Kilbride (National Wildlife Refuge, RO), David Leonard (Ecological Services, RO), Tim Mayer (Water Resources, RO), Michelle McDowell (Migratory Birds, RO), Steve Miller (Ecological Services, PIFWO), Steve Morey (Ecological Services, RO), Kevin O'Hara (National Wildlife Refuge, RO), Mike Rule (National Wildlife Refuge, Turnbull NWR), Tim Whitesel (Fish & Aquatic Conservation, CRFWCO).*

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