U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

# Science Of The Service

*Pacific Region*
*April 17 - June 18, 2024*

Welcome to

# *SCIENCE OF THE SERVICE*

April 17 - June 18, 2024

*Hosted by the*
Pacific Region
*of the*
U.S. Fish & Wildlife Service

Science Of The Service Planning Team (in alphabetical order): *Greg Burak (Fish & Aquatic Conservation), Mike Green (Migratory Birds & Habitat Program), Nicole Hams (Fish & Aquatic Conservation), Leana Goetze (National Wildlife Refuge System), Kaitlyn Landfield (Science Applications), Megan Laut (Ecological Services), David Leonard (Ecological Services), Alexa Martinez (National Wildlife Refuge System), Jennifer Urmston (Migratory Birds & Habitat Program) & Tim Whitesel (Fish & Aquatic Conservation).*

Front Cover*:* Captively-reared, threatened Oregon silverspot butterflies (*Speyeria zerene hippolyta*) are released annually at Nestucca Bay National Wildlife Refuge to support ongoing reintroduction and recovery efforts. Tualatin National Wildlife Refuge volunteer Stefan Dao lends a hand and a data book.

Photo Credit: Samantha Derrenbacher (U.S. Fish & Wildlife Service)

Back Cover*:* A word cloud associated with science.

Original Image Credit: Workforce Institute @ UKG

"We live in uncertain times…" I love pithy quotes, especially when a century old quote is so prescient. I'm sure you have all heard this, and it is one of my favorites from English writer Somerset Maugham's autobiography, *Summing Up*. What you don't often hear however, is the remainder of that quote: "…and our all may yet be taken from us." Apply that thought to conservation. We fight against what *may yet be taken from us* – the definition of a combat biologist. This is the beating heart of conservation and why each of us within the Service work so hard to conserve species and habitats, so they are NOT taken.

The collective "we" in the conservation community form a Service family. That Service family is stronger when we work together to support each other, which is why I love working with all the programs and embrace Science Applications (soon to be Conservation Science and Innovation), which provides the glue that unites us. Each program provides a unique perspective, and we share that perspective through participation in communities of practice, webinars, workshops and training.

Given that background, in 2016, the Pacific Region kicked off its first Science Of The Service (SOTS) to "enhance the awareness and understanding of the scientific information, findings, techniques and approaches being conducted, produced or applied." In those eight years, Service staff, university students and other professionals have shared their knowledge presenting hundreds of papers and posters. This year will continue to build on that scientific foundation, where we have an even greater diversity of presentations and participants. Finally, social scientists point out that we learn best from our peers – SOTS serves that role, connecting us.

In response to the need to connect Region 1 employees with colleagues who are subject matter experts, the Regional SOTS team developed a database to catalog our work. We have a massive region covering thousands of miles, from beaches to alpine zones and it can be challenging to know who to go to with questions about specific topics be that species or habitats. At any time, staff can add peer-reviewed publications to this database. The more entries, the more robust and useful the database will be. This will be especially valuable to new employees who may not already have established networks to draw on for answers to questions or who may be looking for colleagues to connect with on shared interests. Again, we support each other.

In 2025, on the tenth anniversary of the initial event, Headquarters in consultation with the Pacific Region SOTS planning team, plans to launch a nationwide SOTS. As Dr. Deb Rocque said in her 2020 Preface to the SOTS, "We are always better when we can bring people together — be connectors." What better way of connecting staff than bridging the artificially constructed regional boundaries with a National SOTS?

We *are* connecting. We *are* learning from each other. We *are* advancing and supporting science through SOTS, forging ties among ourselves, developing communities of practice and learning peer to peer. And while "We live in uncertain times…", together, we can break down programmatic silos to become a nimbler Bureau in how we, *the collective we*, respond to anthropomorphic change, invasives, reduced funding and rely more on each other to prevent having something taken from us.

*Scott Covington, (Science Applications, Assistant Regional Director, Pacific Region)*

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 Pacific Region. The 2024 event is the 9th annual gathering. The purpose of Science Of The Service is to enhance awareness and understanding of the scientific information, findings, techniques and approaches being conducted, produced or applied in the Pacific Region. 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 Zone and approximate)*

*April 17, 2024*

13:00-14:30 **– Session I - Kick-Off**

*Host: Jennifer Urmston (Science Of The Service Planning Team Member; Pacific Regional Office, Migratory Birds & Habitat Program)*

13:00 – **Orientation**

13:10 – **SOTS 2024: Salutation & Introduction** – Hugh Morrison (Regional Director, Pacific Regional Office)

13:20 – **Keynote Address** – Tapestry thinking: Weaving ecological values of nature with diverse societal sectors to broaden public support for our natural resources – Dr. Nalini Nadkarni (Professor, School of Biological Sciences, University of Utah)

14:05 – **Q&A**

14:20 – **Kick-Off Recap** – Bridget Fahey (Deputy Regional Director, Pacific Regional Office)

14:25 – **Summary**

14:30 – **Adjourn**

13:00-15:00 **– Session II – Traditional 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 – Lynx habitat use in the face of increasing fire in the North Cascades – Carmen Vanbianchi (Home Range Wildlife Research) & Abigail Sage (Washington Fish & Wildlife Office, Ecological Services)

13:35 – Influence of communication tower attributes on greater sage-grouse and avian predator populations – Jacqueline Cupples (Oregon Fish & Wildlife Office, La Grande Field Office, Ecological Services)

14:00 – The role of taxonomy in species level conservation: The case of the Chelan Mountainsnail – Michael Lucid & Teal Waterstrat (Washington Fish & Wildlife Office, Ecological Services)

14:25 – "Ducks can swim" and other lessons learned while mitigating for critically endangered Laysan ducks during an invasive rodent eradication project – Tammy Summers (Midway Atoll National Wildlife Refuge, National Wildlife Refuge System)

14:50 – **Summary**

15:00 – **Adjourn**

13:00-15:00 – **Session III – Traditional Oral & Science Brief presentations**
(* student presentations)

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

13:00 – **Orientation**

13:10 – Reaching beyond the reach: using a stepping-stone approach to restore connectivity – Janine Castro (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

13:35 – Demographic and genetic consequences of a steelhead supplementation program – Christian Smith (Abernathy Fish Technology Center, Fish & Aquatic Conservation)

14:00 – * Anthropogenic resistance on occupancy of Black-tailed deer (*Odocoileus hemionus columbianus*) and coyote (*Canis latrans*) – Clarissa Cressotti (Department of Environmental Science & Management, Portland State University)

14:08 – * Inter- and intrapopulation resource use variation of marine subsidized western fence lizards – Alexi Ebersole (Environmental Policy & Decision Making Program, University of Puget Sound)

14:16 – * Oregon American badger management: TEK and western perspectives – Hunter Grove (Fisheries Wildlife & Conservation Sciences Department, Oregon State University)

14:24 – * New boot scootin': The migratory plasticity of southern mountain caribou - Brianna Lubenau (Department of Fish & Wildlife Sciences, University of Idaho)

14:32 – * Effects of habitat disturbance on stress and immune function in wild deer mice – India Rosario & John Osorio (College of Arts & Sciences, University of Portland)

14:40 – * Evaluation of the float test as a method in determining viability of Garry Oak (*Quercus garryana*) acorns – Angela Bartlett (Biology Department, Western Oregon University)

14:48 – Non-natal juvenile Chinook salmon use of small streams on naval installations in the Puget Sound, WA – Keala Pelekai (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:56 – **Summary**

15:00 – **Adjourn**

13:00-15:00 **– Session IV – Traditional Oral & Science Brief presentations**
(* student presentations)

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

13:00 – **Orientation**

13:10 – Moving species outside their known range in a changing world: Taking smart risks and making good decisions – David Hand (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

13:35 – Monitoring environmental impacts of a conservation introduction: The Sihek at Palmyra Atoll National Wildlife Refuge – Meagan Selvig (Palmyra Atoll National Wildlife Refuge, National Wildlife Refuge System)

14:00 – * Eyes in the sky: How accurate are UAS enumerations of Chinook salmon (*Oncorhynchus tshawytscha*) redds when compared to ground surveys? – Cade Crookshanks (Department of Fish & Wildlife Sciences, University of Idaho)

14:08 – * Effects of reservoir type (run-of-river vs. storage) on native and invasive zooplankton assemblages – Jess Mitchell (School of Biological Sciences, Washington State University - Vancouver)

14:16 – * Population demographics and dynamics of juvenile bull trout in a montane ecosystem – Sage Unsworth (Idaho Cooperative Fish & Wildlife Unit, University of Idaho)

14:24 – * Twenty-year shifts in the distribution of non-native brook trout within bull trout habitat in central Idaho – Nicholas Voss (Idaho Cooperative Fish & Wildlife Research Unit, University of Idaho)

14:32 – * Long-term effects of a prescribed burn on soil biogeochemistry in Pacific Northwest prairies – Lindsey Zakopal (The Evergreen Ecosystem Ecology Laboratory, The Evergreen State College)

14:40 – Searching for a needle in a haystack, a novel approach to a breeding bird survey – William Ritchie (Willapa National Wildlife Refuge, National Wildlife Refuge System)

14:48 – Palmyra Atoll: Monitoring coral reef recovery and resilience in the face of large-scale bleaching events – Paige Mino (Pacific Remote Islands Marine National Monument, National Wildlife Refuge System)

14:56 – **Summary**

15:00 – **Adjourn**

13:00-15:00 **– Session V – Traditional 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 – Seven years of combating *Phragmites australis* in the intermountain west – Deo Lachman (Bear Lake National Wildlife Refuge, National Wildlife Refuge System)

13:35 – Understanding landscape values for wildlife conservation – Riley Andrade (Pacific Regional Office, Science Applications) & Leah Schrodt (Oregon Fish & Wildlife Office, Ecological Services)

14:00 – Monitoring Midway's albatross populations – trends, threats, and future directions – Laura Brazier (Midway Atoll National Wildlife Refuge, National Wildlife Refuge System)

14:35 – How much trapping effort is needed for early detection of European green crab? – Theresa Thom (Pacific Regional Office, Fish & Aquatic Conservation)

14:50 – **Summary**

15:00 – **Adjourn**

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

*Host: Kaitlyn Landfield (Science Of The Service Planning Team Member; Pacific Regional Office, Science Applications)*

13:00 – **Orientation**

13:10 – Drones, AI and coral recovery…oh my! – Amanda Pollock (Pacific Islands Refuges and Monuments Office, National Wildlife Refuge System)

13:35 – Swimming like the wind: using wind energy distributions to characterize juvenile salmon and steelhead migration in the Columbia River Basin – Steve Haeseker (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:00 – Summer evaluation of Tsoo-Yess River coho salmon pre-smolt releases – Gregory Byford (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:08 – Invasive quagga mussel detection and treatment in the Snake River, Idaho – Alyssa Bangs (Idaho Fish & Wildlife Office, Ecological Services)

14:22 – **Summary**

14:30 – **Adjourn**

13:00-15:00 **– Session VII – Traditional Oral Presentations**

*Host: Leana Goetze (Science Of The Service Planning Team Member; Pacific Regional Office, National Wildlife Refuge System)*

13:00 – **Orientation**

13:10 – Invasive coconut palm control at Palmyra Atoll National Wildlife Refuge: A project update including a comparison of the "Marathon" verses "Sprint" methods – Rustin Gooden (Pacific Remote Islands Marine National Monument, National Wildlife Refuge System)

13:35 – Repeat spawning and length at spawning in Columbia River steelhead – David Swank (Columbia River Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:00 – Management actions for conserving forest bird populations at the Big Island National Wildlife Refuge Complex, Hawai'i – Eldridge Naboa (Big Island National Wildlife Refuge Complex, National Wildlife Refuge System)

14:35 – Abundance and survival rates of genetically distinct populations of red knots in the Pacific flyway – Vanessa Loverti (Pacific Regional Office, Migratory Birds & Habitat Program)

14:50 – **Summary**

15:00 – **Adjourn**

13:00-15:00 **– Session VIII – Traditional Oral Presentations**

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

13:00 – **Orientation**

13:10 – Movements and habitat use vary across the Rocky Mountain population of Trumpeter swans – Andrea Kristof (Camas National Wildlife Refuge, National Wildlife Refuge System) & Sharon Poessel (U.S. Geological Survey)

13:35 – You are what you eat: developing methods to use tundra swan feces to monitor blood lead levels, habitat use, food selection, and waterfowl health during spring migration through the Pb-contaminated lower Coeur d'Alene River Basin – Sarah Emeterio (Idaho Fish & Wildlife Office, Ecological Services)

14:00 – Mapping an outbreak of the corallivorous Crown-of-Thorns starfish at Palmyra Atoll NWR – Amanda Pollock (Pacific Islands Refuges & Monuments Office, National Wildlife Refuge System)

14:35 – Seasonal movements of adult yellow perch between two contrasting lakes (Lake Union and Lake Washington) in the Seattle metropolitan area – Roger Tabor (Western Washington Fish & Wildlife Conservation Office, Fish & Aquatic Conservation)

14:50 – **Summary**

14:45 – **Adjourn**

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

*Host: Greg Burak (Science Of The Service Planning Team Member; Lower Snake River Compensation Plan Office, Fish & Aquatic Conservation)*

13:00 – **Orientation**

**Conservation and ethical challenges of managing native species to benefit other native species**

13:10 – Over my dead body – The challenge of controlling a charismatic species to save a threatened one – Robin Bown (Oregon Fish & Wildlife Office, Ecological Services)

13:35 – Can habitat enhancements and raven management save sage-grouse from ravens? – Jacqueline Cupples (Oregon Fish & Wildlife Office, La Grande Field Office, Ecological Services)

14:00 – No “low hanging fruit” – The double-crested cormorant management plan to reduce predation on juvenile salmonids in the Columbia River estuary – Michelle McDowell (Pacific Regional Office, Migratory Birds & Habitat Program)

14:25 – Panel Discussion – *moderated by* Greg Burak

15:00 – **Adjourn**

13:00-15:00 **– Session X – Traditional Oral Presentations**

*Host: Michael Green (Science Of The Service Planning Team Member; Pacific Regional Office, Migratory Birds & Habitat Program)*

13:00 – **Orientation**

13:10 – Genetic evaluation of trojan YY brook trout treatments in four streams – Steven Mussmann (Abernathy Fish Technology Center, Fish & Aquatic Conservation)

13:35 – Providing a life raft: can artificial floating platforms help protect shorebirds during the Wake Atoll rat eradication? – Anna Vallery (Pacific Remote Islands Marine National Monument, National Wildlife Refuge System)

14:00 – How have migrant passerines responded to 17 years of change in the upper Snake River plain? – Andrea Kristof (Camas National Wildlife Refuge, National Wildlife Refuge System) & Austin Young (Idaho State University)

14:35 – Establishing endangered plant populations at Midway Atoll – pōpolo and loulu – Amanda Adams (Midway Atoll National Wildlife Refuge, National Wildlife Refuge System)

14:50 – **SOTS 2024: Conclusion & Valediction** – Hugh Morrison (Regional Director, Pacific Regional Office)

14:45 – **Adjourn**

# Abstracts

(in order of scheduled presentation)

**Tapestry thinking: Weaving ecological values of nature with diverse societal sectors to broaden public support for our natural resources**

Dr. Nadkarni will discuss the increasing need for ecologists to weave the ecological values of nature that they study with societal values that might lie far outside of wildlife research and management, an approach she terms “tapestry thinking.” She will draw upon examples from her own work that have created synergistic exchanges with a diverse range of public groups, including urban youth, corporations, faith-based groups, and the incarcerated. She will suggest “boosts” that may help individual scientists and natural history organizations overcome barriers to disseminate research in community venues where people live, work, worship, and recreate.

**Author:** *Nalini Nadkarni (Professor, School of Biological Sciences, University of Utah)*

**Presenter:** *Nalini Nadkarni, School of Biological Sciences, The University of Utah, Salt Lake City, Utah 84112 phone: 360-870-6632 email: nalini.nadkarni@utah.edu*

**Lynx habitat use in the face of increasing fire in the North Cascades**

In our current era of climate-driven megafires, Canada lynx (*Lynx canadensis*) in the North Cascades of Washington face an uncertain future. Hotter and drier summers coupled with abundant fuels have resulted in larger, more frequent, and higher-severity burns. Over the past 20 years, such fires have transformed North Cascades lynx habitat from being mostly mature forest to heavily impacted by fire. Because of these fires, the structure of the forest that lynx depend on has shifted toward a more homogeneous early-seral stage. This landscape level shift towards more open habitat presents a highly significant threat to lynx since they rely on dense forest structures that support their primary prey, snowshoe hares. Forest treatment projects to reduce fuels could help managers limit future megafires and conserve lynx habitat long-term. However, removing fuels for fire management can seem *at* odds with the immediate conservation of forest-dependent species such as lynx. Researchers must help overcome these challenges by providing information to forest managers regarding habitat selection in burned areas coupled with the flammability of selected habitats and habitat configurations. Using GPS collars outfitted to lynx living in burned areas, snow tracking, trail cameras, and fuelbed mapping, Home Range Wildlife Research is working in partnership with the USFWS to fill these important knowledge gaps. Our project aims to equip managers with information for assessing treatment plans based on their ability to preserve adequate habitat for the current lynx population and safeguard the landscape from catastrophic habitat loss to megafires for long-term protection of lynx.

**Authors:** *Carmen Vanbianchi [1], Abigail Sage [2] & Karen Hodges [3] ([1] Home Range Wildlife Research, [2] U.S. Fish & Wildlife Service, [3] University of British Columbia)*

**Presenters**: *Carmen Vanbianchi, Home Range Wildlife Research, P.O. Box 1345, Winthrop, Washington 98862 phone: 423-202-0829 email: carmen@homerange.org & Abigail Sage, U.S. Fish & Wildlife Service, Washington Fish & Wildlife Office, 215 Melody Lane, Wenatchee, Washington 98801 phone: 360-359-8062 email: abigail_sage@fws.gov*

**Influence of communication tower attributes on greater sage-grouse and avian predator populations**

Communication infrastructure development, particularly tower structures, negatively impact greater sage-grouse (*Centrocercus urophasianus*) populations and also provide nesting/perching substrates for avian predators throughout sagebrush ecosystems. However, how impacts may vary depending on site-specific tower attributes (e.g., height, conformation, antenna arrangement) is not well understood. To quantify how tower attributes may influence impacts to sage-grouse and avian predators, we used a two-pronged approach to relate tower attribute data to sage-grouse population trends and avian predator perching/nesting data. We surveyed 1,078 tower sites across California, Idaho, Nevada, Oregon, and Wyoming from 2021 – 2023. At each site we inventoried multiple tower attributes, conducted predator nest surveys, and collected samples for dietary analysis. We then used existing sage-grouse population data (lek counts) within a Bayesian hierarchical state-space model to estimate population growth for sage-grouse leks from 1996 – 2020 and explore impacts of tower attributes on population trends. Models revealed that multiple tower attributes influence impacts to sage-grouse populations. We discovered predator nests at 120/1,078 (11.1%) tower sites, 73 of which were active nests occupied by ravens (*Corvus corax*; n=59), red-tailed hawks (*Buteo jamaicensis*; n=10), golden eagles (*Aquila chrysaetos*; n=2), and osprey (*Pandion haliaetus*; n=2). Preliminary data suggest avian predators preferentially nested on certain tower and antenna types. We also collected 2,037 diet samples at tower sites. Of analyzed samples, we detected 117 unique vertebrate species, including sage-grouse and other species of conservation concern, present in the diet of avian predators. These findings are preliminary, provided for timely science communication, and subject to change.

**Authors:** *Jacqueline Cupples [1], Sarah Webster [2], Shawn Szabo [3], Pete Coates [2], Jonathon Dinkins [3], Taal Levi [3], Shawn O'Neil [2], Jennifer Hill [1], Steve Abele [1], Darren Long [4], Glenn Frederick [4], Doug Mayes [4] & Ethan Ellsworth [4] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey, [3] Oregon State University, [4] Bureau of Land Management)*

**Presenter**: *Jacqueline Cupples, U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Office, La Grande Field Office, 3502 Highway 30, La Grande, Oregon 97850 phone: 541-962-8593 email: jacqueline_cupples@fws.gov*

**The role of taxonomy in species level conservation: The case of the Chelan mountainsnail**

Mountainsnails (*Oreohelix spp.*) occur in arid montane western North American habitats and have heavily unresolved taxonomy. Six species (shell forms) have been proposed to occur in the Entiat River drainage area. The Chelan mountainsnail (*Oreohelix n. sp. 1*) was included in the 1994 Northwest Forest Plan "Survey and Manage" program and, in 2008, was one of 32 terrestrial mollusks petitioned to be listed under the Endangered Species Act (ESA). Our study was initiated to develop products needed to inform the Chelan mountainsnail Species Status Assessment to resolve if it is a listable entity. In 2021 we collected specimens from which we extracted DNA and developed genomic RADseq sequences. We conducted phylogenetic analyses on 109 samples to assess molecular support for species level status. Chelan form samples were not monophyletic but five of the 'forms' collectively grouped into moderately structured (Fst = 0.09-0.25) and highly inbred (Fis = 0.91-0.97) clades. This is indicative of an independent evolutionary trajectory; however, was not sufficiently distinct to identify independent taxonomic units. As a result of this work, the petition to list Chelan mountainsnail was withdrawn. Substantial resources have been directed toward the Chelan mountainsnail for nearly three decades and our study demonstrates the importance of developing solid taxonomic frameworks prior to embarking on species level conservation. This and other recent work have important implications for other taxa with unresolved taxonomy being considered for listing under the ESA including the Hoko vertigo (*Vertigo sp.*), Dalles sideband (*Monadenia fidelis minor*), and Evening fieldslug (*Deroceras hesperium*).

**Authors:** *Michael Lucid [1], Teal Waterstrat [1], Mason Linscott [2], Andrew Rankin [3] & Lacy Robinson [3] ([1] U.S. Fish & Wildlife Service, [2] University of Virginia, [3] Selkirk Wildlife Science LLC)*

**Presenters**: *Michael Lucid, U.S. Fish & Wildlife Service, Washington Fish & Wildlife Office, 215 Melody Lane, Wenatchee, Washington 98801 phone: 509-665-3508 email: michael_lucid@fws.gov & Teal Waterstrat, U.S. Fish & Wildlife Service, Washington Fish & Wildlife Office, 510 Desmond Drive SE, Lacey, Washington 83702 phone: 360-753-7760 email: teal_waterstrat@fws.gov*

**“Ducks can swim” and other lessons learned while mitigating for critically endangered Laysan ducks during an invasive rodent eradication project**

Non-native house mice (*Mus musculus*) were discovered to depredate nesting albatross on Sand Island, Midway Atoll in 2015, leading to plans to eradicate the invasive rodents by island-wide application of the rodenticide brodifacoum. Proposed measures for mitigating negative effects of the rodenticide on non-target species included measures to minimize risk of exposure to endangered Laysan ducks (*Anas laysanensis*). Initially, the approved mitigation plan called for temporarily wing-clipping all ducks and translocating those on Sand Island to nearby but mouse-free Eastern Island. The Eastern Island population would be provided with supplemental food and water, and 200 ducks would be maintained in aviaries until environmental levels of rodenticide residue on Sand Island were deemed to pose little additional risk. The onset of the COVID-19 pandemic in 2020 curtailed the project, but allowed for pilot studies of the mitigation plan, which subsequently required major modifications. When mouse eradication efforts were finally implemented in 2023, few birds were to be kept in aviaries, and efforts were intensified to quickly locate individuals returning to Sand Island and treat them for evident or potential ingestion of rodenticide. With little background data available, a team of veterinarians, aviculturalists, and biologists developed and adapted protocols to diagnose levels of risk and determine appropriate treatment and care. An outbreak of botulism on Eastern Island further complicated treatment decisions. With intensive efforts of dozens of staff and volunteers, however, the numbers of Laysan ducks remained high as rodenticide residue levels fell below levels of risk for the population.

**Authors:** *Tammy Summers [1], Sarah Youngren [2], Jonathon Plissner [1], James Breeden [1], Kelly Goodale, Alex Chmielewski, Laurie Bataen [3], Megan Kirchessner [4] & Lisa Shender [3] ([1] U.S. Fish & Wildlife Service, [2] Island Conservation, [3] National Park Service, [4] World Health Organization)*

**Presenter**: *Tammy Summers, U.S. Fish & Wildlife Service, Midway Atoll National Wildlife Refuge, 94-155 Leo’ole St., Unit B211, Waipahu, Hawaii 96797 phone: 808-954-4864 email: tammy_summers @fws.gov*

**Reaching beyond the reach: using a stepping-stone approach to restore connectivity**

Decades of time and energy have been spent on salmon recovery in the Columbia Basin. Salmon habitat restoration projects started small – small in scope, scale, and budget -- but over the last several decades have become dramatically larger and more complex, and hence more expensive. Individual projects have coalesced into programs, and programs have become careers. Yet, the perennial question remains -- what have we achieved? While many of our questions will remain unanswered, there is mounting evidence that larger, more complex projects expand and enhance salmon habitat. Now, instead of working at the site-scale, projects are frequently implemented at the reach or multi-reach scale. But where do we go from here? How do we reach beyond the reach?

Since 2010, restoration projects in the lower Columbia River have been evaluated by an Expert Regional Technical Group that considers the potential benefits to juvenile salmon. Original criteria favored larger restoration projects but provided little guidance for the spatial distribution of projects along the river. Recognizing this limitation, in 2019 the ERTG developed a landscape framework for restoration to assess and reduce habitat discontinuities. Restoration actions are now evaluated using a landscape ecology approach and a stepping-stone model. Relative distance between restored habitat patches (or gaps) are now evaluated on an equal basis with project size. This approach operationalizes landscape ecology-based decisions for migratory salmon and restores linkages between river reaches. Initial monitoring in the Estuary shows that tighter linkages connecting high quality habitat patches produce synergistic benefits for juvenile salmon.

**Authors:** *Janine Castro [1], Dan Bottom [2], Greg Hood [3], Kim Jones [4], Kirk Krueger [5] & Ron Thom [6] ([1] U.S. Fish & Wildlife Service, [2] NOAA Fisheries - retired, [3] Skagit River System Cooperative, [4] Oregon Department of Fish and Wildlife - retired, [5] Washington Department of Fish and Wildlife, [6] Pacific Northwest National Laboratory - emeritus)*

**Presenter**: *Janine Castro, U.S. Fish & Wildlife Service, Columbia River Fish & Wildlife Conservation Office, 1211 SE Cardinal Court, Vancouver, Washington 98683 phone: 360-604-2500 email: janine_castro@fws.gov*

**Demographic and genetic consequences of a steelhead supplementation program**

Supplementation of naturally spawning populations by the addition of hatchery-spawned individuals is commonly conducted for recovery of threatened and endangered populations and to support harvest opportunities. Our objective was to evaluate whether the use of a juvenile captive broodstock and an integrated paradigm could increase returns of steelhead (*Oncorhynchus mykiss*), while avoiding negative genetic impacts commonly associated with hatchery propagation. We analyzed 291 genetic markers in adult steelhead returning to an integrated population in southwest Washington over the course of 15 years. Reproductive success (RS) of fish spawning in the natural environment was evaluated by origin (hatchery versus natural) and return year. Data were then pooled over years to maximize sample sizes for comparing RS estimates among groups (i.e., estimation of relative reproductive success [RRS]). We observed a weak relationship between RS and origin, but a significant relationship between RS and return year (i.e., hatchery- and natural-origin fish did well or poorly together each year). Estimates of RRS for fish spawned in the hatchery ranged from 2.4 to 6.4, indicating that fish spawned in the hatchery produced more returning adult progeny than did fish allowed to spawn in the natural environment. Hatchery-origin fish exhibited reduced genetic diversity as well as evidence of increased temporal population structure. We conclude that the program was successful in achieving an increase in adult returns but not in avoiding negative genetic effects on the population and that any lasting impacts of supplementation remain to be determined.

**Authors:** *Christian Smith, Rachael Headley, Matt Smith, Benjamin Kennedy, John Holmes, Melissa Nehmens, Brice Adams, Mathew Piteo & Jennifer Von Bargen (U.S. Fish & Wildlife Service)*

**Presenter**: *Christian Smith, U.S. Fish & Wildlife Service, Abernathy Fish Technology Center, 1440 Abernathy Creek Road, Longview, Washington 98632 phone: 360.442.7980 email: christian_smith@fws.gov*

**Anthropogenic resistance on occupancy of Black-tailed deer (*Odocoileus hemionus columbianus*) and coyote (*Canis latrans*)**

Efforts to restore habitat connectivity in urbanized areas can increase the likelihood of human-wildlife conflict. Thus, it's important to discern human values that impact their behavior towards surrounding wildlife and habitat. We will identify how the behavior of humans residing near greenspaces impact wildlife movement of Black-tailed deer (*Odocoileus hemionus columbianus*) and coyotes (*Canis latrans*). Homeowners with a yard near viable habitat will be surveyed to identify encouraging actions the promote landscape occupancy and discouraging actions that impeded landscape occupancy. Surveys will gauge the individuals' demographics and attitudes towards these two species through a series of ranking statements. Resulting survey data will be quantified to assess how specific actions impact wildlife occupancy. Urban Wildlife Information Network's (UWIN) camera trap data from 29 sites in Portland, Oregon will be utilized to identify where Black-tailed deer and coyotes have been recorded in the past three years in juxtaposition with homeowner located within a 500-foot diameter of the camera coordinates. UWIN camera trap data will offer recorded species abundance and location, while date from Oregon Connectivity Assessment and Mapping Project will offer projected species abundance based on ideal habitat conditions. The data obtained will be applicable to wildlife and conservation management by identifying community attitudes and actions on homeowner private land located near actively used species habitat. This will inform managers on how landscapes surrounding prospective habitat corridors are being used, and thus how they will affect the potential habitat and species occupancy.

**Authors:** *Clarissa Cressotti [1,2], Catherine de Rivera [,1,2], Max Nielsen-Pincus [1] & Olyssa Starry [1,2] ([1] Portland State University, [2] Urban Wildlife Information Network)*

**Presenter:** *Clarissa Cressotti, Department of Environmental Science & Management, Portland State University, Urban Wildlife Information Network. 295 NW Lost Springs Terrace Unit 305, Portland, Oregon 97229 phone: 413-579-7448 email: cressot@pdx.edu*

**Inter- and intrapopulation resource use variation of marine subsidized western fence lizards**

Marine resource subsidies alter consumer dynamics of recipient populations in coastal systems. The response to these subsidies by generalist consumers is often not uniform, creating inter- and intrapopulation diet variation and niche diversification that may be intensified across heterogeneous landscapes. We sampled western fence lizards, *Sceloporus occidentalis*, from Puget Sound beaches and coastal and inland forest habitats, in addition to the lizards' marine and terrestrial prey items to quantify marine and terrestrial resource use with stable isotope analysis and mixing models. Beach lizards had higher average $\delta^{13}C$ and $\delta^{15}N$ values compared to coastal and inland forest lizards, exhibiting a strong mixing line between marine and terrestrial prey items. Across five beach sites, lizard populations received 20 to 51% of their diet from marine resources, on average, with individual lizards ranging between 7% and 86% marine diet. The hillslope of the transition zone between marine and terrestrial environments at beach sites was positively associated with marine-based diets, as the steepest sloped beach sites had the highest percent marine diets. Within-beach variation in transition zone slope was positively correlated with the isotopic niche space of beach lizard populations. These results demonstrate that physiography of transitional landscapes can mediate resource flow between environments, and variable habitat topography promotes niche diversification within lizard populations. Marine resource subsidization of Puget Sound beach *S. occidentalis* populations may facilitate occupation of the northwesternmost edge of the species range. Shoreline restoration and driftwood beach habitat conservation are important to support the unique ecology of Puget Sound *S. occidentalis.*

**Authors:** *Alexi Ebersole, Marie E. Bunker, Stacey L. Weiss & Kena Fox-Dobbs (University of Puget Sound)*

**Presenter:** *Alexi Ebersole, Environmental Policy & Decision Making Program, University of Puget Sound, 1500 North Warner Street, Tacoma, Washington 98416 phone: 541-801-3273 email: alexi.eber34@gmail.com*

**Oregon American badger management: TEK and western perspectives**

American badger (*Taxidea taxus*) are ecosystem engineers that play an integral role in promoting biodiversity within their habitat. Despite their importance we lack a comprehensive understanding of their ecological impact, particularly from a Traditional Ecological Knowledge (TEK) perspective. Our study aims to close this knowledge gap by investigating American badger management practices used by Tribes in Oregon throughout time and comparing them to current approaches to species management. We will document early spring behavior for American badgers as this is when they are most active using trail cameras in locations that have previously been identified through existing TEK. Next, ethnographic interview methodology commonly used in TEK will be applied to recorded interviews of Indigenous and non-native community members Transcribed and coded interviews will be analyzed for common themes and patterning regarding badger behavior to better understand how TEK impacts badger populations and management practices compared to western perspectives. The outcomes of this project will better inform scientific and tribal communities about badger ecology, and contribute to information that leads to better policy and management decisions that directly benefit badger populations.

**Authors:** *Samantha Chisholm Hatfield, Hunter Grove & Amy Mallozzi (Oregon State University)*

**Presenter:** *Hunter Grove, Fisheries Wildlife & Conservation Sciences Department, Oregon State University, 1500 SW Jefferson Way, Corvallis, Oregon 97331 phone: 541-294-8755 email: hunter.grove01@gmail.com*

**New boot scootin': The migratory plasticity of southern mountain caribou**

Southern mountain caribou (*Rangifer tarandus caribou*; hereafter referred to as caribou) is an endangered migratory species. Caribou spring migration has distinct planar (horizontal) and elevational movements as they travel from low elevations to high elevation meadows. Due to this habitat specialization, caribou are sensitive to habitat alteration and fragmentation, which is increasingly present within their range. Plasticity in the migratory behavior of caribou may alleviate the effects of disturbance on survival and recruitment. We measured whether an individual migrated during the spring for 226 individual caribou between 2000 – 2021 (345 caribou years). We first identified whether the individual migrated along planar or elevational gradients (strategy selection). For migrating individuals, we quantified migration characteristics including start date, starting elevation, distance, and duration. We used model selection to identify the effects of habitat on strategy selection and the characteristics of both planar and elevational migration. We found that caribou exhibit diverse migratory behavior. Strategy selection and characteristics were highly variable across and within herds. Planar migration strategy selection was not driven by the habitat covariates we measured. However, elevation migration strategy selection was driven by the amount of disturbance on the landscape. As disturbance increased, the propensity to migrate elevationally increased. The characteristics of both planar and elevational migration were driven by conditions during the previous winter, spring conditions, disturbance, and growing season. This is the first comprehensive study of the migratory plasticity of caribou. This work identifies bottom-up limitations to caribou movement and can inform recovery planning efforts.

**Authors:** *Brianna M. Lubenau [1], David E. Ausband [2], Matthew R. Falcy [2], Robert Serrouya [3] & Brittany Morlin [4] ([1] Idaho Cooperative Fish & Wildlife Research Unit, [2] U.S. Geological Survey, [3] Alberta Biodiversity Monitoring Institute, [4] U.S. Fish & Wildlife Service)*

**Presenter:** *Brianna M. Lubenau, Idaho Cooperative Fish & Wildlife Research Unit, Department of Fish & Wildlife Sciences, University of Idaho, 875 Perimeter Drive, Moscow, Idaho 83844 phone: 208-885-6176 email: bwinkel@uidaho.edu*

**Effects of habitat disturbance on stress and immune function in wild deer mice**

Human activity has altered 97% of the Earth's surface. These anthropogenic modifications of habitats are wide ranging and often result in loss of biodiversity. Understanding why some species seem to adapt to habitat alteration while others are unable to cope requires not only an understanding of the ecological and behavioral impacts, but also an understanding of physiological responses, such as stress levels and immune function. We collected blood and hair samples from western deer mice (*Peromyscus sonoriensis*) in habitats ranging from heavily disturbed by human activity to relatively pristine. From blood samples, we obtained total white blood cell (WBC) counts as a measure of immune function. From hair, glucocorticoid (GC) levels were quantified as a measure of chronic stress. Western deer mice from highly disturbed habitats had lower WBC counts and higher GC levels than those from less disturbed habitats. These results suggest that habitat disturbance is a source of chronic stress, which, in turn, suppresses immune function in deer mice. Our study reveals that even species that show resilience towards habitat disruption may still be at risk of lowered fitness and extinction, further highlighting the need to conserve undisturbed wildlife habitat.

**Authors:** *India Rosario, John Osorio & Laurie Dizney (University of Portland)*

**Presenters:** *India Rosario & John Osorio, University of Portland, College of Arts & Sciences, 5000 N Willamette Blvd, Buckley Center 216, Portland, Oregon 97203 phone: 503-943-8000 email: rosarioi25@up.edu & osorioj25@up.edu*

**Evaluation of the float test as a method in determining viability of Garry Oak (*Quercus garryana*) acorns**

Oak woodlands are recognized as one of Oregon's designated "strategy habitats" by the Oregon Department of Fish and Wildlife due to their ecological importance to wildlife and their concerning decline. To effectively restore oak woodlands, conservation practitioners need efficient methods to assess acorn viability of the dominant species, Garry oak (*Quercus garryana*). A commonly used method involves submerging acorns in water. Acorns that sink are considered likely to germinate, while those that float are considered nonviable. To assess the accuracy of this method, we collected acorns in autumn from Garry oaks during a low production year (2022) and a high production year (2023) in Benton County, Oregon. Collections were performed as 10-minute time-constrained searches below the canopy of individual trees in various habitats. Acorns were float tested and separated into four categories per tree: germinated float, non-germinated float, germinated sink, and non-germinated sink. To validate float test results, up to 20 non-germinated acorns that floated and 20 non-germinated acorns that sank per tree were placed in a growth chamber and checked bi-weekly for germination. A significant positive relationship was found between acorns that sank and acorns that germinated, with the float test predicting 85% of the variation in 2022 and 86% in 2023. These results strongly indicate the validity of the float test in assessing acorn viability. This allows for habitat managers to calculate the number of acorns and person-hours needed to achieve specific planting goals, providing a practical approach for conservation initiatives in oak woodlands.

**Authors:** *Angela Bartlett, Gareth R. Hopkins & Ava R. Howard (Western Oregon University)*

**Presenter:** *Angela Bartlett, Biology Department, Western Oregon University, 345 Monmouth Avenue North, Monmouth, Oregon 97361 phone: 541-999-4266 email: angelabartlett1234@gmail.com*

**Non-natal juvenile Chinook salmon use of small streams on naval installations in the Puget Sound, WA**

Naval Base Kitsap (NBK) is the Navy's third largest fleet concentration area, spanning more than 12,000 acres across the Kitsap peninsula within the Puget Sound, Washington. NBK installation grounds encompass small streams and tributaries which are home to various freshwater species. Through the Sikes Act, such installations are required to develop Integrated Natural Resource Management Plans (INRMPs) to direct conservation and ensure Endangered Species Act (ESA) compliance. ESA-listed species such as the Puget Sound Chinook salmon and Hood Canal summer chum salmon have access to some of these NBK streams, though they offer limited spawning habitat. However, this limitation does not preclude use as non-natal utilization of marine-draining tributaries is a well-documented life history strategy in many salmon species. In this study we sampled six streams on NBK property to determine the presence of juvenile Chinook salmon and other salmon species. We found juvenile Chinook salmon and chum fry in all streams surveyed, with abundances peaking in mid-February and late-March, respectively. Juvenile coho salmon were also observed in four of the six tributaries surveyed. The discovery of ESA-listed Puget Sound Chinook salmon juveniles within all the streams sampled warrants further research and future actions to preserve and improve these habitats. This information will be used by the Navy to further develop their INRMP to protect these streams from adverse actions or modifications.

**Authors:** *Keala Pelekai, Jack Brill & Jeffery Johnson (U.S. Fish & Wildlife Service)*

**Presenter**: *Keala Pelekai, U.S. Fish & Wildlife Service, Western Washington Fish & Wildlife Conservation Office, 500 Desmond Drive SE, Lacey, Washington 98503 phone: 406-214-5874 email: keala_pelekai@fws.gov*

**Moving species outside their known range in a changing world: Taking smart risks and making good decisions**

As climate change and other stressors irretrievably alter species' habitats and the natural processes on which they depend, our ability to use historical benchmarks for species conservation and habitat restoration is diminishing. Addressing the challenge of a non-analog future will require that we make decisions – even in the face of uncertainty – and take smart risks. Conservation introductions, moving species outside of their indigenous range for conservation purposes, can save species from extinction, replace lost ecological function, or drive ecosystem change towards a desired condition, but their use is controversial. Given this, and the number of listed species in our Region, we saw a need for a tool to facilitate making transparent and robust decisions on when to use, and not use, conservation introductions that incorporates decision science, reintroduction science, social science, and Indigenous knowledges. Our culturally, geographically, and biologically diverse Region provides an ideal testing ground for a framework that accounts for an array of social and ecological contexts. Prior to drafting the framework, we solicited input from more than 200 people from state and federal agencies, Tribes, NGOs, and other organizations from across the Region. Guided by the tenets of structured decision making, the framework is designed to be forward-thinking and inclusive to help the USFWS, partners, and interested parties reach a decision that considers the needs of the species and their habitats, alongside potential impacts to affected ecosystems and human communities in the face of a changing climate. Here, we present the framework and how it was developed.

**Authors:** *Jeff Burgett [1], Jesse D'Elia [1], Bridgette Flanders [1], Holly Freifeld [1], Leana Goetze [1], David Hand [1], Georgia Hart-Fredeluces [1], Paul Heimowitz [2], Mike Hudson [1], Kaitlyn Landfield [1], Megan Laut [1], David Leonard [1], Wendy Miles [1], Chris Swenson [1], Alana Simmons [1] & Roberta Swift [1], ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey)*

**Presenter**: *David Hand, U.S. Fish & Wildlife Service, Columbia River Fish & Wildlife Conservation Office, 1211 SE Cardinal Court, Vancouver, Washington 98683 phone: 360-604-2500 email: david_hand@fws.gov*

**Monitoring environmental impacts of a conservation introduction: The Sihek at Palmyra Atoll National Wildlife Refuge**

The conservation introduction of the Sihek, or Guam kingfisher (*Todiramphus cinnamominus*), at The Nature Conservancy's (TNC) Nature Preserve within Palmyra Atoll National Wildlife Refuge of the Pacific Remote Islands Marine National Monument is planned for 2024. Endemic to Guam, Sihek were extirpated in the wild 30 years ago due to the introduction of the brown tree snake (*Boiga irregularis*). Today ~150 Sihek persist in captive facilities across the globe. Reintroduction to Guam is the ultimate conservation objective for Sihek, though the persistent population of brown tree snakes on Guam led scientists to evaluate alternative locations to establish an experimental population. The heavily vegetated islands of Palmyra Atoll support a predator-free, native rainforest hosting a rich assemblage of arthropods and other potential prey species. Predation on local species is the most likely impact on Palmyra's ecosystem though prey preference is speculative based on Sihek biology. To detect impacts to Palmyra's ecological community, the team is executing an environmental monitoring program to establish baseline prey densities and trends with ongoing monitoring post-release. In 2023, FWS staff established monitoring plots across the atoll which are regularly monitored by TNC science volunteers. Visual observations, sweep-netting and documentation of presence and quantity of potential prey species (e.g. geckos, cockroaches, beetles) are documented for each plot. Not only will prey species trends inform decision-making and the level of impact on Palmyra's ecosystem but also, bolster Sihek ecological knowledge which will ultimately support the re-introduction of Sihek to their native range on Guam.

**Authors:** *Meagan Selvig, Stefan Kropidlowski & Megan Laut (U.S. Fish & Wildlife Service)*

**Presenter**: *Meagan Selvig, U.S. Fish & Wildlife Service, Marine National Monuments of the Pacific, 300 Ala Moana Boulevard, Room 5-231, Honolulu, Hawaii 96850 phone: 509-665-3508 email: meagan_selvig@fws.gov*

**Eyes in the sky: How accurate are UAS enumerations of Chinook salmon (*Oncorhynchus tshawytscha*) redds when compared to ground surveys?**

The annual enumeration of salmonid redds in shallow Idaho headwaters serves as a crucial estimation of anadromous fishery abundances and informs management decisions. In particular, the monitoring of adult Snake River Basin Spring/Summer Chinook salmon (*Oncorhynchus tshawytscha*) provides critical information for its listing status under the Endangered Species Act (ESA). Redd surveys have traditionally been performed either through intensive ground surveys or the use of manned aircraft. These redd visualization and survey methods can be costly, dangerous to fisheries professionals, and may prove difficult for assessing long-term population trends when employed inconsistently. These challenges underscore the need for alternative methods that provide accurate results preformed in a replicable manner. Given the recent advancements of Unmanned Aerial Systems (UAS), or 'drone', technology, we expand upon existing studies evaluating the effectiveness of this equipment by identifying Chinook salmon redds in Johnson Creek basin in partnership with the Nez Perce Tribe (NPT). After collection of aerial imagery from multiple flights at different spawning periods, Agisoft Metashape was used to compare UAS imagery to traditional ground survey methods conducted by the NPT. Analysis of both survey methods yielded comparable results with a total enumeration of 144 redd sites (SD ± 4 redds) with further spatial rectification to be conducted. In addition to an analysis of UAS redd quantification methods, we established a protocol to accurately replicate survey methods conducted within similar survey reaches. The refinement of this technology in a real-world fisheries application facilitates advancements in the conservation and monitoring of at-risk fisheries species.

**Authors:** *Cade Crookshanks [1], Kyle Ureta [1], Matthew Steinwurtzel [1], Jason Karl [1], Doug Nelson [2] & Brian Kennedy [1] ([1] University of Idaho, [2] Nez Perce Tribe)*

**Presenter:** *Cade Crookshanks, Department of Fish & Wildlife Sciences, University of Idaho, 875 Perimeter Drive, Moscow, Idaho 83843 phone: 775-354-5633 email: croo8280@vandals.uidaho.edu*

**Effects of reservoir type (run-of-river vs. storage) on native and invasive zooplankton assemblages**

Impoundments (i.e., dams and their resulting reservoirs) hydrologically alter riverine systems by lengthening water residence time and altering water quality. Zooplankton are vital primary and secondary consumers in these systems and are an important prey base for the economically and ecologically important salmonids of the Pacific Northwest. Previous studies from our lab have determined that zooplankton assemblage structure in the Columbia River basin is linked to seasonality and water quality. Our current project (NSF-DISES-DAMS) aims to determine the ways zooplankton assemblage structure, seasonality, and presence of invasive species differ between reservoir types (run-of-river vs. storage). To answer these questions, we are leading a two-year sampling effort of four impoundments, including two run-of-river reservoirs (Bonneville and The Dalles) and two storage reservoirs (Cougar and Detroit). Triplicate zooplankton samples are being collected at each site bimonthly, along with surface water quality data, and the collected specimens are being identified to the lowest feasible taxon (typically species). One year into our sampling effort, non-metric multidimensional scaling (NMDS) ordination results are showing readily observable differences in patterns of zooplankton assemblage composition between reservoirs and reservoir types. Additionally, seasonal patterns of abundance between reservoir types indicate stark differences between the presence of invasive species in run-of-river vs. storage reservoirs.

**Authors:** *Jess Mitchell, Stephen M. Bollens & Gretchen Rollwagen-Bollens (Washington State University - Vancouver)*

**Presenter:** *Jess Mitchell, School of Biological Sciences, Washington State University - Vancouver, 14204 NE Salmon Creek Avenue, Vancouver, Washington 98686 phone: 360-546-9115 email: jessica.l.mitchell@wsu.edu*

**Population demographics and dynamics of juvenile bull trout in a montane ecosystem**

Bull Trout, *Salvelinus confluentus,* (BLT) were listed as threatened within the conterminous United States in 1998 under the Endangered Species Act. Although some BLT populations within the U.S. Fish and Wildlife Service's designated core areas of recovery are stable or increasing, BLT in the Coeur d'Alene Core Area, Idaho (CDACA) have experienced dramatic declines, but little is known about the mechanisms responsible. Implementation of effective recovery actions will require a thorough understanding of the population demographics and dynamics of the juvenile component of the BLT population in the CDACA. In 2022-2023, we sampled 197 stream reaches on the mainstem St. Joe River and five additional tributaries (California Creek, Heller Creek, Medicine Creek, Sherlock Creek, Wisdom Creek) in the St. Joe River basin. In total, we sampled 1,530 juvenile BLT in the watershed. For all BLT greater than 70 mm, total length was recorded, scales were removed for ageing, a portion of the anal fin was removed for genetic analysis, and a passive integrated transponder (PIT) tag was injected into the body cavity. Fish movement was tracked throughout the late summer and autumn months in 2022-2023 using five PIT tag arrays constructed throughout the watershed. Additionally, habitat surveys were conducted at a subset of study sites to evaluate dominant habitat associations for juvenile BLT in the watershed. Our results will help direct conservation efforts by providing insight into the ecology of juvenile BLT in montane ecosystems and the suitability of spawning and rearing habitat in the upper St. Joe River basin.

**Authors:** *Sage Unsworth [1], Michael C. Quist [2], Andy Dux [3] & Carlos A. Camacho [3] ([1] Idaho Cooperative Fish & Wildlife Unit, [2] U.S. Geological Survey, [3] Idaho Department of Fish & Game)*

**Presenter:** *Sage Unsworth, Idaho Cooperative Fish & Wildlife Unit, University of Idaho, 875 Perimeter Dr. MS 1141, Moscow, Idaho 83844 phone: 208-908-2899 email: unsworth@uidaho.edu*

**Twenty-year shifts in the distribution of non-native brook trout within bull trout habitat in central Idaho**

Brook Trout (*Salvelinus fontinalis*) is not native to western North America but was widely introduced to promote angling opportunities between the late 19th and late 20th centuries. Because non-native brook trout negatively affect native salmonids such as cutthroat trout (*Oncorhynchus clarkii*) and federally threatened bull trout (*Salvelinus confluentus*), understanding if and where brook trout populations are expanding in the 21st century is necessary for effective conservation planning. Consequently, we investigated brook trout distributional shifts in coldwater streams in central Idaho, a region containing diverse aquatic habitats that support numerous bull trout populations of conservation concern. First, we aggregated all available electrofishing survey data collected in ten high-elevation watersheds in central Idaho that contain bull trout populations. Then, we identified 20-year shifts in brook trout occupancy by re-sampling 222 historical survey locations using the same methods and effort as used historically. Over the past two decades, total site occupancy by Brook Trout was either stable or increased in all watersheds. Most watersheds exhibited little or no increase in occupancy, but others exhibited large increases indicative of upstream range expansion. Most colonized sites were immediately adjacent to previously existing brook trout populations. All colonizations occurred in streams that previously contained brook trout or were tributaries of streams that previously contained brook trout. In contrast, we did not observe colonizations in any uninvaded streams that were separated by potential source populations by larger streams or rivers. We discuss our results in the context of ongoing bull trout conservation and brook trout control efforts.

**Authors**: *Nicholas Voss [1], Michael Quist [2], Brett Bowersox [3] & Daniel Nolfi [4] ([1] Idaho Cooperative Fish & Wildlife Research Unit, [2] U.S. Geological Survey, [3] Idaho Department of Fish & Game, [4] U.S. Fish & Wildlife Service)*

**Presenter:** *Nicholas Voss, Idaho Cooperative Fish & Wildlife Research Unit, 875 Perimeter Dr. MS 1141, University of Idaho, Moscow, Idaho 83844 phone: 201-546-2863 email: nvoss@uidaho.edu*

**Long-term effects of a prescribed burn on soil biogeochemistry in Pacific Northwest prairies**

Historically, native peoples have utilized prescribed fires to maintain overall ecosystem integrity of native grasslands within the Pacific Northwest. This, along with natural forces (e.g. lightning) have kept these fragile ecosystems from woody encroachment and controlled invasive plant species spread, much of which is of edaphic in nature and controlled by soils. Here, we reassessed a 2013 study on experimental treatments of landscape-scale fire reintroduction and fire-exclusion (control) plots on prairie sites in western Washington to quantify any potential changes in soil composition over a ten-year period. We collected soil samples to assess carbon (C), nitrogen (N), soil carbon to nitrogen ratios (C:N), organic matter, bulk density, soil respiration, and aboveground biomass data, predicting that in the ten-year time since fire (TSF) between treatments, in the previously burned plots there would be an overall decrease in aboveground biomass, an increase in sequestered soil carbon (C) from accumulated char, and an overall decrease in microbial soil respiration when compared with the control plots. We also predicted that C:N would decrease when compared with the values measured in 2013. Long-term effects of burn treatments varied, with an overall decrease of total aboveground biomass, an increase in sequestered soil carbon ( %C) between years, an increase in total C between treatments, and an overall decrease in soil C:N ratios. These results indicate that controlled fires in Pacific Northwest prairies result in a lower biomass, a long-term increase in net nutrient mineralization rates available for plant uptake, and an increase in sequestered carbon.

**Authors:** *Lindsey Zakopal [1], Dylan G. Fischer [1] James Lynch [3], Kathryn Hill [2] & R. Adam Martin [2] ([1] The Evergreen State College, [2] Center for Natural Lands Management, [3] Joint Base Lewis-McChord Fish & Wildlife)*

**Presenter:** *Lindsey Zakopal, The Evergreen Ecosystem Ecology Laboratory, The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, Washington 98505 phone: 512-577-2090 email: lindsey.zakopal@gmail.com*

**Searching for a needle in a haystack, a novel approach to a breeding bird survey**

The endemic subspecies of the Pacific coastal form of horned lark is found only in western Oregon and Washington. As its population and distribution has decreased significantly due to a declining amount of suitable habitat, streaked horned larks (*Eremophila alpestris strigata*) are now restricted to a few large open grassland sites, coastal beaches, airports, and islands in Washington and islands of the lower Columbia River, developed sites, and agricultural lands in the Willamette Valley in Oregon. Streaked horned larks nesting at coastal beaches in Washington require large areas of open sand with sparsely vegetated, native beach plants and low human disturbance. But their populations have been declining as dune-stabilizing invasive beach grasses encroach on available habitat, thereby creating a new ecological regime of densely vegetated coastal dunes.

Low detectability has been suspected for several years at coastal sites due to limited visibility created by vegetation and terrain and the lark's cryptic behavior around nests. At the Leadbetter Point unit of Willapa NWR, the trend in detections has been declining while the estimated number of occupied territories has remained constant or has increased. To investigate this phenomenon, we are conducting a hotspot cluster analysis using ESRI Field Maps and ArcGIS Pro combining lark detection data, nest locations, and spatially discrete tracks to delineate occupied breeding territories. An analysis is ongoing and to date over 200 track locations have been recorded during the past two years. Preliminary data identified occupied breeding territories that traditional survey methods missed.

**Authors:** *William Ritchie & Khem So (U.S. Fish & Wildlife Service)*

**Presenter**: *William Ritchie, U.S. Fish & Wildlife Service, Willapa National Wildlife Refuge, 7112 67th Place, Long Beach, WA 98631 phone: 360 642-3860 email: william_ritchie@fws.gov*

**Palmyra Atoll: Monitoring coral reef recovery and resilience in the face of large-scale bleaching events**

Palmyra Atoll National Wildlife Refuge is part of the Pacific Remote Islands Marine National Monument and located 1,000 miles south of Honolulu, HI. It is renowned as one of the most pristine and resilient coral reefs in the Pacific. Due to the lack of anthropomorphic disturbances for decades, such as overfishing and pollution, researchers have studied this dynamic reef system to better understand the effects of climate change on reef systems. Since 2009, a variety of techniques, including photo quadrats, have been used annually to document reef conditions at Palmyra. Continual data sets have captured two previous bleaching events as well as the robust recovery of the reefs each time. With limited annual monitoring trips, clarity on the bleaching and recovery of corals was limited. Warm water bleaching conditions were predicted at Palmyra in September 2023 and the Refuge and partners coordinated with researchers to expand annual monitoring efforts to support a mid-year monitoring trip in February 2024.The consecutive trips captured the beginning of what became a widespread and prolonged bleaching event with elevated ocean temperatures persisting for a total of 16-weeks. During this time, ocean conditions were monitored with an array of temperature loggers, photo quadrats, and other methodologies. With the help of partners, the Refuge examined the initial results and discuss the extent of coral bleaching, loss, and recovery, at Palmyra Atoll that occurred 6-months after the start of the 2023 bleaching event.

**Authors:** *Paige Mino & Stefan Kropidlowski (U.S. Fish & Wildlife Service)*

**Presenter**: *Paige Mino, U.S. Fish & Wildlife Service, Pacific Remote Islands Marine National Monument, 300 Ala Moana Blvd, Rm 5-231, Honolulu, Hawaii 96850 phone: 808-953-8362 email: paige_mino@fws.gov*

## Seven years of combating *Phragmites australis* in the intermountain west

*Phragmites australis* is an invasive grass that is a large management concern in many North American wetlands; its control is an integral part of conservation efforts. However, assessing the efficacy of invasive management and monitoring can be difficult. We analyzed seven years of phragmites data at Bear Lake NWR for the years 2016 and 2018-2023 to assess the effectiveness of chemical treatments and prescribed burns on *Phragmites*. We also tested a new monitoring protocol and analytical method to evaluate our treatments. Between 2016 and 2020, the mean area surveyed was 178.89 acres and between 2021 and 2023 the mean surveyed area was 1503.67 acres. We increased the number of acres that were re-surveyed each year, culminating in 97.74% re-surveyed in 2023. On average, we eliminated 92.87% of *Phragmites* in re-surveyed areas and found a consistent year-to-year reduction in *Phragmites* occurrences. Most phragmites encountered in a given year were new occurrences. We compared *Phragmites* occurrences in and out of burned areas following a prescribed burn in 2020. We found that despite a large initial reduction, *Phragmites* was 2.8 times more likely to persist in burned areas and the burned areas were 1.5 times more likely to host new occurrences of *Phragmites* than non-burned areas. Our new method provided a more accurate estimate of area surveyed and allowed for better year-to-year comparisons. These comparisons facilitate data driven management by quantifying the effectiveness of our treatments and allowing us to pinpoint areas where different approaches may be needed to successfully control *Phragmites*.

**Authors:** *Deo Lachman & Jeremy Jirak (U.S. Fish & Wildlife Service)*

**Presenter**: *Deo Lachman, U.S. Fish & Wildlife Service, Bear Lake National Wildlife Refuge, 322 4th St., Montpelier, Idaho 83254 phone: 208-847-1757 email: deo_lachman@fws.gov*

## Understanding landscape values for wildlife conservation

The conservation of fish, wildlife, plants, and their habitats often results in changes to the places and associated benefits that are important to the American public. For instance, if a species is translocated or reintroduced to an area people may be concerned how that could impact their way of life, livelihood, or autonomy. Comparatively, support could arise for reasons such as recreational, cultural, or symbolic significance. Here, we explore the concept of assigned landscape values in relation to sea otter conservation across coastal communities in the Pacific Northwest. Landscape values capture the perceived material and immaterial benefits of a place, often acting as drivers behind people's management preferences for wildlife conservation. We measured landscape values using a mapping activity during a series of 16 open houses hosted in Oregon and Northern California. A total of 345 people participated, identifying 17 landscape values such as natural beauty, recreation, commercial fishing, biological diversity, and sociocultural connections to the coast. Attitudes towards the impact of sea otters ranged from concerned (negative) to supportive (positive), with many people holding mixed expectations. Positive versus negative attitudes were related to the value bundles held by open house attendees and were spatially clustered throughout the landscape. We can use our understanding of landscape values as a starting point to (1) better know and relate to the community; (2) identify where conflict could emerge and why; and (3) determine conservation indicators of change that match the priorities of the people we serve.

**Authors:** *Riley Andrade & Leah Schrodt (U.S. Fish & Wildlife Service)*

**Presenters**: *Riley Andrade, U.S. Fish & Wildlife Service, Eastside Federal Complex, 911 NE. 11th Avenue, Portland, Oregon 97232 phone: 503-896-0977 email: riley_andrade@fws.gov & Leah Schrodt, U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Conservation Office, 2600 SE 98th Avenue, Suite 100, Portland, Oregon 97006 phone: 971-930-2211 email: leah_schrodt@fws.gov*

**Monitoring Midway's albatross populations – trends, threats, and future directions**

Midway Atoll is home to the world's largest nesting populations of black-footed and Laysan albatrosses, which have been the focus of numerous studies almost continuously since 1957. Long-term monitoring of the populations over the past two decades has included annual nest censuses and standardized monitoring of both adult survivorship and reproductive success to inform population models and identify trends and potential threats to the population. Low reproductive success in recent years have raised concerns about possible effects of climate change even though impacts on the breeding population sizes may not become immediately apparent for birds that generally don't begin breeding until age 7-9. Studies of habitat and microclimate associations with reproductive success are informing habitat management decisions, and Midway's demographic data also are being used for studies of larger-scale climatic trends and their effects on seabird populations. Midway also continues to support other research efforts identifying threats to albatross and other seabird populations, such as fishing bycatch and environmental toxins. The consistent, long-term monitoring and banding programs provide unparalleled datasets for further inquiries into the breeding biology and population demography of these species.

**Authors:** *Laura Brazier [1], Jonathon Plissner [1], Beth Flint [1], Roberta Swift [1], Marc Romano, Marc [1], William Kendall [2], Christopher Malachowski [3], Matt Rogosky [2] & Jennifer Mckay [2] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey, [3] Colorado State University)*

**Presenter**: *Laura Brazier, U.S. Fish & Wildlife Service, Midway Atoll National Wildlife Refuge, 94-155 Leo'ole St., Unit B211, Waipahu, Hawaii 96797 phone: 808-954-4814 email: laura_brazier@fws.gov*

**How much trapping effort is needed for early detection of European green crab?**

We present a case study assessing the effort needed to detect invasive European green crab *Carcinus maenas* on the coast of Washington State and Salish Sea shorelines. The goal of invasive species early detection monitoring programs is to detect new infestations soon after introduction so that eradication and quarantine measures can be used to control their spread. However, detection of newly introduced invasive species often occurs after populations are large and well established. The ability to detect newly introduced invasive species is affected by sampling procedures, including how much effort is expended. To assess the level of trapping effort needed to detect green crab and other taxa when they are rare, we used species accumulation theory to calculate sample-based rarefaction curves, total species richness, and estimates of sample completeness. We then used these estimates to describe the relationship between sampling effort and detection at two different spatial scales. Our results suggest that high probability early detection of green crabs or other rare taxa in many coastal waterbodies will require significantly more trapping effort than was expended in 2020. Our analyses further suggest that the effort required to provide for early detection was less at the site-specific spatial scale than at the waterbody scale. However, sample completeness at the site-specific spatial scale was negatively correlated with species richness. Current trapping efforts to find new green crab populations and to manage existing populations also provide an opportunity to detect other invasive organisms that may establish in similar habitats.

**Authors:** *Theresa Thom [1] & Tim Counihan [2] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey)*

**Presenter**: *Theresa Thom, U.S. Fish & Wildlife Service, Eastside Federal Complex, 911 NE. 11th Avenue, Portland, Oregon 97232 phone: 971-278-8029 email: theresa_thom@fws.gov*

**Drones, AI and coral recovery … oh my!**

Palmyra Atoll NWR (Palmyra) is a remote coral atoll in the central Pacific Ocean, and a unit of the Pacific Remote Islands Marine National Monument. Although the diverse reefs fringing Palmyra's outer perimeter are among the healthiest in the world, the reefs within Palmyra's lagoon systems have yet to recover from WWII-era alterations that destroyed formerly healthy coral habitat. During WWII, the atoll was intensively modified to support a naval air station and these developments resulted in significant alterations to the water flow and temperature patterns within the lagoons. Since WWII, the barriers to water flow have degraded and broken apart, returning some tidal flow to the lagoons, allowing for coral recruitment. The ability to monitor changes in coral reef habitats is crucial for gaining insights into the overall health and resilience of the lagoon ecosystem. Utilizing drones for acquiring high-resolution imagery at regular intervals presents an opportunity for frequent temporal-scale data collection in habitats visible from above the water surface. Machine learning techniques prove to be particularly effective tools for analyzing large, high-resolution image datasets, and this study focuses on assessing the efficacy of detecting and distinguishing coral colonies of different species and conditions. Our investigation involved the collection and processing of three complete sets of drone imagery over the entire lagoon starting in January 2022. Using this data, coupled with an extensive field effort, we utilize deep learning computer analysis to map and compare coral growth, recovery, and change.

**Authors:** *Amanda Pollock [1], Joseph Pollock [2], George Raber [3], Steve Schill [2] & Dana Sabine [2] ([1] U.S. Fish & Wildlife Service, [2] The Nature Conservancy, [3] University of Southern Mississippi)*

**Presenter**: *Amanda Pollock, U.S. Fish & Wildlife Service, Pacific Islands Refuges and Monuments Office, 300 Ala Moana Blvd, 5-231, Honolulu, Hawaii 96850 phone: 808-927-2511 email: amanda_pollock@fws.gov*

**Swimming like the wind: using wind energy distributions to characterize juvenile salmon and steelhead migration in the Columbia River basin**

Juvenile salmon and steelhead in the Columbia River basin migrate through a series of reservoirs and dams on their way to the Pacific Ocean. Dam operations, reservoir elevations, flow levels, and seasonal effects influence the amount of time it takes for juveniles to reach the ocean and their speed of migration. Weibull, Gamma, and other distributions are commonly used to characterize wind energy potential (i.e., wind speed) and these distributions provide an analogous framework for characterizing the migration speed of juvenile salmon and steelhead. In this presentation, we evaluated several wind energy distributions and assessed their degree of fit to observations of migration speed. We found that dam operations, measures of water velocity, and seasonal effects were important factors that influenced the scale and shape of the velocity distributions for juvenile salmon and steelhead. Because juveniles experience mortality during their migration, we show that the observed velocity distributions are biased to a degree that depends on the velocity and instantaneous mortality rate of the initial population. These measures of migration velocity and the effects of dam operations, water velocity, and seasonal effects provide standardized measures of migration speed for juvenile salmon and steelhead in the Columbia River Basin that can be compared to other systems, with or without dams and reservoirs.

**Authors:** *Steve Haeseker [1] & Jerry McCann [2] ([1] U.S. Fish & Wildlife Service, [2] Fish Passage Center)*

**Presenter**: *Steve Haeseker, U.S. Fish & Wildlife Service, Columbia River Fish & Wildlife Conservation Office, 1211 SE Cardinal Court, Vancouver, Washington 98683 phone: 360-604-2500 email: steve_haeseker@fws.gov*

**Summer evaluation of Tsoo-Yess River coho salmon pre-smolt releases**

Coho salmon hatchery programs primarily release smolts for reasons including increased survival through early rearing and concerns about hatchery-wild fish interactions. However, releasing fed-fry (pre-smolts) may also be a viable option for programs to achieve their goals when summer rearing conditions in the hatchery are not always suitable and there is not a segregated wild population of the species where habitat is suitable. The Makah National Fish Hatchery began releasing pre-smolts into the Tsoo-Yess River watershed in the spring of 2018 as an alternative to rearing the full program of 200,000 coho salmon to the smolt stage due to summer rearing limitations that lead to the mortality of all juvenile coho salmon at the hatchery in 2015. Pre-smolt releases in the spring of 2019, 2021, and 2023 were evaluated to assess summer distribution, density, abundance, survival, growth, and body condition. Across years, we observed variable summer survival, but fish densities were always greater in the tributaries where summer water temperatures were cooler. Within year, we observed differences in growth and body condition throughout the watershed, which held a similar pattern across years. Areas with higher juvenile coho salmon densities observed slower growth and lesser body condition, suggesting density-dependence processes are likely occurring. Reducing stocking densities to better align with the habitat and trophic system dynamics may increase growth and body condition, which often increases survival and adult return rates.

**Authors:** *Gregory J. Byford [1], Benjamin K. Cross [1], Deon Roche [2] & Tiffany Petersen [2] ([1] U.S. Fish & Wildlife Service, [2] Makah Tribe)*

**Presenter**: *Gregory J. Byford, U.S. Fish & Wildlife Service, Western Washington Fish & Wildlife Conservation Office, 500 Desmond Dr. SE, Lacey, Washington 98503 phone: 360-870-0349 email: gregory_byford@fws.gov*

**Invasive quagga mussel detection and treatment in the Snake River, Idaho**

*Dreissenid* mussels are an invasive freshwater mussel that are having large-scale impacts on river and lake systems in the United States. Until 2023, there had been no records of *Dreissenid* mussels invading the Columbia River basin. However, in September of 2023, quagga mussel (*Dreissena rostriformis*) veligers (planktonic larvae) were collected in the Snake River near Twin Falls, Idaho during routine monitoring. This area is heavily utilized for recreation and is also upstream of populations of two federally listed snail species and within the historical habitat of a third. Utilizing an existing rapid response plan, emergency large-scale survey and public outreach efforts were implemented by the Idaho State Department of Agriculture in partnership with federal, state, and local entities. Treatment occurred two weeks after discovery within a 6-mile section of the Snake River with the goal of eradicating all life stages of quagga. This was an unprecedented treatment effort, and both success of quagga eradication and long-term impacts are as yet unknown.

**Author:** *Alyssa Bangs (U.S. Fish & Wildlife Service)*

**Presenter**: *Alyssa Bangs, U.S. Fish & Wildlife Service, Idaho Fish & Wildlife Office, 1387 S. Vinnell Way, Suite 368, Boise, ID 83709 phone: 208-378-5345 email: alyssa_bangs@fws.gov*

**Invasive coconut palm control at Palmyra Atoll National Wildlife Refuge: A project update including a comparison of the "Marathon" verses "Sprint" methods**

In April 2019, the U.S. Fish and Wildlife Service initiated a project to control 95% of the population of invasive coconut palms (*Cocos nucifera*) from Palmyra Atoll National Wildlife Refuge with initial funding from the National Wildlife Refuge System's Large Invasive Species Allocation and supplemental funding from the Bipartisan Infrastructure Law. As of January 7th, 2024 the project has dedicated 5,945 person hours controlling 20,269 adult palms and 1,195,218 palm sprouts. using both mechanical and chemical (glyphosate) treatments. The majority of the treatments have been accomplished by the "Marathon method" which involves a team of one staff person and up to four volunteers deployed for 4 months to treat palms for a limited number of hours per day and week. Daily and weekly hours are limited to avoid team burnout over the 4-month rotation in a hot and humid environment carrying out strenuous treatments. These prescribed limits are necessary for 4-month teams but have contributed (along with Covid-19 delays) to the duration of the project being extended beyond the original planned completion date. In an attempt to control more palms at a faster pace, Managers are now experimenting with the "Sprint method", which involves contracting a highly skilled, 8-member, Invasive Species Strike Team which works significantly more hours per day and per week but only for 2 weeks at a time. We evaluated the cost and productivity levels of the Marathon and Sprint methods, and then used the results to estimate alternative project completion timelines.

**Authors:** *Rustin Gooden [1], Paige Mino [1], Stefan Kropidlowski [1], Katie Franklin [2], Dana Sabine [2], Julie Sullivan [3] & Wes Jolley [3] ([1] U.S. Fish & Wildlife Service, [2] The Nature Conservancy, [3] Island Conservation)*

**Presenter**: *Rustin Gooden, U.S. Fish & Wildlife Service, Pacific Remote Islands Marine National Monument, 300 Ala Moana Blvd Rm 5-231, Honolulu, Hawaii 96850 phone: 808-852-0679 email: rustin_gooden@fws.gov*

**Repeat spawning and length at spawning in Columbia River steelhead**

I used records from the PTAGIS database to examine rates of repeat spawning in Columbia River steelhead. I queried spawning migration years (June 1st to May 31st) from 2002-03 to 2020-21, over which 832 unique tagged repeat spawning steelhead were observed at Bonneville Dam. The general migratory pattern observed was that most adults first ascended Bonneville Dam in July or August, spawned between March and May, then emigrated as kelts in April or May. Some adults ascended Bonneville in the summer, fell back, then reascended Bonneville in the late winter or early spring, sometimes multiple times. The overall repeat spawning rate was 0.85%. It was much higher in wild fish (1.92%) than in hatchery fish (0.19%), as most steelhead hatcheries in the Columbia Basin use lethal spawning for egg take, as well as fishing regulations that prohibit harvest of wild steelhead. Skip spawners, or fish that skipped a year between spawning migrations, comprised 48% of all repeats. This is a life-history behavior that is more prevalent among summer-run steelhead, which typically have longer migrations than winter-run. The median length of repeat spawners (680 mm) was greater than that of maiden spawners (628 mm). The median length of repeat spawners who skipped a year (715 mm) was larger than consecutive year spawners (650 mm). Growth from 1st to 2nd spawning ranged from 0 to 120 mm for consecutive spawners, with a median of 40 mm; for skip spawners the range was 20 to 180 mm, with a median of 100 mm.

**Author:** *David Swank (U.S. Fish & Wildlife Service)*

**Presenter**: *David Swank, U.S. Fish & Wildlife Service, Eastside Federal Complex, 911 NE. 11th Avenue, Portland, Oregon 97232 phone: 360-604-2500 email: david_swank@fws.gov*

**Management actions for conserving forest bird populations at the Big Island National Wildlife Refuge Complex, Hawai‘i**

The BINWRC was established for the conservation of forest birds and their habitats. Surveys of forest bird populations have been conducted annually at the BINWRC; at Hakalau Forest Unit (HFU) since 1987 and periodically at the Kona Forest Unit (KFU) since 1995. We found a continuation of several trends observed in previous analyses at HFU, with most species' trends upward. However, several species showed downward trends in closed-forest habitats. Results were mixed at KFU. This data analysis has allowed managers to evaluate if management actions to mitigate threats have been effective for conserving forest birds. Threats to forest birds at the BINWRC, including habitat loss, avian disease, feral ungulates, and non-native predators, appear to be having a negative impact. Continuing and enhancing management actions such as restoring forests, removing invasive species, limiting the prevalence of avian disease, controlling predators, and collaborating with adjacent landowners, could help mitigate the impacts and allow the BINWRC to remain a key site for forest bird conservation in Hawai‘i.

**Authors:** *Steven Kendall [1], Rachel Rounds [1], Richard Camp [2], Ayesha Genz [3], Donna Ball [1], Thomas Cady [1] & Eldridge Naboa [1] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey, [3] University of Hawai‘i at Hilo)*

**Presenter**: *Eldridge Naboa, U.S. Fish & Wildlife Service, Big Island National Wildlife Refuge Complex, 60 Nowelo Street, Hilo, Hawai‘i 96720 phone: 808-443-2300 email: eldridge_naboa@fws.gov*

**Abundance and survival rates of genetically distinct populations of red knots in the Pacific flyway**

Recent analyses indicate that two genetically distinct populations of Red Knots, rather than one, as formerly recognized, migrate along the Pacific Flyway. Consequently, the Pacific Flyway now hosts the two smallest populations of this species globally. Given uncertainty about the population status of Red Knots in the Pacific Flyway, we used genetic analyses and mark-recapture data to assess both the size and survival rates of the now-recognized two populations. During spring migration in 2022 and 2023, we surveyed Grays Harbor and Willapa Bay and collected mark-resight data from >100 different Red Knots, most of them having been marked in the U.S. We captured >130 birds, attached field-readable leg flags, and collected blood samples for future genetic analysis. Despite over one decade of capture and marking experience involving knots in coastal Washington, we encountered three unanticipated challenges: 1) in contrast to previous years, we saw few of the >500 knots we captured and marked in the few years leading up to this project, 2) our captures in 2022 and 2023 were far smaller than in previous years, and 3) in 2023, knots did not forage or roost in traditional areas, perhaps due to a profusion of early-cycle Dungeness crabs which were well distributed and consumed by knots, a prey preference we had not noted previously. The 2024 season will be dedicated to resighting work, and we intend to secure funds to extend the project two additional years to achieve our resighting objectives.

**Authors:** *Vanessa Loverti [1], Jim Johnson [1], James Lyons [2], Terry Chesser [2], Jesse Conklin [3] & Joe Buchanan [4] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey, [3] University of Groningen, [4] Washington Department of Fish and Wildlife)*

**Presenter**: *Vanessa Loverti, U.S. Fish & Wildlife Service, Eastside Federal Complex, 911 NE. 11th Avenue, Portland, Oregon 97232 phone: 503-736-4497 email: vanessa_loverti@fws.gov*

**Movements and habitat use vary across the Rocky Mountain population of Trumpeter swans**

The Rocky Mountain Population (RMP) of North American Trumpeter swans includes breeders in the Greater Yellowstone Area (GYA) and other western states (the “U.S. segment”), and in western Canada (the “Canada segment”). Conservation concern for the U.S. segment stems from its slow population growth, limited migratory behavior of GYA swans, and crowded wintering habitats. However, the spatial ecology of this population remains poorly known. To better understand migratory behavior and habitat use, we used telemetry data from 55 RMP Trumpeter Swans captured in the western U.S. Preliminary results showed that the 45 swans (60 swan-years) that spent breeding seasons after capture in the U.S. traveled an average of 89 km (± 100 [SD]; range = 0 – 487 km) between breeding and wintering areas. In one-third of these swan-years, birds did not migrate at all. For 10 swans (16 swan-years) that summered in Canada, 5 individuals appeared to molt but not nest, and 4 birds appeared to nest in 1 or more years. Migratory connectivity was weaker (0.07-0.15) in years when more swans migrated to Canada for summer. During the breeding season, Canada swans used low-elevation lakes, but U.S. swans used high-elevation lakes. Both groups increased use of agricultural fields outside of the breeding season. Our study indicates the potential for interchange between the U.S. and Canada segments, which has implications for potential recovery of the U.S. segment. The extensive variation in movement behavior of GYA swans suggests that encouraging migratory behavior and restoring winter habitats may support Trumpeter swan conservation.

**Authors:** *Andrea Kristof [1], Sharon Poessel [2], Todd Sanders [1], William Long [3], Brandon Reishus [4], Matt Proett [5], Claire Gower [6], Nicole Ibrahim [7] & Todd Katzner [2] ([1] U.S. Fish & Wildlife Service, [2] U.S. Geological Survey, [3] Wyoming Wetlands Society, [4] Oregon Department of Fish and Wildlife, [5] Idaho Department of Fish and Game, [6] Montana Fish, Wildlife & Parks, [7] University of Maryland)*

**Presenters**: *Andrea Kristof, U.S. Fish & Wildlife Service, Camas National Wildlife Refuge, 2130 E 2350 Rd N, Hamer, Idaho 83425 phone: 208-662-5423 email: andrea_kristof@fws.gov & Sharon Poessel, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 230 Collins Road, Boise, Idaho 83702 email: spoessel@usgs.gov*

**You are what you eat: developing methods to use tundra swan feces to monitor blood lead levels, habitat use, food selection, and waterfowl health during spring migration through the Pb-contaminated lower Coeur d'Alene River basin**

The lower Coeur d'Alene River basin in Northern Idaho consists of thousands of acres of lateral lakes and wetlands within a major waterfowl migratory corridor. Over 100 years of mining upstream in the Silver Valley resulted in extensive mine-waste deposition into the wetland sediments. Consequently, over 95% of the wetlands, which are included in the Bunker Hill Superfund Site, have sediment Pb-concentrations toxic to waterfowl. Tundra swans are particularly vulnerable to Pb-toxicity as they ingest contaminated soil while foraging for and eating root and tubers. Restoration efforts are underway but will require decades to complete. As such, cost-effective and informative methods are needed to monitor short- and long-term biological responses to specific projects, across the basin over time, and to inform future remediation and restoration methods. The Idaho Fish and Wildlife Office is working with the USEPA, Idaho Department of Fish and Game, and Coeur d'Alene Tribe to develop methods using tundra swan feces to passively monitor blood lead levels, habitat use, food selection and waterfowl health during spring migration through the basin. Early results show promise in establishing the relationships between the fecal, blood and sediment-lead levels. Vegetation present in the feces suggests a wider variety of preferred forage than previously known. Additional work is underway to identify exposure locations and food preference, which can help guide design and plant selection at restoration sites to attract waterfowl. Despite current results being limited by trapping challenges and low replication, they demonstrate the importance of creating non-invasive, low-cost, effecting monitoring methods.

**Authors:** *Sarah Emeterio [1], Mark Jankowski [2], Todd Luxton [2], Jennifer Crawford [2], David Leptich [3], David Van de Riet [3], Steve Sluka [3], Cameron Heusser [4], Patrick McGovern [4] & Brittany Morlin [1] ([1] U.S. Fish & Wildlife Service, [2] U.S. Environmental Protection Agency, [3] Idaho Department of Fish and Game, [4] Coeur d'Alene Tribe)*

**Presenter**: *Sarah Emeterio, U.S. Fish & Wildlife Service, Idaho Fish & Wildlife Office, 3232 W. Nursery Road, Coeur d'Alene, Idaho 83815 phone: 208-510-5456 email: sarah_emeterio@fws.gov*

**Mapping an outbreak of the corallivorous Crown-of-Thorns starfish at Palmyra Atoll NWR**

Crow-of-Thorns Starfish (COTS) are currently a threat to the coral reefs of the Palmyra Atoll National Wildlife Refuge (Palmyra), where researchers, volunteers, and staff have reported extensive coral damage due to a current and ongoing outbreak. Although COTS are native to Palmyra, they become a threat when they reach outbreak levels, and these outbreaks can cause atoll-wide coral decline. An outbreak is triggered when COTS densities exceed 1,000- 1,500 starfish/km2, and the Palmyra outbreak was detected in 2018. Control of COTS through management actions is a critical intervention step for Palmyra's long-term reef health and resilience. The goal of COTS management is not to eradicate COTS, but to use a tactical management response that effectively decreases the severity and extent of the outbreak on the reefs of Palmyra. In April of 2023 the first trip of the Palmyra COTS Control Project was conducted. The goals of this trip were to 1) Survey as much of the coral reef habitat as possible to map the current presence, abundance, and distribution of COTS, 2) Determine the COTS population management needs, and 3) Delineate the most heavily populated areas to help target management efforts. A total of 470 acres of coral reef were surveyed for COTS and 640 COTS were treated/controlled over the course of the trip. Hots spots were found on the Northern fore reef and Penguin Spit back reef. A population estimate of 6,307 COTS was derived from survey data.

**Authors:** *Amanda Pollock [1], Jeremy Raynal [1], Channing St. Aubin [1], Ryan Hagerty [1], Jessica Glazner [2], Kevin Lino [3] & Caitlin Shishido [1] ([1] U.S. Fish & Wildlife Service, [2] University of Hawaii, [3] U.S. Navy)*

**Presenter**: *Amanda Pollock, U.S. Fish & Wildlife Service, Pacific Islands Refuges and Monuments Office, 300 Ala Moana Blvd, 5-231, Honolulu, Hawaii 96850 phone: 808-927-2511 email: amanda_pollock@fws.gov*

**Seasonal movements of adult yellow perch between two contrasting lakes (Lake Union and Lake Washington) in the Seattle metropolitan area**

We examined the seasonal movements of adult yellow perch (*Perca flavescens*) between, a small, shallow lake (Lake Union) and a large, deep lake (Lake Washington). Lake Union is the largest part of the Lake Washington Ship Canal (LWSC), a long, narrow waterway between Lake Washington and Puget Sound. Yellow perch were implanted with acoustic tags that had a battery life of at least 460 days. All tagged yellow perch were captured and released in Lake Union in the summer of 2020 or 2021. Movements were monitored primarily with 14 stationary receivers that were deployed at key locations between the two lakes. Additional information was obtained from mobile tracking and other stationary receivers in Lake Washington. Of the 47 fish tagged, we were able to get seasonal movement data on 30 fish. Twenty-three (77%) of them left Lake Union and moved into Lake Washington while the other seven (23%) remained in the LWSC and appeared to overwinter there. Most movements from Lake Union to Lake Washington occurred in September or October when water temperatures were decreasing while those from Lake Washington to Lake Union were variable. Migrations between Lake Union and Lake Washington usually took just a few hours and took place day or night. The farthest observed distance moved from the release site was approximately 16 km. Within Lake Washington, tagged yellow perch were found over a broad area in the northern two/thirds of the lake. Overall, tracking results indicated yellow perch can make extensive migrations between the two lakes.

**Authors:** *Roger Tabor [1], Daniel Lantz [2], Lauren Urgenson [2], Aaron Bosworth [3] & Jeffery Johnson [1] ([1] U.S. Fish & Wildlife Service, [2] King County, [3] Washington Department of Fish and Wildlife)*

**Presenter**: *Roger Tabor, U.S. Fish & Wildlife Service, Western Washington Fish & Wildlife Conservation Office, 500 Desmond Drive SE, Lacey, Washington 98503 phone: 360 259-0225 email: roger_tabor@fws.gov*

**Over my dead body – The challenge of controlling a charismatic species to save a threatened one**

Controlling populations of a charismatic species, even to save an endangered one, can encounter significant resistance within the resource community and from the public. Barred owls, a recent invader in the west, are threatening our iconic spotted owl. The Service conducted experimental removal of barred owls to test whether such actions would conserve spotted owls. We engaged a stakeholder group during development of the experiment to ensure our understanding of the issues around killing barred owls. The Service is currently developing a management strategy covering Washington, Oregon, and California. We will discuss the effort, the issues, and the resistance encountered.

**Author:** *Robin Bown (U.S. Fish & Wildlife Service)*

**Presenter**: *Robin Bown, U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Office, 2600 SE 98th Avenue, Portland, Oregon 97266 phone: 503 231-6923 email: robin_bown@fws.gov*

**Can habitat enhancements and raven management save sage-grouse from ravens?**

In 2018, the Baker Sage-grouse Local Implementation Team (LIT) partnered with Oregon State University (OSU) to understand the degree to which a high density of common ravens (*Corvus corax*; hereafter ravens) may be negatively affected greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) nest success in Baker County, Oregon. The Service permitted Oregon Department of Fish and Wildlife (ODFW) to conduct lethal raven removal in the Baker sage-grouse Priority Area for Conservation (PAC) as part of a before-after-control-impact study. At the same time, the LIT significantly increased habitat restoration activities within the PAC. This study is ongoing, however initial results are providing lessons for lethal and non-lethal raven management, as well as guiding efforts to mitigate anthropogenic subsidies that support ravens and target restoration within identified "sink" habitats.

**Author:** *Jacqueline Cupples (U.S. Fish & Wildlife Service)*

**Presenter**: *Jacqueline Cupples, U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Office, La Grande Field Office, 3502 Highway 30, La Grande, Oregon 97850 phone: 541-962-8593 email: jacqueline_cupples@fws.gov*

**No “low hanging fruit” – The double-crested cormorant management plan to reduce predation on juvenile salmonids in the Columbia River estuary**

The U.S. Army Corps of Engineers’ Double-crested Cormorant Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary was implemented in 2015, after decades of monitoring and research. The Service was a cooperating agency and issued the permits for the take of double-crested cormorants, a species protected under the Migratory Bird Treaty Act. The Plan was included in National Oceanic and Atmospheric Administration’s Federal Columbia River Power System Biological Opinions as a reasonable and prudent measure to ensure the continued existence of ESA-listed populations of salmonids in the Columbia River Basin. The implementation was litigated due to the conflict of killing double-crested cormorants to protect salmonids. Although the Plan was successful as described in the Plan, the overall goal of reducing predation on ESA-listed salmonids has not been achieved. The opposite has occurred. Next steps have been developed through continued partnerships with multiple Federal, State and Tribal partners and nongovernmental entities.

**Author:** *Michelle McDowell (U.S. Fish & Wildlife Service)*

**Presenter**: *Michelle McDowell, U.S. Fish & Wildlife Service, Eastside Federal Complex, 911 NE. 11th Avenue, Portland, Oregon 97232 phone: 503-231-2024 email: michelle_mcdowell@fws.gov*

**Genetic evaluation of trojan YY brook trout treatments in four streams**

Trojan YY male (MYY) brook trout provide a targeted method for treatment and potential eradication of invasive brook trout populations. Since 2019, these fish have been stocked into four streams in New Mexico (Leandro Creek, Placer Creek, Rito de los Piños, and Rio Bonito) with the intent of eradicating non-native brook trout populations. Here, we provide the genetic evaluation of MYY brook trout performance in the four treatment streams and one untreated control stream (Little Vermejo Creek) from 2019 through 2022. Genetic samples (N = 3,610) representing young-of-year (YOY) and adult samples from five streams and each MYY cohort from 2018 through 2022 were amplified using a 223-locus GTseq panel. Genetic sex identification was performed, and MYY brook trout offspring were identified using NEWHYBRIDS. Male-favored sex ratios and increasing MYY offspring proportions were found among YOY fish in all four treatment streams. However, these demographic changes have been more slowly accrued in adult population segments. Additional findings could impact genetic monitoring of MYY actions in treated streams. For example, sex-specific genotyping biases were detected for two of four evaluated sex-identifying markers. MYY offspring with XX sex genotypes were also detected in Placer Creek and Rio Bonito, indicating hatchery escapement of MXY Brook trout among the MYY fish. Despite these issues, we observed positive performance of MYY Brook Trout as a potential management tool. However, possible MXY hatchery escapement and slow recruitment of MYY offspring to reproductive age provide potential areas of study for future monitoring efforts.

**Authors:** *Steven Mussmann & Melissa Nehmens (U.S. Fish & Wildlife Service)*

**Presenter**: *Steven Mussmann, U.S. Fish & Wildlife Service, Abernathy Fish Technology Center, U.S. Fish and Wildlife Service, Longview, Washington 98632 phone: 360-442-7980 email: steven_mussmann@fws.gov*

**Providing a life raft: can artificial floating platforms help protect shorebirds during the Wake Atoll rat eradication**

Wake Atoll lies approximately 2,200 miles west of the Hawaiian Islands and consists of three islands surrounding a shallow lagoon. Wake's islands are managed by the U.S. Air Force while the shallow lagoon and the surrounding waters are managed by USFWS as a National Wildlife Refuge and part of the Pacific Remote Islands Marine National Monument. Wake Atoll supports a diverse assemblage of species and serves as an important wintering habitat for several shorebird species, including Pacific golden-plover (*Pluvialis fulva*), ruddy turnstone (*Arenaria interpres*), and bristle-thighed curlew (*Numenius tahitiensis*). An effort to eradicate rats from Wake Atoll is currently underway, using the anticoagulant rodenticide Brodifacoum-25W Conservation. Though this method has proven effective in many eradications, it is not without risks to native, non-target wildlife, especially shorebirds. While timing of the bait drop for when the fewest number of shorebirds are present is the primary means of mitigation, the several hundred shorebirds that spend the summer at Wake are at risk of exposure. We have deployed six experimental floating platforms in the Wake lagoon to serve not only as a rodent-free site for shorebird roosting and supplemental feeding, but also a safe site for administering Vitamin K1, the treatment for anticoagulant rodenticide poisoning. Distribution of Vitamin K1 to non-target species has historically been difficult without a practical way to deliver treatments while avoiding inadvertently treating the targeted rodents. The floating platforms are a novel method for providing access to this treatment, along with uncontaminated food, to shorebirds throughout this eradication attempt.

**Authors:** *Anna Vallery, Beth Flint & Stefan Kropidlowski (U.S. Fish & Wildlife Service)*

**Presenter**: *Anna Vallery, U.S. Fish & Wildlife Service, Marine National Monuments of the Pacific, 300 Ala Moana Boulevard, Room 5-231, Honolulu, Hawaii 96850 phone: 808-859-0068 email: anna_vallery@fws.gov*

**How have migrant passerines responded to 17 years of change in the upper Snake River plain?**

Camas National Wildlife Refuge (NWR) encompasses approximately 4,500 hectares on the Snake River Plain in eastern Idaho, including riparian habitat along Camas Creek augmented by cottonwood (*Populus trichocarpa* & *P. deltopids*) and Russian Olive (*Elaeagnus angustifolia*) shelterbelts. A baseline study conducted between 2005 to 2007 demonstrated that the riparian woodland and shelterbelts provided a regionally important stopover site for migrating landbirds. The study documented 99 species including an abundance of Wilson's Warblers (*Cardellina pusilla*), Hermit Thrushes (*Catharus guttatus*), and Ruby-crowned Kinglets (*Corthylio calendula*), and found that many individuals spending several days at Camas NWR gained significant weight. Since then, regional climatic and water use changes have been sufficient such that the species composition and age structure of the Refuge riparian habitat has changed. Today, dead and fallen cottonwoods and Russian olive shelterbelts occur adjacent to a narrower riparian zone. We did not know the degree to which the Refuge has continued to function as an important migratory passerine stopover site. In 2023, we replicated the baseline study's banding and surveys during spring and fall migration to evaluate use by migrant passerines. We found continued heavy use of the Refuge by migrating passerines, but passerine species composition, abundance, and stopover ecology have shifted across the 17-year period between sampling. These shifts likely reflect both changes in Refuge vegetation and broader scale population changes in North American passerines population under the prevailing regime of climate change and impacts of human enterprise across the breeding and wintering ranges of passerine birds.

**Authors:** *Andrea Kristof [1], Austin R. Young [2], Jay D. Carlisle [3] & David J. Delehanty [2] ([1] U.S. Fish & Wildlife Service, [2] Idaho State University, [3] Boise State University)*

**Presenters**: *Andrea Kristof, U.S. Fish & Wildlife Service, Camas National Wildlife Refuge, 2130 E 2350 Rd N, Hamer, Idaho 83425 phone: 208-662-5423 email: andrea_kristof@fws.gov & Austin R. Young, Idaho State University, Department of Biology, 921 S. 8th Ave. Mail Stop 8007, Pocatello, Idaho 83209 phone: 208-282-3765 email: austinyoung@isu.edu*

**Establishing endangered plant populations at Midway Atoll – pōpolo and loulu**

Habitat restoration efforts at Midway Atoll have included propagation and outplantings of two endangered species endemic to the Hawaiian archipelago. Pōpolo, *Solanum nelsonii*, was historically found in both the main and Northwestern Hawaiian Islands, but was nearly extirpated from Midway because of the presence of invasive rodents. The relict population on isolated Spit Island became the source of seed for restoration of populations across the rest of the atoll and an intensive propagation program led to the first outplantings in 2014 and a current established population of >3,000 individual plants. Despite high productivity of fruit and viable seed, however, little if any natural recruitment is evident, with some evidence indicating that seed and seedling predation by invasive house mice may still threaten long-term viability of the population. Soil nutrients, non-native arthropods, or parasitic nematodes may also be factors limiting recruitment. Loulu, *Pritchardia remota*, is a fan palm endemic to Nihoa. From 300 seeds brought to Midway in 2009 ~20 individuals germinated and survived to be outplanted between 2011 and 2014. In 2023, the four surviving plants all flowered, although only one individual has produced viable seeds, which have currently produced nearly 800 seedlings. A mature *Pritchardia* tree of unknown origin and uncertain species identification poses the potential risk of cross-fertilization and hybridization but difficulties resolving the phylogeny of the genus have created a dilemma in determining if the plant should or can be removed.

**Authors:** *Amanda Adams & Jonathon Plissner (U.S. Fish & Wildlife Service)*

**Presenter**: *Amanda Adams, U.S. Fish & Wildlife Service, Midway Atoll National Wildlife Refuge, 94-155 Leo'ole Street, Unit B211, Waipahu, Hawaii 96797 phone: 808-954-4813 email: amanda_adams@fws.gov*

“The question is not what you look at that matters, but what you see.”

*(Henry David Thoreau, Walden - 1854)*

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**U.S. Fish & Wildlife Service**
**Pacific Region**
**911 NE 11th Avenue**
**Portland, Oregon 97232**