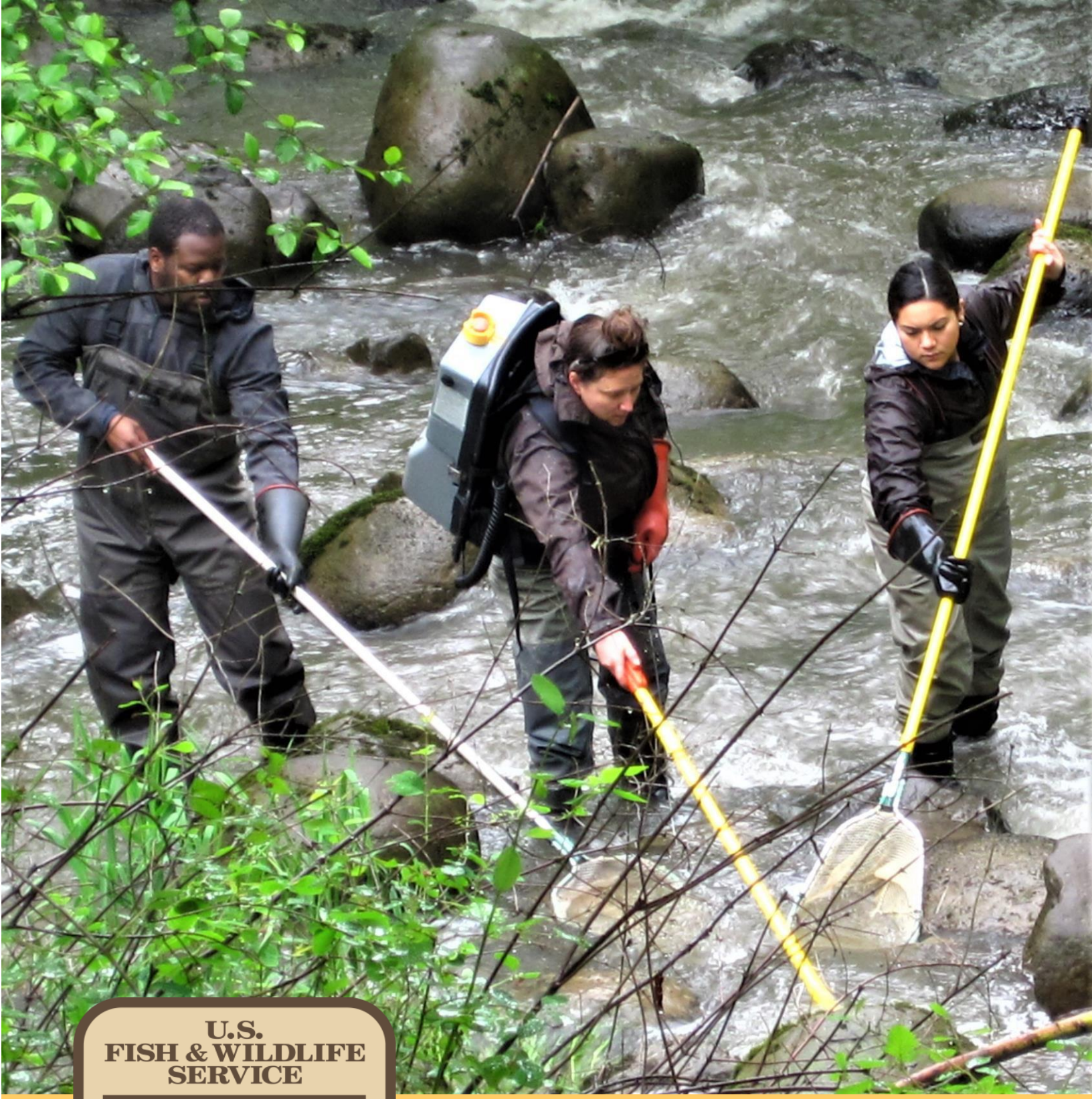

U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

# Science Of The Service

*April 21-June 9, 2021*



*Columbia-Pacific Northwest & Pacific Islands Region's*
*April 21-June 9, 2021 ~ virtually from Portland, Oregon*

## *LINKS TO PRESENTATION RECORDINGS*

**Opening Session: April 21**
https://www.youtube.com/watch?v=zk4URvMgnCM

**April 28 Session**
https://www.youtube.com/watch?v=EAivsT20F24

**May 5 Session**
https://www.youtube.com/watch?v=Q4AXaJyt3vM

**May 12 Session**
https://www.youtube.com/watch?v=9NqdtPDykZI

**May 19 Session**
https://www.youtube.com/watch?v=KdX-UvA0FLY

**May 26 Session**
https://www.youtube.com/watch?v=lzfTaynymyc

**June 2 Session**
https://www.youtube.com/watch?v=RUWt8jqIM5s

**June 9 Session**
https://www.youtube.com/watch?v=MjF58NrAjyk

Welcome to

# *SCIENCE OF THE SERVICE*

April 21-June 9, 2021
*virtually from* Portland, Oregon

*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 Program), Nicole Hams (Fish & Aquatic Conservation), Paul Heimowitz (Ecological Services), Kevin Kilbride (National Wildlife Refuge System), David Leonard (Ecological Services), Alexa Martinez (National Wildlife Refuge System), Mari Reeves (Ecological Services), Tim Whitesel (Fish & Aquatic Conservation).*

Front Cover (left to right)*:* Rikeem Sholes, Judith Barkstedt and Christina Uh (Columbia River Fish & Wildlife Conservation Office) electrofishing for salmonids as part of an urban ecology project in Tryon Creek (Portland, Oregon).

Photo Credit: Brook Silver (U.S. Fish & Wildlife Service)

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

How would you describe your new normal at work?

This year's impressive Science Of The Service line-up clearly demonstrates the pursuit of science excellence has prevailed throughout the pandemic. Your innovative work continues as teams find new ways to work together to manage populations, conserve habitats, and tackle the toughest conservation challenges of our time. We have clearly advanced despite the pandemic, and will continue to lean into our forward momentum in the year to come.

So, what are the ways you've noted your reality as a practicing scientist has changed over the course of the past year? Many would note that now, more than ever, we are living in a digital age. Our dependence on technology for virtual information and data sharing has not just increased, it has become *the way.* Within the scientific community, this dependence has catapulted us into a long-anticipated era of data management transformation.

We know how critical it is to base our conclusions and decisions on the best available science. From a fried laptop to a lost thumb drive, each of us knows someone or has personally experienced what if feels like to have data damaged, compromised, or lost. Our new normal has brought to bear the importance of effective and responsible data management and sharing to ensure the information supporting our decisions remains transparent, accessible, and safe. In response, we are now building better data repositories, data warehouses, and data sharing platforms to house and manage our work. I challenge you to learn more about what data management improvements are being made in your region and take advantage of emerging tools and approaches that can help you protect and advance the science upon which our agency depends (visit the Data Management Sharepoint Site).

Perhaps your new normal focuses more on a rising awareness of equity, social responsibility, and environmental justice. Our conservation community is broader and deeper than ever before and we are in turn getting better at integrating ourselves within the many communities we serve. We are embracing the value of all scientists, regardless of age, race, ethnicity, or gender identification. We are valuing diversity of thought, ideas, philosophies, and skillsets. Each of us has role to play in creating a work culture of inclusion, acceptance, and warmth. I encourage you to take time every day to make a colleague feel valued, welcomed, and celebrated in your corner of the world.

A heightened awareness of how our actions impact others also extends to how we engage with those we serve. This past year natural spaces were inundated by first-time visitors seeking a safe escape from the confines of their homes during the pandemic. The growing interest on the part of the public to access and use public lands is a huge opportunity for us, and we must continue to nurture trust and stewardship with all segments of the American public by keeping decision-making transparent and natural spaces accessible, as appropriate. Anticipating and addressing the social science aspects of our endeavors is becoming even more relevant to us defining and achieving a successful conservation outcome. Consider how or where your work intersects with people, and how you can incorporate the strengths of the social sciences early and often in your work to optimize your project outcomes.

Despite the past year's hardships, I truly believe our new normal has positioned us to advance science more rapidly, more collaboratively, and more effectively than ever before. We stand ready to reach new heights in conservation science, data management, and social science for the agency. I've never felt as hopeful about the future of science in the Service as I do now, and I am excited to work with you as we shape the future of science together and rise to the challenge of this new age.

*Charisa Morris (Deputy 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 2021 event is the 6th 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 are compiled into this program. The compilation will be posted online at *https://doimspp.sharepoint.com/sites/fws-FF01D00000/SitePages/Past-Presentations.aspx*

***PROGRAM***

*(All times Pacific Time Zone)*

*April 21, 2021*

13:00-15:00 **– Kick-Off Session**

*Host: Nicole Hams (Science Of The Service Planning Team Member, Abernathy Fish Technology Center, Fish & Aquatic Conservation)*

13:00 – **Orientation**

13:10 – **SOTS 2021: Salutation & Introduction** – Robyn Thorson (Regional Director, Columbia-Pacific Northwest Regional Office)

13:25 – **Keynote Address** – The importance of cultural diversity, equity, and inclusion in natural resources science – Ebony Webber (Chief Officer of Operations, MANRRS [Minorities in Agriculture, Natural Resources and Related Sciences], National Office, Atlanta, Georgia)

14:15 – **Employee Reflections on the Keynote Presentation** –

14:15 - Janine Castro (Columbia River Fish & Aquatic Conservation Office, Fish & Aquatic Conservation)
14:20 - Nathan Dexter (Columbia-Pacific Northwest Regional Office, External Affairs)
14:25 - Rikeem Sholes (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)
14:30 - Lorena Wada (Pacific Islands Fish & Wildlife Office, Ecological Services)
14:35 - Q&A

14:40 – **Summary Thoughts** – Hugh Morrison (Deputy Regional Director, Columbia-Pacific Northwest Regional Office)

14:45 – **Presentation of the 2021 Data Management Champion Award** – James Unsworth (Assistant Regional Director, Columbia-Pacific Northwest Regional Office, Science Applications)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 **– Session I – Oral Presentations**

*Host: Paul Heimowitz (Science Of The Service Planning Team Member, Columbia-Pacific Northwest Regional Office, Ecological Services)*

13:00 – **Orientation**

13:10 – Scent detection dogs sniff for yellow crazy ants at Johnston Atoll NWR – Aisha Rickli-Rahman (Pacific Islands Refuges & Monuments Office, National Wildlife Refuge System)

13:35 – Evaluating landscape-scale conservation in the face of climate change: The Pacific Islands Climate Change Cooperative – Wendy Miles (Pacific Islands Climate Change Cooperative Office, Science Applications)

14:00 – Aquifer depletion and the long-term decline of an endangered springsnail – Erin K. Kenison (Idaho Fish and Wildlife Office, Ecological Services)

14:25 – Bull Trout abundance and population structure in a glacial headwater stream – Jeffery Johnson (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 – **Session II – Poster Presentations**

*Host: Mike Green (Science Of The Service Planning Team Member, Columbia-Pacific Northwest Regional Office, Migratory Birds & Habitat Program)*

13:00 – **Orientation**

13:10 – **Subsession A**

- ***Harmon Room***: Hawaiian waterbirds: Indigenous resource management in conservation – Kristen Harmon (University of Hawai'i at Mānoa)
- ***Yen Room***: Cause of Western and Clark's grebe declines in Idaho – Anne Yen (University of Idaho)
- ***Breech Room***: Genetic analysis of native Redband Trout legacy samples from Idaho - Tyler Breech (Idaho State University)
- ***Opie Room***: Indigenous agroecosystems as habitat for endangered Hawaiian waterbirds – Eryn Opie (University of Hawai'i at Mānoa)
- ***Hein Room***: Using unmanned aerial systems to monitor Eelgrass in Padilla Bay, Washington – Hannah Hein (Western Washington University)
- ***Gannam Room***: The beginnings of mussel research at the Abernathy Fish Technology Center - Ann Gannam (Abernathy Fish Technology Center, Fish & Aquatic Conservation)
- ***Buzzell Room***: River Otter diet on the lower Wa'atch and Tsoo-Yess river estuaries in Washington State: Exploring the potential for mitigation of the invasive European Green Crab - Bobbie Buzzell (Western Washington University)
- ***Robb-Chavez Room***: Broadscale distribution, abundance, and habitat association of the Asian Clam (*Corbicula fluminea*) in the lower Columbia River, USA – Salvador Robb-Chavez (Washington State University – Vancouver)
- ***Sharpes Room***: Swimming in 'thin air': Evaluating the combination of hypoxic and thermal stress as an additive or synergistic effect (*Oncorhynchus mykiss* gairdneri) – Carlie Sharpes (University of Idaho)
- ***Cheung Room***: Study of the gut microbiome of female *Canis lupis* in northeast Washington – Sammi Cheung (University of Washington)
- ***Hoffman Room***: Body condition of White-tailed Deer in northeastern Washington – Clara Hoffman (Whitman College)

13:55 – **Transition**

14:00 – **Subsession B**

- ***Parker Room***: Illegal killing of nongame wildlife and recreational shooting in conservation areas – Kristina Parker & Madeline Aberg (Boise State University)
- ***Connolly Room***: Evaluating the effectiveness of community volunteers to control invasive weeds – Aaron Connolly (Boise State University)
- ***Kitamura Room***: Optimal conservation techniques for the genus *Achatinella* considering climate change – Philip Kitamura (University of Hawai'i at Mānoa)
- ***Goloviznina Room***: Advancing monitoring infrastructure with citizen science platforms – Svetlana Goloviznina (Western Oregon University)
- ***Tobin Room***: Winter bat activity on the Billy Frank Jr. Nisqually Wildlife Refuge – Mary Tobin (Western Washington Fish & Wildlife Office, Ecological Services)
- ***Strickfaden Room***: The virtual measurement stake: An R package allowing for snow depth measurements at remote camera stations – Kaitlyn Strickfaden (University of Idaho)
- ***Wymore Room***: Effects of decreasing flows on stream physicochemistry, macroinvertebrate abundance, and Redband Trout (*Oncorhynchus mykiss*) condition in an ephemeral system – Andrew Wymore (The College of Idaho)
- ***Ellis Room***: A comprehensive analysis of the American Black Bear diet through DNA metabarcoding – Gwen Ellis (University of Washington)
- ***Krygsman Room***: Recolonizing the Pacific coast: Western Snowy Plover population and distribution in Oregon & Washington from 2001-2020 – Erica Krygsman (Portland State University)
- ***Trevarrow Room***: Corridors, rest, and predation: The use of large wood structures in streams by wildlife – Ezmie Trevarrow (Oregon State University)

14:40 – **Closing & Social Gathering** – All

15:00 – **Adjourn**

13:00-15:00 **– Session III – Oral Presentations**

*Host: Tim Whitesel (Science Of The Service Planning Team Member, Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)*

13:00 – **Orientation**

13:10 – A novel stream restoration monitoring approach in a post-fire setting – Joshua White (Idaho Fish and Wildlife Office, Ecological Services)

13:35 – An urban stream plays a substantial role in supporting native fish: A decade of monitoring fish response to restoration actions – Brook Silver (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:00 – Bullfrogs at Billy Frank Jr. Nisqually NWR - Black River Unit, Listening for the bullfrog jug-o-rum – Ryan Munes (Nisqually National Wildlife Refuge Complex, National Wildlife Refuge System)

14:25 – Influence of formalin treatment reduction on survival and egg stress response during the incubation phase – Christine A. Parker-Graham (Western Washington Fish & Wildlife Conservation Office, Pacific Region Fish Health Program)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 **– Session IV – Oral Presentations**

*Host: Mari Reeves (Science Of The Service Planning Team Member, Pacific Islands Fish & Wildlife Office, Ecological Services)*

13:00 – **Orientation**

13:10 – Using novel technology to understand causes of mortality in northern sea otters - Michelle St. Martin (Oregon Fish & Wildlife Office, Ecological Services)

13:35 – Is climate change already impacting native lamprey species and their communities? - Christina J. Wang (Columbia River Fish and Wildlife Conservation Office, Fish & Aquatic Conservation)

14:00 – Are all tall structures the same to sage-grouse? A comparison of sage-grouse response to cellular and communication towers and other tall structures and design feature recommendations to mitigate sage-grouse mortality risk and sage-grouse nest depredation by avian predators - Jacqueline Cupples (Oregon Fish & Wildlife Office - La Grande, Ecological Services)

14:25 – Identifying and characterizing juvenile lake sturgeon (*Acipenser fluvescens*) occupancy hot spots within the St. Clair-Detroit River System – Aaron Mettler (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 **– Session V – Oral Presentations**

*Host: Alexa Martinez (Science Of The Service Planning Team Member, Malheur National Wildlife Refuge, National Wildlife Refuge System)*

13:00 – **Orientation**

13:10 – Trend in population size and spatial distribution of common murres in Oregon, 1988 - 2014 – Shawn Stephensen (Oregon Coast National Wildlife Refuge Complex, National Wildlife Refuge System) & Kirsten Bixler (Oregon State University)

13:35 –Using minnow traps to assess Olympic Mudminnow populations – Olivia Williams (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:00 – Stage-0 stream restoration of Whychus Creek – Dirk Renner (Oregon Fish & Wildlife Office – Bend, Ecological Services) & Mathias Perle (Upper Deschutes Watershed Council)

14:25 – Trends in abundance and distribution of birds in an imperiled shurbsteppe landscape affected by wildfires – Julianne Harris (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation) & Heidi Newsome (Central Washington National Wildlife Refuge Complex, National Wildlife Refuge System)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 **– Session VI – Oral Presentations**

*Host: Kevin Kilbride (Science Of The Service Planning Team Member, Columbia-Pacific Northwest Regional Office, National Wildlife Refuge System)*

13:00 – **Orientation**

13:10 – Utilizing mini-ROV's as part of a marine monitoring and management plan – Danielle Burnett (Pacific Remote Islands Marine National Monument, National Wildlife Refuge System)

13:35 – Landscape conservation planning on Maui, Hawaii: Species distribution modeling for 194 plants – Stephen E. Miller (Pacific Islands Fish & Wildlife Office, Ecological Services)

14:00 – Predation of salmon smolts by predatory fishes in the Lake Washington ship canal, 2018 and 2019 – Roger Tabor (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:25 – Conservation introductions: An evaluation of regional FWS perspectives – Paul Heimowitz (Columbia-Pacific Northwest Regional Office, Ecological Services) & Nicholas Cole (U.S. Geological Survey)

14:55 – **Closing**

15:00 – **Adjourn**

13:00-15:00 – **Session VII – Panel for Science**

*Host: David Leonard (Science Of The Service Planning Team Member, Columbia-Pacific Northwest Regional Office, Ecological Services)*

13:00 – **Orientation**

***Move or die: The science and policy of conservation introductions***

13:05 – Opening statement – J. Michael Hudson (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

13:10 – Integrating science and policy to guide assisted colonization decisions – Jesse D'Elia (Columbia-Pacific Northwest Regional Office, Ecological Services)

13:25 – The Nihoa Millerbird project: A case study in translocation planning and implementation – Holly Freifeld (Columbia-Pacific Northwest Regional Office, Ecological Services)

13:40 – Assisted colonization in light of USFWS policy – Bridgette Flanders (Columbia-Pacific Northwest Regional Office, National Wildlife Refuge System)

13:55 – When recovery creates conflict: Some state perspectives on moving species – Jim Unsworth (Columbia-Pacific Northwest Regional Office, Science Applications)

14:10 – Panel discussion – *moderated by* J. Michael Hudson (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:55 –**SOTS 2021: Conclusion & Valediction** – Hugh Morrison (Deputy Regional Director, Columbia-Pacific Northwest Regional Office)

15:00 – **Adjourn**

## Abstracts

(in order of scheduled presentation, by session)

**Keynote Presentation**

**The importance of cultural diversity, equity, and inclusion in natural resources science**

Cultural diversity, equity, and inclusion are critical to delivering excellence in natural resources science careers. A diverse and inclusive scientific workforce pulls from a range of backgrounds, perspectives, and experiences maximizing innovation and ingenuity in the natural resources industry for the benefit of humanity.

**Author:** *Ebony Webber (Minorities in Agriculture, Natural Resources and Related Sciences)*

**Presenter:** *Ebony Webber, MANRRS National Office, 1720 Peachtree Road, N.W., Suite 776 South, Atlanta, Georgia 30309. phone: 404-347-2975 email: ebony.webber@manrrs.org*

## Oral Presentations

**Scent detection dogs sniff for yellow crazy ants at Johnston Atoll NWR**

Yellow Crazy Ants, *Anoplolepis gracilipes* (YCA), an invasive species harmful to island ecosystems including breeding seabirds, were discovered in 2010 at Johnston Atoll National Wildlife Refuge, part of Pacific Remote Islands Marine National Monument. Since discovery, twenty crews have deployed to eradicate YCA by applying formicides. Biologists doing visual searches last detected YCA in December 2017. Two scent detection dogs were trained to detect YCA and were deployed to Johnston for two weeks in December 2020 to locate YCA that may still be present at low densities. We used mapping-grade GPS devices with ≤ 5m accuracy to map survey tracks of canine-handler teams. We quantified search effort by estimating detection distances for each dog using YCA odor training aids hidden during operational YCA surveillance to better understand search coverage by canine-handler teams. We surveyed 177 km over 57 ha of treatment area, in approximately 84 hrs. Solo and his human team tracked an average of 6.65 km/day (range=2.4-10.5 km/day; n=24); Guinness and his human team averaged 6.98 km/day (range=2.9-8.9 km/day; n=21). Dogs surveyed priority areas 1-3 times, where YCA were most recently detected. Seventy-nine percent (57 of 72 hectares) of the treatment area (infestation area plus buffer), was successfully surveyed. Average YCA detection distances (using training aids) were 6.4 meters (range=2.1-13.93m; n=22). No YCA were detected over the 14-day period. Biologists will continue their surveillance and response until June 2021. Employing this technique at Johnston Atoll provides us with an alternative tool to achieving the goal of confirming eradication.

**Authors**: *Aisha Rickli-Rahman [1], Kyoko Johnson [2], Sheldon Plentovich [1], Michelle Reynolds [2], Beth Flint [1], Kate Toniolo [1], Kendra Maty [1] & Keely Hassett [1] ([1] U.S. Fish & Wildlife Service, [2] Country Canine)*

**Presenter**: *Aisha Rickli-Rahman, U.S. Fish & Wildlife Service, Pacific Islands Refuges and Monuments Office, 300 Ala Moana Boulevard Room 5-231, Honolulu, Hawaii 96850. phone: 808-927-2531 email: aisha_rickli-rahman@fws.gov*

**Evaluating landscape-scale conservation in the face of climate change: The Pacific Islands Climate Change Cooperative**

“Landscape-scale conservation” has become a common term in conservation biology – emphasizing the importance of planning at scales that encompass ecological processes and species migrations, and address large-scale environmental threats – but formal frameworks for evaluating the effectiveness of these efforts are rare. Recognizing the need for collaborative responses to large-scale environmental stressors such as climate change, the Department of the Interior began developing a network of Landscape Conservation Cooperatives (LCCs) in 2009. As one of these twenty-two LCCs, the Pacific Islands Climate Change Cooperative (PICCC) was established with the charter purpose of assisting those who manage native species, island ecosystems, and key cultural resources in adapting their management to climate change for the continuing benefit of the people of the Pacific Islands. Guided by a diverse steering committee of land/resource managers, the PICCC serviced a vast area across Hawai‘i and the U.S. Affiliated Pacific Islands. This paper presents key findings from our attempt to evaluate PICCC’s achievements between 2009 and 2018. Based on interviews and a survey, we describe the foundational conditions from which the PICCC set out to establish a landscape-scale conservation framework, the challenges it faced, its goals and achievements, and derive transferable lessons from the experience for any conservation community working with limited resources across large expanses of land and ocean. The research underlying this presentation serves as a record of the unique landscape-scale conservation and climate adaptation approach that was developed by the PICCC’s steering committee and partners over the course of the collaboration.

**Authors:** *Wendy Miles [1,2], Susanne Moser [3] & Deanna Spooner [4] ([1] U.S. Fish & Wildlife Service, [2] East-West Center, [3] Susanne Moser Research & Consulting, [4] retired from the U.S. Fish & Wildlife Service)*

**Presenter:** *Wendy Miles, U.S. Fish & Wildlife Service, Science Applications, Interior Region 12, 300 Ala Moana Blvd, Rm 5-231, Honolulu, Hawai‘i 96850. phone: 808-284-7636 email: wendy_miles@fws.gov*

**Aquifer depletion and the long-term decline of an endangered springsnail**

The Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*) is a spring-dwelling snail, endemic to a short geothermal-influenced section of the Bruneau River in Idaho. This species relies on geothermal springs ranging in temperature from 11°C to 35°C, making them and their habitat especially unique. Annual field surveys along a 5.1 kilometer reach of the Bruneau River have been conducted by the Fish and Wildlife Service from 2004 to 2020. These surveys have explored the distribution and relative abundance of springsnails and the geothermal habitats they rely on. We examined changes in spring and springsnail abundance and distribution across 17 years using monitoring data and found a significant decline in the number of occupied and detected springs through time. These declines are correlated with declining groundwater elevations, such that springs located farthest upstream, at higher elevations, have disappeared with aquifer depletion over time. We have also detected annual fluctuations in the number of occupied springs. This is likely associated with inter-annual variation in river discharge, which creates varying degrees of hydrologic disturbance to snails within the river and river-spring interface. Declining aquifer levels affect hydrothermal influences, ultimately reducing available springsnail habitat and increasing the vulnerability of snail populations to large flushing events. With continued declines in total and occupied springs, springsnail colonies will be more susceptible to high flow events and other stochastic disturbances, posing challenges to species recovery.

**Authors:** *Erin K. Kenison, David Hopper, Greg Burak & Cary Myler (U.S. Fish & Wildlife Service)*

**Presenter:** *Erin K. Kenison, U.S. Fish & Wildlife Service, Idaho Fish & Wildlife Office, 1387 S. Vinnell Way, Suite 368, Boise, Idaho 83709. phone: 208-685-6965 email: erin_kenison@fws.gov*

## Bull Trout abundance and population structure in a glacial headwater stream

Bull Trout (*Salvelinus confluentus*), are difficult to sample, resulting in limited population level information throughout much of their range. 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. A series of PIT arrays in Fryingpan Creek divided 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. We captured 427, of which 159 (>100mm) were large enough to PIT-tag. We 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. 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 >200mm) 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.

**Authors:** *Jeffery Johnson [1], Roger Peters [1], Rebecca Lofgren [2], Matthew Deangelo [2] & Erik Marks [3] ([1] U.S. Fish & Wildlife Service, [2] U.S. National Park Service, [3] Puyallup Tribe of Indians)*

**Presenter:** *Jeffery Johnson, U.S. Fish & Wildlife Service, Western Washington Fish & Wildlife Conservation Office, 510 Desmond Dr. SE, Suite 102, Lacey, Washington 98503. phone: 360-753-6052 email: jeffery_johnson@fws.gov*

**A novel stream restoration monitoring approach in a post-fire setting.**

We developed and implemented a novel monitoring approach to assess the restoration effectiveness of low-tech process-based restoration in a post-fire context in the lower Baugh Creek watershed in central Idaho. We collected data using remote sensing and field surveys to understand the response to restoration at multiple spatial scales and understand the mechanisms responsible for changes following restoration. Preliminary results highlight: 1) the need to understand recovery trajectories and associated time-frames associated with variable starting conditions, 2) the challenges associated with monitoring larger scale restoration projects, 3) the importance of using methods capable of being implemented by a diverse set of practitioners, and 4) how monitoring must be sustained beyond the short term in order to effectively guide adaptive management. After one year, we found that the majority of restoration structures are intact and forced local geomorphic changes, however remote sensing data was less likely to observe geomorphic change, due to the limited scale of change and the limited high flows since restoration. We observed considerable differences to restoration structures between the three different treatment streams. At the scale of the entire project we observed increased sediment retention in the form of uniform channel aggradation and the development of bars, while at the scale of individual structures, geomorphic responses also included scour of the channel bed and bank erosion. Our monitoring illustrates how large-scale restoration projects can leverage large study areas, and numbers of structures to open the doors to new approaches to restoration effectiveness monitoring that incorporates data collected at multiple spatial scales.

**Authors**: *Scott Shaverdian [1] & Joshua White [2] ([1] Anabranch Solutions, [2] U.S. Fish & Wildlife Service)*

**Presenter**: *Joshua White, U.S. Fish & Wildlife Service, Idaho Fish & Wildlife Office, 1387 S Vinnell Way, Boise, Idaho 83709. phone: 208-378-5265 email: joshua_white@fws.gov*

**An urban stream plays a substantial role in supporting native fish: a decade of monitoring fish response to restoration actions**

For over ten years the USFWS worked with the City of Portland to monitor fish response to restoration actions in Tryon Creek, one of the largest urban watersheds in Oregon. The condition of the watershed benefits from a large area of public land and contains habitat well-suited for native fish. However, the lower portion of Tryon Creek is bisected by a 122 m-long culvert that inhibits fish passage upstream. A three-phase project to improve fish habitat and passage began in 2008 when the culvert was retrofitted with a new baffle system. The second phase was completed in 2010 and improved habitat downstream of the culvert. The third phase, when implemented, will replace the existing culvert. From 2005-2019, we collected baseline information to document change over time, compare species presence or absence, and relative abundance. Downstream of the culvert, we identified 14 native and eight introduced species, handled over 7,000 individual fish, of which, 99% were native, including juvenile Chinook (*Oncorhynchus tshawytscha*) and Coho (*O. kisutch*) Salmon and Pacific Lamprey (*Entosphenus tridentatus*). Upstream of the culvert, Coastal Cutthroat Trout (*O. clarki*) and Rainbow Trout (*O. mykiss*) were the predominant species captured. Abundance of Coastal Cutthroat Trout varied among years with an estimated 584 (95% CI [463, 781]) individuals. While monitoring has concluded for the first two phases of the project, a post assessment of the completed culvert replacement will be valuable to evaluate whether the project met its goals and better understand how restoration actions can promote native fish conservation.

**Authors:** *Brook Silver, Julianne Harris, Michael Hudson & Timothy A. Whitesel (U.S. Fish & Wildlife Service)*

**Presenter:** *Brook Silver, U.S. Fish & Wildlife Service, Columbia River Fish & Wildlife Conservation Office, 1211 SE Cardinal Court, Suite 100, Vancouver, Washington 98663. phone 360-604-2580 email: brook_silver@fws.gov*

**Bullfrogs at Billy Frank Jr. Nisqually NWR- Black River Unit. Listening for the bullfrog jug-o-rum**

In September 2019, invasive American Bullfrogs (*Lithobates catesbeianus)* were discovered near Washington's largest Oregon Spotted Frog (*Rana pretiosa*) breeding population. While recognizing the challenges of surveying the recent low-density invader, Billy Frank Jr. Nisqually NWR took a different approach from conventional evening frog call surveys to assess the extent of the invasion. Accessibility to the Black River Unit is limited and difficult. It contains over 10 km of riparian wetlands and three Oregon Spotted Frog breeding areas, making it difficult to survey effectively. Passive acoustic loggers increase the certainty of identifying Bullfrog presence/absence by recording multiple surveys each night. Refuge biologist deployed 28 low cost passive acoustic loggers (AudioMoths) from approximately June through August. The loggers recorded for 5-minutes every 30 minutes, from 7:00 pm – 2:00 am. Using Wildlife Acoustic's Kaleidoscope Software, cluster analysis searched through 25,000 5-minute surveys (~1 terabyte of data) identifying bullfrog calls. Bullfrogs were detected at 7 of the 24 analyzed locations. These detections aligned with nighttime Bullfrog eradiation work, which occurred in August and September. Acoustic monitoring challenges involve managing multiple recording devices, a high volume of data, and the time needed for data analysis. This approach has helped identify the extent of the invasion and will be utilized to direct future management.

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**Influence of formalin treatment reduction on survival and egg stress response during the incubation phase**

Formalin, an aqueous formaldehyde solution, is an FDA-approved chemical used for disease management on hatcheries. Formalin is safe for topical use on fish eggs and is widely used during incubation to prevent fungal (*Saprolegnia* spp.) colonization of the egg surface. Formalin poses a significant public health risk to humans. It is a suspected carcinogen and exposure can cause sensitization of the skin, eyes, and respiratory mucous membranes. As egg incubation occurs in enclosed areas, aerosolized formalin poses a risk of exposing staff to respiratory irritation. Because of the health and environmental risks associated with formalin use and exposure some states, like Wyoming and California, have dramatically reduced and discontinued formalin use in hatcheries in favor of less toxic chemicals like peracetic acid. At least two federal hatcheries in the Pacific Northwest have discontinued formalin use on eggs and have seen eye-up and hatch percentages comparable to eggs incubated with formalin. The degree to which hatcheries can reduce or discontinue formalin will largely be dependent on their water source and pathogen history at the facility. For hatcheries with appropriate water sources, formalin reduction would reduce chemical costs, staff time, staff formalin exposure, and formalin effluent into surrounding waterways. This project evaluated the efficacy of formalin reduction in incubation practices at different hatcheries by measuring percent fertilization, percent eye up, percent hatch, and percent of fry on feed and cortisol levels in eggs and fry at different exposure levels.

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**Using novel technology to understand causes of mortality in northern sea otters**

The southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni)* was listed under the Endangered Species Act in 2005. At that time, predation by killer whales was suspected to be the primary cause of population decline preceding the listing. While predatory attacks have been observed in the past, we lack a clear understanding of how frequently these attacks occur currently and whether they have a significant effect on the population. Given the remoteness of the population, and lack of human infrastructure, we needed to develop a specialized telemetry transmitter suitable for implantation in sea otters that could estimate survival and identify causes of mortality and help us understand why the sea otter numbers have remained low but stable since the time of listing. In a proof-of-concept study, we collaborated with experts from the U.S Geological Survey, Monterey Bay Aquarium, and the Alaska SeaLife Center to develop and test new Life History Tags. Since the study began in 2019, the technology has been successful at providing valuable end-of-life information. This new, and proven, technology can help understand the predation rate of sea otters in Alaska and can be applied to other geographies and in other marine mammals species.

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**Is climate change already impacting native lamprey species and their communities?**

Lampreys are an ancient fish found on all of Earth's continents. They have co-evolved with their prey and host organisms over millennia and thus wherever native lampreys are found they play an important role in aquatic ecosystems. Additionally, lampreys have played an important part in human culture as a traditional food. Rapid changes in the current climate are clear and warming temperatures and changes in precipitation patterns over the past several decades are projected to continue into the future. Though climate change has been identified as a potential threat to lamprey species worldwide, the degree to which it is impacting them is just beginning to be understood. In order to manage and conserve the varied native lamprey species and mitigate for the potential impacts from climate change, it is necessary to understand how lampreys and their biological communities could be affected. We used the potential pathways of community change identified by Hughes (2000) to evaluate whether lampreys and their communities are already being affected by climate change. Evidence supports the likelihood that climate change will affect the physiology and phenology of lampreys as well as their distribution and contributions to communities and ecosystems. Additionally, vulnerability assessments show that native lampreys might be affected by the magnifying effect of multiple stressors including a changing climate. However, when considering their length of time on the planet, evolutionary history, multitude of life history expressions and range of distribution, it is worth contemplating whether lampreys may be relatively resilient to climate change.

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**Are all tall structures the same to Sage-Grouse? A comparison of Sage-Grouse response to cellular and communication towers and other tall structures and design feature recommendations to mitigate Sage-Grouse mortality risk and Sage-Grouse nest depredation by avian predators**

Studies have shown that Sage-Grouse avoid tall structures and both transmission lines and cellular towers were linked to Sage-Grouse extirpation. These structures facilitate nesting and perching of avian predators of Sage-Grouse and their nests and Sage-Grouse collisions with tall structures may cause mortality. Recommended buffer distances between tall structures and Sage-Grouse leks stem from studies that primarily assessed the impacts of transmission lines. However, tall structures are not uniform in terms of: 1) design; 2) arrangement; 3) location; and 4) visibility as modulated by terrain. These differences may influence: 1) the degree to which they facilitate use by avian predators; 2) the extent of avian predation of Sage-Grouse nests; 3) Sage-Grouse avoidance of otherwise suitable habitat near structures; and 4) mortality resulting from Sage-Grouse collisions with structures. These risks must be weighed against cellular towers' benefits: improved communication, public safety, and wildfire response to protect sagebrush habitats in remote areas. Federal Communications Commission (FCC) data indicate that the total number of applications and new antennas constructed in or near Sage-Grouse habitat has increased by nearly 185% since 2005, while Sage-Grouse populations continue to decline across their range. Our project spans four states and aims to develop science-supported recommendations for the siting, design, and retrofitting of communication and transmission towers. We will (1) assess the degree to which cellular and/or other communication towers influence Sage-Grouse lek occupancy and attendance; and (2) investigate mechanism(s) driving observed patterns in Sage-Grouse lek attendance, space use, and demographic rates in proximity to tall structures.

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**Identifying and characterizing juvenile lake sturgeon (*Acipenser fluvescens*) occupancy hot spots within the St. Clair-Detroit River system**

Over the last two decades the St. Clair–Detroit River System has been sampled extensively to determine spatial and temporal patterns of Lake Sturgeon (*Acipenser fulvescens)*.To identify spatial patterns in juvenile Lake Sturgeon (< 1,000 mm TL) habitat use, 'hot spots' were identified through optimized hot spot analysis and interpolated by inverse distance weighted analysis. Additionally, habitat variables (i.e., water depth, water velocity, and dominant substrate type) at each 'hot spot' were investigated using a single season occupancy model to determine their influence on occupancy probability. In total, 1,203 juvenile Lake Sturgeon were captured across 4,197 sites. Three unique 'hot spots' were identified; western Lake Erie near the Detroit River, east of Fighting Island in the Detroit River, and the North Channel of the St. Clair River. Interpolated 'hot spots' encompass roughly 73 km² in western Lake Erie, 5 km² in the Detroit River, and 7 km² in the St. Clair River. Detection probabilities within 'hot spots' ranged from 8.8%- 43.4%, highlighting the importance of this metric when determining habitat occupancy of rare species. No habitat variables significantly predicted juvenile Lake Sturgeon occupancy. The odds of juvenile Lake Sturgeon occupying a site was influenced by flow and water depth, however this was dependent on waterbody type. Irrespective of waterbody, 69% of all juveniles captured were found on sand and gravel substrate. These results provide valuable insight about juvenile habitat use that can help managers formulate effective conservation and restoration strategies supporting the continued recovery of Great Lakes Lake Sturgeon.

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**Trend in population size and spatial distribution of Common Murres in Oregon, 1988 - 2014**

Since 1988, the U.S. Fish & Wildlife Service has conducted annual aerial surveys of Oregon coast seabird colonies, which generated more than 60,000 35 mm slides between 1988 and 2008. We recently catalogued, digitized, and archived the slides, and assessed spatiotemporal trends in Common Murre (*Uria aalge*) abundance in Oregon, where approximately two thirds of the entire California Current population nests. We completed census counts of all murres in Oregon in 1994 and 2014 and combined those with two previous census counts to estimate Common Murre abundance roughly every ten years between 1988 and 2014. The trend in abundance was also estimated for an additional random subsample of colonies approximately every three years of the study period to assess trends at a finer temporal scale. Between 1988 and 2014 the estimated breeding population of murres in Oregon declined by more than 20%, with a southward shift in distribution during this period. Multiple factors may have driven this population decline and spatial shift including disturbance from Bald Eagles (*Haliaeetus leucocephalus*), changing ocean conditions, and emigration from the state. Our results will inform marine spatial planning efforts including potential renewable energy development projects in Oregon's nearshore waters and contribute to the development of site-specific monitoring protocols.

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## Using minnow traps to assess Olympic Mudminnow populations

The Olympic Mudminnow (*Novumbra hubbsi*) is a small freshwater fish, endemic to western Washington State. Although the species is listed as state “Sensitive”, the historic lack of routine monitoring has resulted in poor understanding of population dynamics over time in support of management and conservation. Olympic Mudminnow commonly live in wetlands with tannic water and soft substrates, making conventional electrofishing and seining sampling approaches difficult. Alternatively, minnow traps can easily be set in a wide range of depths and habitat types and allow for more systematic, repeated sampling. We conducted monthly surveys over a 19-month period at a local wetland in Olympia, Washington to help develop standardized sampling methods for monitoring Olympic Mudminnow populations. Monthly catch rates of Olympic Mudminnow were highest in August through November when the water depths were low and water temperatures were decreasing. Trap mortality was relatively low for both Olympic Mudminnow and amphibians but increased during the warm spring and summer months. Additionally, we provide data from a case study where we used minnow trapping to monitor the colonization of a new wetland at the Quinault National Fish Hatchery (QNFH) following the construction of a new weir. Minnow trapping at the QNFH indicated Olympic Mudminnow quickly colonized the new wetland and after 2 years, catch rates were similar to nearby wetlands. Overall, minnow trapping appeared to be an effective method for monitoring Olympic Mudminnow populations year-round; however, sampling in the fall appears to be advantageous because catch rates were high, and mortality was low.

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**Stage-0 stream restoration of Whychus Creek**

The USFWS PFW Program has been working with the Upper Deschutes Watershed Council, and others to restore reaches of Whychus Creek, a tributary to the Deschutes River. Our partnership is using a phased approach to restore the stream. Restoration goals seek to restore stream and valley conditions to what is referred to as 'Stage-0,' a reference condition simulating anastomosing channel conditions. Stage-0 was the target condition when we implemented the 2016 Whychus project using the geomorphic grade line approach, this approach resets the valley bottom by filling and cutting the valley to fit a predetermined elevation gradient. Over the last four years our partnership has been monitoring the results of this restoration project and evaluating this approach for restoration. We've used the monitoring data to improve our approach for the next phases of restoration. In addition, we are planning a different restoration technique, a process-based approach to Stage-0 for the Willow Springs restoration project on Whychus Creek. This will use small wood structures and the stream itself in a multi-year adaptive approach to restore the stream and valley. Both of these projects are planned for implementation in 2021.

This presentation will explain Stage-0 restoration, how it differs from more traditional approaches to stream restoration. We will highlight monitoring results from the last 4 years including lessons learned from the first phase. We will discuss how we are incorporating those lessons into the next phases and review and discuss the process based approach to Stage-0 we are trying.

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**Trends in abundance and distribution of birds in an imperiled shrubsteppe landscape affected by wildfires**

Habitat conversion from primarily sagebrush to primarily grassland is a major threat to shrubsteppe obligate and associated birds. One cause of this conversion is wildfires, which are becoming more common on this landscape. Our objectives were to identify trends in abundance and distribution (1997-2015) of 19 bird species in the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE) on Hanford Reach National Monument. The ALE includes some of the largest contiguous stands of shrubsteppe in the region; however, conversion of sagebrush to grassland has occurred due to major fires in 2000 and 2007. We assessed trends in bird count data collected annually (33 sites sampled 0-5 times/year) in the ALE, using two analytical methods: 1) state-space modeling of counts to examine trends in abundance; and 2) multi-season occupancy modeling to examine trends in distribution. Results from both analyses suggest similar general trends (either increase, stable, or decline) for most species; however, estimates of trends in abundance were generally less precise than estimates of trends in occupancy. Although not the case for all species, sagebrush nesters generally exhibited declining trends, whereas grassland nesters exhibited stable or increasing trends. Results suggest the shift to primarily grasslands in the ALE may cause a similar shift in bird assemblage to one that is primarily composed of grassland species, with low abundances of sagebrush obligate species. Results suggest that continued restoration and conservation of sagebrush is critical to protect this rare habitat and the bird species that require it.

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**Utilizing mini-ROV's as part of a marine monitoring and management plan**

Palmyra Atoll National Wildlife Refuge (PANWR) management team is beginning to utilize mini Remotely Operated Vehicles (ROVs) for long term marine monitoring of this refuge's extensive reef ecosystem. Here, we present lessons learned and results from a "proof of concept" footage gathering trip in late 2020, highlighting logistical concerns and the learning curve for establishing an ROV program. We discuss situations where an ROV is most useful, outline the workflow for analyzing footage, and what types of analysis and/or monitoring is possible from ROV footage.

We have concluded that ROVs are useful tools for managers. However, there is a challenging learning curve for operating and maintaining these units, which should be planned for before attempting to establish such a program. The proper operation and acquisition of relevant data using a ROV is time consuming and challenging, and may not be an efficient survey method for monitoring shallow water areas that can be easily accessed and surveyed by snorkelers or towed camera systems. Alternatively, ROVs could be useful in hard to reach shallow areas with high rugosity, that a small boat cannot access. We recommend using the ROV for deeper depths, areas that would require divers, or are too deep for divers to survey. Inexpensive mini-ROVs can operate in depths up to 900 ft., greatly increasing the ability to survey depths beyond 100 ft, the limit for conventional SCUBA surveys. Deeper areas have historically been difficult or impossible for natural resource managers to monitor, but are ecologically important, a mini-ROV program has the potential to greatly expand manager's knowledge of the resources they are charged with protecting.

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**Landscape conservation planning on Maui, Hawaii: Species distribution modeling for 194 plants**

Species distribution modeling (SpDM) and range modeling are widely used and well documented ecological tools. These modeling methods provide unique opportunities for multispecies landscape-scale conservation planning. We present an example of ongoing landscape planning for the island of Maui where land managers and species experts work directly with SpDM modelers to develop an ecosystem-based management strategy for the ecological communities on Maui. The SpDMs of 194 plant species establish an objective framework for discussions on best approaches to conservation planning and on-the-ground management.

Combining SpDMs with a unique conservation population-building algorithm and footprint optimization model gives analytical flexibility to derive multiple options for landscape management actions (fencing, weed control, ungulate removal, out-planting, translocation, etc.). In evaluating current landscape options, SpDMs incorporate climate parameters in the analyses. These climate parameters (average annual temperature and seasonality; average annual precipitation and seasonality) can be changed to conditions predicted by downscaled regional climate models. The climate-adjusted outcomes reflect estimates of future species distributions and habitat suitability that can be used to build future landscape models and evaluate future ecosystem-based management strategies.

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**Predation of salmon smolts by predatory fishes in the Lake Washington ship canal, 2018 and 2019**

Predation during the smolt outmigration period can be an important source of mortality for anadromous salmonid stocks in the Pacific Northwest. In 2018 and 2019, we assessed predation by four nonnative fishes (Largemouth Bass, Smallmouth Bass, Rock Bass, and Yellow Perch) and one native fish (northern pikeminnow) in the Lake Washington Ship Canal (LWSC; Seattle, Washington), a highly modified waterway that connects Lake Washington with Puget Sound. Of particular interest is consumption of Chinook Salmon smolts, which are part of the federally-listed Puget Sound population. Predatory fishes were sampled with gillnets in May-July during the smolt outmigration period. All five predatory species were documented to consume smolts but Smallmouth Bass and Yellow Perch appeared to be the primary predators. Smolts comprised a minor part of the diet of Largemouth Bass and Rock Bass. Northern Pikeminnow often consumed smolts; however, their abundance in the LWSC appears to be low. Juvenile salmonids consumed by smallmouth bass included Chinook Salmon, Coho Salmon, Sockeye Salmon, and Cutthroat Trout and were consumed throughout the LWSC. In contrast, the only salmonid species consumed by yellow perch was Chinook Salmon and it was only documented in one area of the LWSC. Predation occurred primarily in large yellow perch (> 250 mm total length). Because Yellow Perch are abundant, they may be a more important predator of Chinook Salmon than previously recognized. However, predation by Yellow Perch appears to be patchy and additional sampling is needed to determine their overall impact on Chinook Salmon.

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**Conservation introductions: An evaluation of regional FWS perspectives**

Conservation introductions (CI) involve intentional movement of organisms outside their indigenous range for purposes such as avoiding extinction and supporting ecosystem functions in the receiving environment. As global-scale threats like climate change increasingly challenge the Service's mission, CI is receiving more attention as a conservation adaptation strategy. Despite engaging in CI projects, the Service possesses limited guidance or tools to support CI decision-making. Moving an organism outside its indigenous range for conservation purposes raises unique policy and philosophical issues compared to other translocation types. Understanding these and other human dimensions considerations is a critical first step toward developing a decision framework. To that end, with funding from Science Applications, Regions 9 &12 have partnered with USGS to investigate internal FWS perspectives about CI. The study involves semi-structured interviews of approximately 40 employees representing a broad spectrum of Program affiliations, job responsibilities, technical expertise, experience with translocations, and geographic familiarity (examining differences between perspectives in Regions 9 and 12 is one explicit objective). A cross-program team of Service biologists collaborated with USGS to design the interview questions, which also were informed by a CI literature review. Data collection will begin in January 2021 and subsequent interview analysis will use both deductive and inductive coding methods; this presentation will describe some preliminary findings. Results from this project will set the stage to similarly examine CI activities, attitudes and policies by Service partners, and ultimately will inform development of support resources for Service and partner CI decision-making.

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## Poster Presentations

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**Hawaiian waterbirds: Indigenous resource management in conservation**

In Hawai‘i, as globally, sea level rise threatens the availability of suitable habitat for endangered native waterbirds and other coastal species. Hawaiian wetland agro-ecosystems (*lo‘i*) are social-ecological sub-systems that if restored under an indigenous resource management paradigm, have the potential to meet human needs while simultaneously expanding nesting habitat of endangered Hawaiian waterbirds. Here we use spatial analyses to project end of the century (2100): (1) area of existing potential waterbird habitat likely to be lost due to sea level rise; and (2) area of potential waterbird habitat that may be gained through restoration of *lo‘i* systems. We find that *lo‘i* restoration has the potential to not only compensate for projected losses of conventional wetland habitat due to sea level rise, but to substantially contribute to recovery efforts for endangered waterbirds that are currently habitat-limited. This study demonstrates the potential for contemporary indigenous land management to solve conservation dilemmas in the Hawaiian Islands, as well as to contribute to solving global challenges such as sea level rise and habitat loss.

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## Cause of Western and Clark's grebe declines in Idaho

Western and Clark's grebes are iconic waterbirds of western North America that breed on inland lakes in colonies and winter along the western coast. Western and Clark's grebes face rapid population declines across their range and steeper declines in Idaho. Reasons behind their decline are unknown but possible causes include nest predation, lack of forage fish, anthropogenic disturbances, and rapid fluctuation of water levels at nesting sites. We urgently need to determine which threats are responsible for population declines to address endangerment and extinction risks. Cascade Reservoir has the largest nesting colony of Western Grebes in Idaho which has been documented since 2003 by Idaho Department of Fish and Game biologists. Over 1000 grebe nests have been counted at the colony at Cascade Reservoir, but chick counts during annual brood surveys have been extremely low in recent years. The second largest nesting colony in Idaho is at Lake Lowell on Deer Flat National Wildlife Refuge, surveyed intermittently by USFWS biologists since 2010. The adult grebe population and chick counts from boat surveys at Lake Lowell also declined in recent years. The cause(s) of low recruitment at both nesting lakes are unknown and is the focus of our research. Lake Wolcott at Minidoka National Wildlife Refuge was another major grebe nesting site in Idaho but no nesting grebes were observed there since 2018. Here we summarize our efforts over the past four years to try to identify the major threats at these two remaining breeding colonies in Idaho.

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**Genetic analysis of native Redband Trout legacy samples from Idaho**

Redband Trout (*Oncorhynchus mykiss*) are native to many drainages in western Idaho, inhabiting diverse ecotypes including desert and montane streams. Native Redband Trout populations in Idaho have been shown to be phenotypically, and in some cases genetically, differentiated. However, because of the properties of aquatic connections, geographic proximity may not predict relationships and interconnectedness of aquatic taxa. Using samples collected by multiple organizations over a 20-year period, single nucleotide polymorphism (SNP) data was generated for twelve populations of native Redband Trout and one hatchery strain of Rainbow Trout. Using this SNP data, we aimed to quantify population structure, isolation by distance, diversity, and effective population size of native Redband Trout across Idaho to investigate intraspecific variation and connectivity among populations. We found population clusters mainly grouped by drainage, with a trend of isolation by distance unsurprising given the river kilometers between collections. Effective population sizes varied across collections, and may require future studies to further validate estimates. Overall, the genetic diversity of Redband Trout in Idaho was influenced by connectivity of populations, often organized by drainage.

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**Indigenous agroecosystems as habitat for endangered Hawaiian waterbirds**

Approximately 15% of wetlands have been lost across Hawai‘i since the industrial era, with ~44% of the total loss occurring in coastal areas, contributing to the listing of Hawaiian waterbird species as endangered. Native Hawaiians vastly expanded wetlands in the lowlands with the development of flooded-field agroecology systems (lo‘i wai kalo) for the production of kalo (Taro; *Colocasia esculenta*), fish, waterbirds, and invertebrates. Lo‘i wai kalo created a mosaic of patches that provided habitat to multiple waterbird species with differing life history requirements. We aimed to understand the relationship between waterbird life cycles and management cycles within the agro-ecosystem as a means to assess the potential of *lo‘I* restoration to contribute to waterbird recovery. Our 2019 and 2020 observations revealed *‘ae‘o* (*Himantopus mexicanus knudseni*) and *‘alae‘ula* (*Gallinula galeata sandvicensis*), both disturbance-adapted species, partitioned the *lo`i* habitat temporally and spatially according to managed succession within the agro-ecosystem, which mimics the disturbance regimes these waterbirds evolved in. Alae ‘ula nesting observations occured in the harvest stage lo‘i and ‘ae‘o nesting observations occured in the fallow stage lo‘i with foraging occuring across all stages. This means these flooded-field systems have the potential to contribute to waterbird recovery, and our observations of multiple successful fledging events of both *‘ae‘o* and *‘alae‘ula* within *lo‘i* habitat supports this notion. Results from this study are important for informing management decisions regarding both *lo‘i kalo* and waterbird populations and may help influence policies that allow waterbird populations to once again thrive alongside human populations.

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**Using unmanned aerial systems to monitor Eelgrass in Padilla Bay, Washington**

In the Pacific Northwest, the native *Zostera marina* and non-native *Z. japonica* co-occur in tidal flats along the Pacific coast and in Puget Sound. Padilla Bay in Skagit County, Washington is home to the largest eelgrass meadow in Puget Sound and one of the largest eelgrass meadows in North America. Eelgrass develops highly productive ecosystems that are an important part of coastal environments and provide many ecological services including wildlife habitat, carbon sequestration, and sediment stabilization. Eelgrass meadows are difficult and time-consuming to study using ground-based methods but, using unmanned aerial systems (UAS) to acquire imagery offers a way to collect data on eelgrass meadows multiple times within a single growing season. In this study, we used a DJI Matrice 210 UAS mounted with a 10-band Micasense Dual Camera system to collect imagery of the Eelgrass at low tide on several occasions throughout the season. We also collected biomass, shoot length, and percent cover ground-truth data at plots along three transects in the study area. Models built from a principal components analysis of the spectral data and ground-truth data performed well in predicting *Z. marina* biomass and overall percent cover. Additionally, this method allowed for an inter-seasonal change analysis in the high intertidal zone. Using UAS to monitor eelgrass extent throughout a single growing season can help identify where *Z. japonica* is spreading in previously unvegetated areas.

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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 nutritional requirements, physiology and behavior. As more mussel mortality events are occurring and as the possible need for keeping mussels in refugia is developing, the Abernathy Fish Technology Center (AFTC) has begun laboratory studies in these areas with mussels. This work is to investigate mussel nutrition looking at feeds and needed feed particle size. In addition, the analysis of mussel nutrient content can be used to gain information about their health status. A current study in the Chehalis Basin is using nutrient content as one of the variables to evaluate mussel health status. Physiological responses have been investigated in relation to environmental stressors such as water temperature. Stress indicators in hemolymph such as cortisol have been checked in mussels exposed to increasing water temperatures. Many aspects of the laboratory work can be applied to fieldwork investigating the extent and cause(s) of mussel die offs. Also, understanding the effects of water temperature on mussel behavior such as burrowing will help with sampling surveys to document populations and possibly determine relocation protocols. Currently the AFTC is working with the Western Pearlshell Mussel (*Margaritifera falcate*) collected from Abernathy Creek.

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**River otter diet on the lower Wa'atch and Tsoo-Yess river estuaries in Washington State: Exploring the potential for mitigation of the invasive European Green Crab**

Establishment of the invasive European Green Crab (*Carcinus maenas*) in Washington State has led to heightened concerns regarding impacts on marine communities and loss of eelgrass beds. Current control methods include early detection and mitigation, but little is known about predators that might influence the propagation of this species over time. Understanding predator-prey relationships is important for determining the success of the European Green Crab. The River Otter (*Lontra canadensis*) has been shown to predate on European Green Crab in California and in the crabs' native range. River otters may similarly consume green crab in Washington State. As a first step in exploring natural mitigation of green crab, I conducted a comprehensive diet study of river otters from scats collected on the lower Wa'atch and Tsoo-Yess river estuaries in Washington State, which are a hot-spot of European Green Crab. I used scat analysis of hard prey remains (e.g., bones and shells) to document the consumption frequency of green crab and their importance in relation to other prey items. No green crab occurred in scats collected on the Tsoo-Yess River, and green crab consumption by river otters on the Wa'atch River was low (5.2% FO overall). I conclude green crab are not currently important prey, but this might be a reflection of green crab abundance rather than low preference. To better quantify potential mitigation of green crab, I suggest conducting population estimates of river otters and continued river otter diet observations to gauge future consumption of green crab in this area.

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**Broadscale distribution, abundance, and habitat association of the Asian clam (*Corbicula fluminea)* in the lower Columbia River, USA**

The Asian Clam, *Corbicula fluminea*, is an invasive freshwater bivalve that has established populations throughout the globe, including the Pacific Northwest, USA and which is thought to have deleterious effects on natural and human systems. During 2017-2020 we collected adult and juvenile *C. fluminea* from 15 mid-channel and 29 shore-based sampling locations throughout the lower Columbia River to elucidate the association of *C. fluminea* with habitat characteristics, including dissolved $O_2$, pH, temperature, salinity, specific conductivity, depth, geographic location, chlorophyll *a* concentration, bank slope, and sediment composition (granulometry, TOC). *Corbilcula fluminea* abundance was greatest at the Sandy River confluence near Gresham, Oregon (avg. 342 ind. $m^{-2}$) with the majority of sample sites with abundances >100 ind. $m^{-2}$ located west of Bonneville Dam. Our results provide a better understanding of the basic biology and ecology of this global invader, as well as provide natural resource managers with information on where, when, and why this bivalve invades temperate river ecosystems.

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**Swimming in 'thin air': Evaluating the combination of hypoxic and thermal stress as an additive or synergistic effect (*Oncorhynchus mykiss gairdneri*)**

Aquatic hypoxia, or dissolved oxygen (DO) deficiency, has increased in frequency with rising water temperatures as a result of climate change. Temperature and DO are important factors that can affect many biotic processes for salmonids. Fish can adjust to environmental variables such as temperature change and hypoxia using phenotypic plasticity. Redband Trout (*Oncorhynchus mykiss gairdneri*) have desert, cool montane, and cold montane ecotypes in Idaho. This research analyzed the effects of hypoxia and thermal stress, both in combined and isolated tests, on age-1 Redband Trout. These fish have been acclimated in a common garden at 21°C, 18°C, and 15°C, to model desert, cool montane, and cold montane habitats, respectively. The experiment examined cardiac phenotypic response using an electrocardiogram (ECG) to measure the heart rate of individuals when exposed to hypoxic conditions and acute thermal stress. The treatment started each individual's acclimation temperature and 100% DO saturation. Hypoxia was initiated by bubbling N2 gas into the water at a constant rate to reduce DO to 50% saturation. The Redband Trout then experienced a temperature increase until their ECG displays arrhythmia, which marks the endpoint of the study. The results will show the heart rate at cardiac arrhythmia for each individual. Phenotypic plasticity is possible for hypoxia and acute temperature tolerance in Redband Trout. This could imply persistence for the species. However, if the combination of hypoxic and thermal stress has a synergistic effect, climate change could have worse consequences for fish than previously understood.

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**Study of the gut microbiome of female *Canis lupis* in northeast Washington**

Within the last decade, wolves have been returning to Washington State following an 80-year absence. Mapping their population growth and reproductive activity is key to understanding their recovery and to assisting wildlife conservation management. The presence of breeding females is a key criterion for identifying an established pack. Accurate noninvasive identification of pregnant wolves through scat could greatly assist such efforts. Measuring progesterone levels in feces provide a reliable index of pregnancy in most mammals; progesterone rises post-ovulation, but only remains elevated above a “pregnancy-threshold” among pregnant females. Unfortunately, this metric is less reliable in canids. Progesterone levels remain elevated in all post-ovulatory females, regardless of whether the females become pregnant. Since gut microbiome diversity has also been shown to differ between pregnant and non-pregnant mammals, this study examined whether the combination of progesterone levels and gut microbiome diversity can refine pregnancy diagnosis in free-ranging wolves. Fecal samples from female wolves (N=62) with known progesterone levels were provided by the Center for Conservation Biology from a 2015-2017 study in northeast Washington. Gut microbiome profiles were generated by sequencing the V4 16S rRNA gene region in each sample and analyzed using Qiime 2 and R with the Silva reference database for microbial taxonomy classification. Pregnant wolves are expected to have a different bacterial community from non-pregnant wolves. The combination of progesterone level with gut microbiome may help to further refine a pregnancy diagnosis in free ranging wolves by distinguishing true pregnant females from post-ovulatory non-pregnant females.

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## Body condition of White-tailed Deer in northeastern Washington

The nutritional state of animals can indicate population health and stressors in an individual's life. In White-tailed Deer (*Odocoileus virginianus)* stressors that can affect their nutritional state include forage ability, indirect predation effects, disease, season, age, and maternal demands, among others. We opportunistically sampled road-killed White-tailed Deer in northeastern Washington State to (1) assess the nutritional state of the population and (2) determine the correlation between two different methods of evaluating body condition. To assess body condition in this study, we compared a subset Kistner score based on assessment of fat on the pericardium and kidneys to bone marrow fat percentage. We compared these methods to determine if using bone marrow fat was a viable method of analysis, since researchers may be interested in the body condition of deer where not all remains are present (e.g. instances of predation and scavenging). Over four years of collecting, we found that body condition varies across seasons, with the highest averages in fall at 17.13% and lowest averages during lactation at 6.65%. During pregnancy, the average percent fat was 9.58%. We also found that body fat percentage and bone marrow percentage were not correlated, and bone marrow analysis did not seem to be a consistent method for determining body condition. This data will be used in the context of a larger project looking at various stressors and their effect on population, and the methodological analysis is important for future projects that wish to analyze the body condition of White-tailed Deer.

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**Illegal killing of nongame wildlife and recreational shooting in conservation areas**

Illegal killing of nongame wildlife is a global yet poorly documented problem. The prevalence and ecological consequences of illegal killing are often underestimated or completely unknown. We review the practice of legal recreational shooting and present data gathered from telemetry, surveys, and observations on its association with illegal killing of wildlife (birds and snakes) within conservation areas in Idaho, USA. In total, 33% of telemetered Long-Billed Curlews (*Numenius americanus*) and 59% of other bird carcasses found with known cause of death (or 32% of total) were illegally shot. Analysis of spatial distributions of illegal and legal shooting is consistent with birds being shot illegally in the course of otherwise legal recreational shooting, but snakes being intentionally sought out and targeted elsewhere, in locations where they congregate. Preliminary public surveys indicate that most recreational shooters find abhorrent the practice of illegal killing of wildlife. Viewed through this lens, our data may imply only a small fraction of recreational shooters is responsible for this activity. This study highlights a poorly known conservation problem that could have broad implications for some species and populations of wildlife.

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## Evaluating the effectiveness of community volunteers to control invasive weeds

A team of organizations, including the U.S. Fish and Wildlife Service, have undertaken a habitat restoration project at the Intermountain Bird Observatory's (IBO) Diane Moore Nature Center. The site is in the Boise River Important Bird Area and is an important habitat for songbirds and insect pollinators. Years of unregulated use has allowed Cheatgrass (*Bromus tectorum*), Rush Skeletonweed (*Chondrilla juncea*), Tumble Mustard (*Sisymbrium altissimum*) and other invasive weeds to overrun the area. Beginning in 2018, we established a series of experimental plots populated with over 20 native plant species across the 22-acre site. One challenge in maximizing seedling survival has been reducing competition with invasive weeds. In 2020 we piloted a unique "Adopt-a-Plot" program to control weeds. IBO enlisted the help of 37+ generous volunteers and asked them to "adopt" one or more plots and perform regular weeding and maintenance therein. After one complete season, nearly all 75 plots were adopted which resulted in hundreds of volunteer hours offset by the community. The efforts put forth by our volunteers freed up student interns to focus on watering, data collection and planning. An added benefit of the program is the sense of ownership and responsibility for restoration activities that was passed to community members. This poster will describe recruitment techniques, volunteer management strategies, and proven metrics of success that resulted in 55-60% survival of the out-planted native seedlings. This information will inform future restoration efforts at the Diane Moore Nature Center and other sites along the Boise River.

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**Optimal conservation techniques for the genus *Achatinella* considering climate change**

Recent, drastic population declines caused by introduced predators suggest that Hawaiian Tree Snails in the subfamily *Achatinellinae* are unlikely to exist outside of predator-proof enclosures (PPE) and/or captive rearing facilities by 2030. In Oahu, seven species are protected in PPEs, and most others are represented in captive rearing. The effectiveness of current PPE and proposed PPE are likely to be impacted by climate change induced species range shifts. In this study, we developed ensemble species distribution models under present conditions and end-of-century moderate warming scenario to identify potential sites for PPE potentially resilient to climate change, and to determine the potential number of species that may be protected given a certain number of enclosures. The ensemble model consisted of Random Forest, Boosted Regression Trees, Maxent and Maxnet models combined by a weighted mean that was derived from each model's performance and further constrained using the maximum value of the four model's predictive accuracy as the minimum cut-off on the suitability index. The resulting locations were filtered by the 30% slope, to exclude areas too steep for PPE construction. Results suggest that most of the potential sites for PPE exist outside of species' historical ranges. When projecting our model to other neighboring islands, the area with suitable PPE conditions is far greater than the extent of potential areas on Oʻahu, suggesting that a multi-island approach to determining optimal sites for conservation may be necessary to achieve species recovery.

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**Advancing monitoring infrastructure with citizen science platforms**

Monitoring is a core component of conservation plans as well as an opportunity for local stakeholders to contribute. When local stakeholders contribute, more high-quality data can be collected further meeting the demands to make educated decisions in short periods of time as well as shortening the times it takes to take legal action. The objective is to create a better digital monitoring infrastructure for the conservation project surrounding the protection of Western Painted Turtles and Western Pond Turtles in the Pacific Northwest. This was done by researching commonly used designs of citizen science projects accomplished over the past ten years and improving the platform based on recommendations by citizen scientist practitioners. This set the framework to design and build a multi-platform monitoring application. It was concluded that current citizen science platforms can be further improved by designing for citizens in mind by crediting their work in science publication, better communications between scientists and citizens, and accommodating for disabilities through ergonomic design. The final product was a mobile and browser application that embodies this concept that will be ready for user-testing in the spring. With it, providing potential for conservation scientists to use this platform to monitor multiple endangered species.

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**Winter Bat Activity on the Billy Frank Jr. Nisqually Wildlife Refuge**

Little is known about the roosting ecology of many bat species in the Pacific Northwest, making it difficult to assess species population status and develop comprehensive strategies in protecting those populations. Ultrasonic detectors can passively detect bats, to species or genus level, as they echolocate during foraging and travel. We deployed two ultrasonic detectors at the Billy Frank Jr. Nisqually Wildlife Refuge in October 2020. We plan to monitor through April 2021 in order to understand the seasonal activity patterns and species composition on the Refuge. We selected this period to monitor because of a deadly bat disease called white-nose syndrome (WNS) that is present in Washington State. Many species hibernate during this period, but WNS can cause bats to arouse early. We are collecting this baseline acoustic data so we can detect any changes in bat activity or species composition that may result from WNS on the Refuge and surrounding areas. Our preliminary results show activity from California Myotis (*Myotis californicus*), Little Brown Bat (*M. lucifigus*), Yuma Myotis (*M. yumanensis*) and Silver-Haired Bat *(Lasionycteris noctivagans*) during the first week of October. After that only the California Myotis and Silver-Haired Bat have been detected as of mid-January. Little Brown Bats and Yuma Myotis are hibernating species that have been found with WNS in Washington. Anecdotal reports of California Myotis and Silver-Haired Bats indicate year-round activity in the lowlands of the Puget Sound, and so our data thus far supports those reports.

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**The virtual measurement stake: An R package allowing for snow depth measurements at remote camera stations.**

Remote cameras are an established method for studying demography, ecological processes, and behavior of wildlife populations. Cameras are also used to monitor environmental variables such as snow conditions, vegetation phenology, and stream stage. However, when using cameras to collect wildlife and environmental data simultaneously, deployment of permanent instruments to measure environmental variables may discourage animal movement into the camera viewshed, invalidating the assumption of random animal movement that is vital to deriving accurate population estimates from remote camera data. We describe an R package named "contourr" which uses images taken during camera deployment to superimpose a "virtual" measurement stake onto images that do not contain a permanent stake. Using an image-processing technique called edge detection, this R package identifies pixels belonging to the edges of a measurement stake and then recolors those same pixels in subsequent images. We use this approach to measure snow depth. We present an evaluation of bias in snow depth measurements taken with the virtual snow-measuring stake (VSS) relative to permanent snow-measuring stakes. The VSS requires much less field effort and cost to implement than permanent stakes, making it particularly advantageous for studies in remote locations or studies with a large number of camera deployments where logistical constraints would preclude use of permanent instruments. Additionally, this method can be used to take measurements from previously collected images provided one can return to camera deployment locations and replicate the original camera viewshed.

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**Effects of decreasing flows on stream physicochemistry, macroinvertebrate abundance, and Redband Trout (*Oncorhynchus mykiss*) condition in an ephemeral system**

Intermittent rivers and ephemeral streams are the most common water bodies in many parts of the world. Yet, these ecosystems remain far less studied than perennial waterways. Dry Creek, a small ephemeral stream in southwestern Idaho, supports a genetically pure population of Redband Trout (*Oncorhynchus mykiss*). Our study objective was to evaluate trout response to changing physicochemical conditions and macroinvertebrate abundance as stream habitats shift from flowing, connected habitats to stagnant, isolated habitats. From June to September 2019, we used data loggers to monitor stream temperatures and dissolved oxygen concentrations at 30-min intervals across 10 study reaches. We measured current velocity weekly at all study reaches. Across each reach, drifting macroinvertebrates were collected biweekly, while trout were sampled monthly. Upon capture, trout were measured (mm) and weighed (g). We used the fish condition factor (*K*) to estimate fish health. Across the study period, current velocity decreased across all study reaches. Mean daily water temperatures (6.4-22.3°C) were within an acceptable range for Redband Trout. On 18 days in August and September, dissolved oxygen levels fell below the critical limit for trout (6.0 mg/L). Across all reaches, the rate of delivery of drifting macroinvertebrates (number/15 min) was significantly lower in August than June and July ($p<0.05$). Mean *K* for Redband Trout was significantly higher in July (1.25) than September (0.99) ($p<0.05$). We attribute the decrease in fish condition over time to low levels of dissolved oxygen and decreased delivery of drifting macroinvertebrates brought upon by reduced stream flow.

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**A comprehensive analysis of the American Black Bear diet through DNA metabarcoding**

Understanding complex and dynamic inter-species relationships is key for informing and developing environment and wildlife conservation policies. Accurately identifying the diet of various predators across Washington can provide insight into these relationships in terms of diet and predator-prey dynamics. Metabarcoding diet studies have been completed on a range of predators, but a complete analysis of the American Black Bear (*Ursus americanus*) diet remains elusive, since it is opportunistically omnivorous and these studies focused on animal-based predator-prey relationships (Shi *et al*. 2019). The conduction of a preliminary study comparing the black bear's diet in northeastern and central Washington, suggested their diet could be greatly influenced by human activity. Samples from northeastern Washington contained primarily deer and elk as prey, whereas samples from central Washington had prey matches to swine and cattle. Scat samples with swine and cattle matches were located within proximity to campsites. As an atypical food source, these results suggest the pervasiveness of human-based food source availability to wildlife. Samples that had no prey identified likely had a mainly plant-based composition. This herbivorous portion will identify the native and introduced plant species and their frequency of occurrence in order to understand the reliance of black bears on specific native species, as well as the extent of how local populations have incorporated introduced plant species into their diet and their ecosystem intrusion. A comprehensive diet profile will allow for the examination of the influence of the wildlife-urban interface on food availability and resource selection in the Washington Black Bear population.

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**Recolonizing the Pacific coast: Western Snowy Plover population and distribution in Oregon & Washington from 2001-2020**

The Pacific coast population of Western Snowy Plover (*Charadrius nivosus nivosus*) occurs from Washington to Baja, California, and was listed as federally threatened in 1993. U.S. Fish and Wildlife oversees conservation efforts for the population under six recovery units (RUs; Oregon & Washington = RU1). We reviewed window survey data from 2001-2020, and visualized the RU1 population size and distribution. Over this period, the population increased dramatically and recolonized sites that were likely unoccupied since the 1970s. Population growth occurred in concert with breeding season management, monitoring, and habitat restoration. Since 1990, the Oregon Biodiversity Information Center (ORBIC) has conducted intensive breeding season monitoring on the south and central Oregon coast. As a result of these conservation efforts western snowy plovers are now regularly documented at multiple recolonized sites, especially on Oregon's north coast, and have successfully bred at some sites. Nearly all banded birds recently recorded at these sites were hatched from the core breeding range.

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**Corridors, rest, and predation: The use of large wood structures in streams by wildlife**

It is well known that large wood in streams affects river channel shape, sediment deposits, stream flow, and available habitat for aquatic species. However less is known about how wildlife interact with this large wood and how it might facilitate links between the aquatic and terrestrial food webs. This study aims to capture behaviors that wildlife use while interacting with large wood in streams to gain a better understanding of the role of large wood in riparian ecology. Thirteen trail cameras were placed at naturally occurring and artificially placed large wood structures in streams within the same watershed. These cameras capture terrestrial interaction with the log structures through collecting photo sets and short videos. The cameras have been operational for five months and will continue to collect data for another seven in order to capture seasonal and daily variations in behavior and use. Preliminary results show 29 observed species including 15 birds and 14 mammals. Several distinct behaviors have been observed falling into categories such as communication, food handling, grooming, hunting/foraging, movement, predator avoidance, and rest. It is expected that species occurrences and behavior will change seasonally. This study will provide foundational information for future studies focusing on restoration ecology and the use of large wood in streams as well as studies wishing to make population estimates in riparian areas.

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## 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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**Integrating Science and Policy to Guide Assisted Colonization Decisions**

It is unsurprising that the Endangered Species Act of 1973 is silent on the subject of assisted colonization; substantive debate over its use within the scientific community didn't materialize for several decades after the ESA was written. In the early 1980s the USFWS abruptly adopted a policy to prevent moving species outside of their historical range out of concern that these types of translocations might be used to sanction the destruction of habitats for rare endemics. While that blanket policy is no longer in place, our 1984 experimental population regulations retain its vestiges. The problem we are trying to solve now is vastly different than the problem we were attempting to solve in the 1980s. In addition, we are currently implementing and approving assisted colonization projects on a case-by-case basis without an overarching decision-making framework. I discuss the problems caused by the lack of a decision-framework; and, based largely on the IUCN Guidelines for Conservation Reintroductions and Other Translocations, I suggest some foundational scientific and policy considerations that could inform the development of an assisted colonization decision-framework.

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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.

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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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“Unless someone like you cares a whole awful lot, nothing is going to get better, it's not.”

*(Theodor Seuss Geisel, 1904-1991)*

*Picture credit: Tim Whitesel, U.S. Fish & Wildlife Service*

**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), Michelle McDowell (Migratory Birds & Habitat Program, 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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