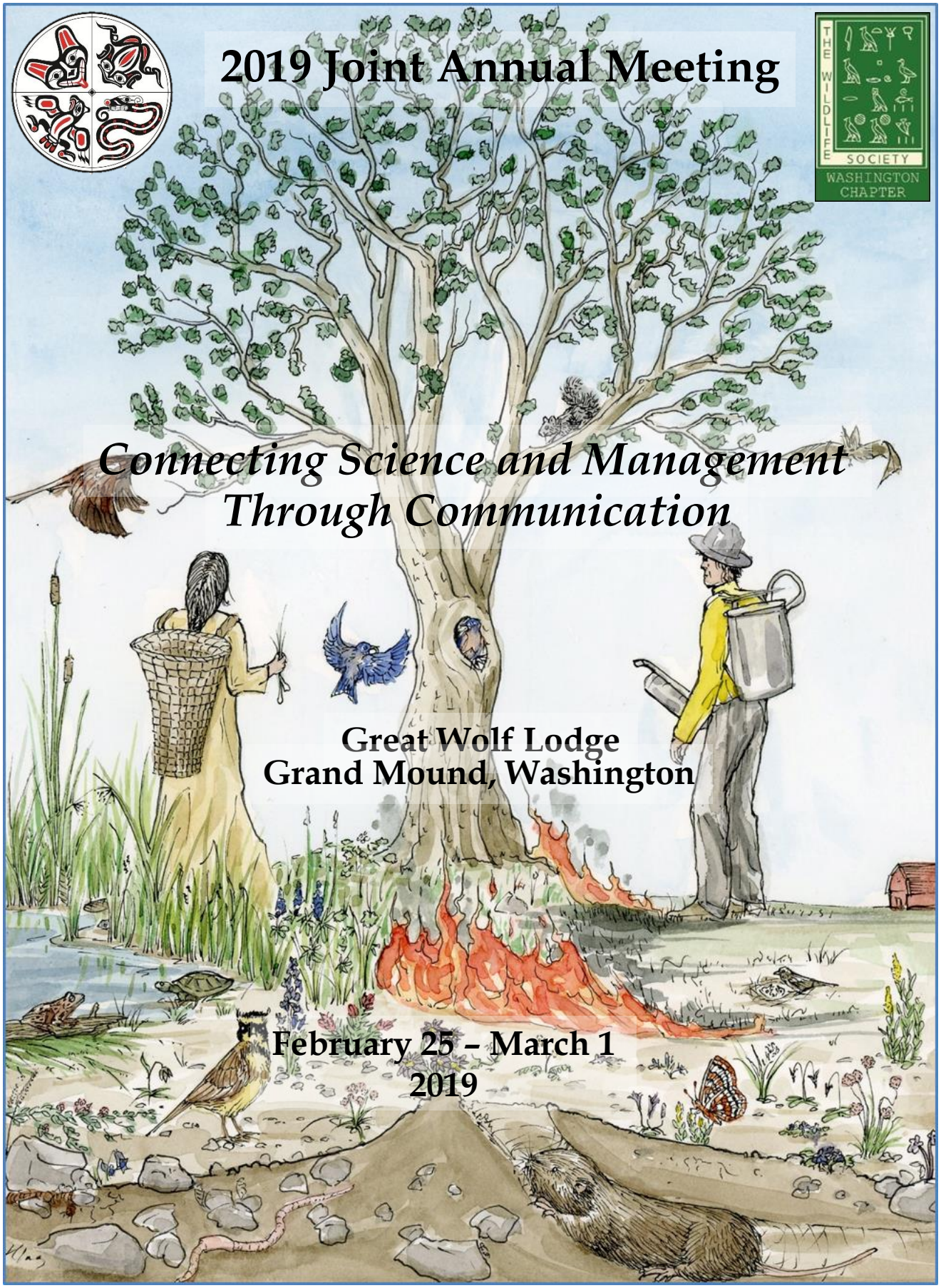
2019 Joint Annual Meeting



Connecting Science and Management Through Communication

Great Wolf Lodge
Grand Mound, Washington

February 25 – March 1
2019

Hosted by the Washington Chapter of the Wildlife Society & The Society for Northwestern Vertebrate Biology
In association the NW Partners in Amphibian and Reptile Conservation

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Welcome from the Partners!

Washington Chapter of The Wildlife Society - (WATWS)- The Washington Chapter is a statewide affiliate of The Wildlife Society devoted to promoting *excellence in wildlife stewardship through science and education*. Chapter members represent a diverse array of wildlife conservation and management agencies, non-governmental organizations, academic faculty, students, education programs, and other disciplines dedicated to conserving diversity, sustaining productivity, and ensuring responsible use of wildlife resources for the benefit of society. The Washington Chapter encourages research and professional growth through grants, workshops, annual meetings, and undergraduate scholarships.

2018-2019 Executive Board

President: Katy Stuart
President Elect: Lisa Dowling
Vice President: Sara Hansen
Past President: Danielle Munzing
Secretary: Teresa Lorenz
Treasurer: Sarah Kindschuh
Board Members: Annemarie Prince, Dominic Bachman, Kevin White, Clint Robins

The Society for Northwestern Vertebrate Biology (SNVB) is the longest running scientific association devoted to the study of vertebrate ecology in the Pacific Northwest. Our society strives to promote professional working relationships among ornithologists, mammalogists, herpetologists, and ichthyologists in our region.

Please explore our website and be sure to check out our flagship publication, Northwestern Naturalist. If you share our passion for learning about the natural history and ecology of the Northwest our annual meeting is a great place to meet new people while learning about research that is currently being conducted in our region. Find out more at www.thesnvb.org.

2018-2019 Executive Board

President: F. Teal Waterstrat
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Steering Committee: Lisa Dowling, Katy Stuart, F Teal Waterstrat, Jessica Brown, & Katy Weil

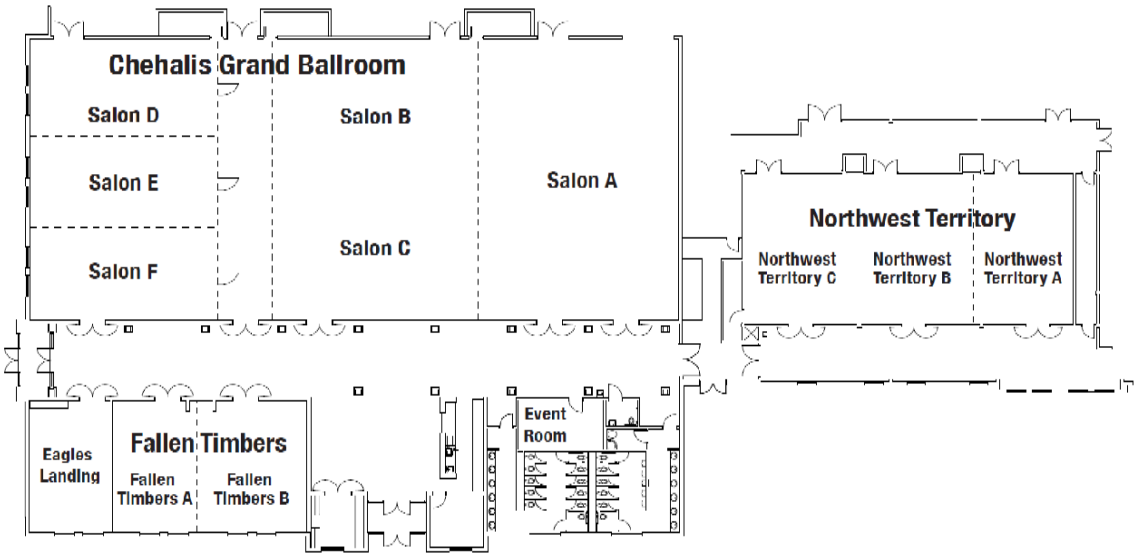
Planning Committee: Katy Stuart, Lisa Dowling, Sara Hansen, Danielle Munzing, Sarah Kindschuh, F Teal Waterstrat, Jessica Brown, Patrick Burke, Bruce Thompson, Bill Vogel, Leah Rensel, Katy Weil, Michelle Dragoo, Alex Pavlinovic, Chelsea Waddell, Blake Hossack, Clara Wheeler, Amy Price, Victoria Kaufman, and Randi Riggs

Cover Artwork: Graham Klag; http://grahamklag.com/

Location, Information and Attractions

Great Wolf Lodge in Grand Mound, Washington is the region's premier destination for conferences, meetings and events. Located minutes south of Olympia, the all-suite property offers a spacious conference center, uncompromised culinary quality and a unique suite of attractions to cut loose at the end of the day.

Great Wolf Lodge Meeting Room Layout



Great Wolf Lodge Hotel Layout

2019 Joint Annual Meeting Schedule-at-a-Glance

Time	Monday February 25th	Tuesday February 26th		Wednesday February 27th			Thursday February 28th			Friday March 1st	
7:00				Registration & Vendors 7am to 5 pm			Registration & Vendors 7am to 5 pm			Breakfast with a Wildllifer	
8:00	**Chemical Immobilization Workshop** (on site) w/Dr. Johnson	**Chemical Immobilization Workshop** (AM off site/ PM on site) w/Dr. Johnson	**Conservation Communication Workshop** w/ Bruce Thompson				**Terrestrial Mammals:** Small Mammals Hoofed Mammals -	**Marine Mammal Symposium**	**NW PARC Symposium**	**Natural Illustration Workshop** w/ Anne Yen	~~**North American Wildlife Law** w/ Bill Vogel & Patrick Burke~~
9:00											
10:00				Plenary Session							
11:00											
12:00				**Hosted Lunch**			**WA TWS & SNVB Member Luncheons**			**GO HOME!**	
13:00				**Herpetology**	**Avian studies**	**Ignite!**	**Terrestrial Mammals:** Carnivores, - NW Bats, Bat Acoustic monitoring workshop	**Marine Mammal Symposium**	**NW PARC Symposium**		
14:00											
15:00											
16:00											
17:00											
18:00				**Resume workshop Poster Session and Evening Social**			**Banquet, Awards, Auction & Raffle, Photo Contest**				
19:00											
20:00											
21:00											

Conference Highlights – Plenary Speakers

James Waddell

James Waddell is a Civil Engineer who is retired from a 35-year public service career with the U.S. Army Corps of Engineers. During his Federal career, he served as a leader in the development of the policies and practices of Sustainable Development. He was the first in the Federal Government to identify and integrate all the global warming research programs, allowing scientific information to better inform National and International policies. After his retirement from the Corps in 2013, he has been actively engaged in the review of the biological and economic benefits and costs of the 4 Lower Snake River Dams in eastern Washington. He has shared his work through multiple platforms from participating and presenting at congressional, agency, and public meetings to his part in the documentary film DamNation. He is currently leading a small volunteer team of mostly current and former government employees working to develop a Supplemental Environmental Impact Statement. He continues to devote his expertise to public service and has mastered the skill of communicating technical information and ideas through multiple media platforms.

Penny Becker, Ph.D.

Penny Becker is an experienced wildlife conservation professional who has dedicated her career to addressing the social, political, and environmental issues that impact species in greatest need of conservation. In addition to her doctorate in Wildlife Management, she has sought out opportunities to expand her knowledge around leadership, policy and human aspects around conservation. Dr. Becker focuses on employing adaptive leadership practices to help people hone their ability to adapt in complex social and political environments, break through barriers to collaboration, and transform conflict into productive relationships to meet conservation goals. During her time in Tanzania, South Africa as well as here in Washington, Dr. Becker has demonstrated her skill in building cooperation for natural resource challenges by communicating complex scientific content to a broader audience. In her role at the Department of Fish and Wildlife she is tasked with both keeping common species common and recovering listed wildlife species by recommending approaches on how to develop and maintain the social, political, and resource support necessary to achieve conservation of at risk species. Dr. Becker's ability to integrate technical expertise, innovative management techniques, and advanced skills in negotiation and conflict transformation are key to her success as a leader in wildlife conservation.

Nathan Dexter

Nathan Dexter is currently the FWS Pacific Region Native American Liaison, a position he has held since 2014. A native Oregonian, he grew up Klamath Falls, Portland, and Madras before attending Lewis & Clark College in Portland, Oregon and law school at the University of Colorado School of Law in Boulder, Colorado. Nathan has worked as a whitewater rafting guide on the McKenzie River, an assistant teacher in a middle school program for students with learning disabilities, an attorney with Legal Aid Services of Oregon, an in-house attorney for the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, and a program manager at the Department of Energy in Washington, DC. If he's not spending his free time with his wife Lisa or daughter Alivia, you may find him working a fly rod in pursuit of redband trout on the Williamson River in southern Oregon.

~ Art and Photo Credits ~

- Graham Klag – http://grahamklag.com 'Oak Prairie' Program Cover Art
- Lisa Dowling - Columbia Pygmy Rabbit pg. 3
- Amy Price - Lizard pg 10
- Amy Price - Northern Spotted Owl pg. 19
- Emilie Blevins- NW pond turtle pg 12

Conference Highlights
Banquet Dinner and Live Entertainment
at the Chehalis Grand Ballroom

What can a toad teach us? Musings from a Warped Biologist – Jay Bowerman

Jay Bowerman earned his MS. from the University of Oregon where he studied with Dr. Jim Kezer, investigating salamander chromosomes. Jay directed Sunriver Nature Center from 1973-2003, then continued as "principal researcher" until 2017, with focus on amphibian ecology and conservation. Now retired but serving on the board of the Bend Science Station and continuing to spend time with scientists. Other interests include cross country skiing, canoeing, and music. With his wife Teresa, they have been involved in the commissioning of the "Malheur Symphony" that will premier in May of this year.

– Silent Auction – Raffle – Photo Contest –

Purchase your raffle tickets from your friendly student volunteer during the conference for a chance to win amazing prizes! Raffle items will be displayed in the Grand Ballroom. Remember proceeds from the raffle go to fund student scholarships!

- Drawings take place at various times throughout the meeting and banquet
- Winners will be posted near the Registration Desk
- Prizes can be claimed at the Registration Desk by presenting your winning ticket
- All prizes need to be picked up before 8:00 AM on Friday

Wednesday February 27th Meeting Schedule

7:30	**Registration Opens**		
9:45	**Welcome and Meeting Introduction:** **WA-TWS, SNVB, NW PARC - *Chehalis Grand Ball Room***		
10:00 - 12:00	**Plenary Session: Connecting Science and Management through Communication** **James Waddell (USACE, retired), Penny Becker (WDFW), Nathan Dexter (USFWS)** ***Chehalis Grand Ball Room***		
12:00	**WA TWS - SNVB Hosted Lunch- *Chehalis Grand Ball Room***		
	NW Herpetology *Fallen Timbers A&B* Moderator: **Aimee McIntyre**	**Avian Studies** NW *Territories "A"* Moderator: **Jessica Brown**	**Ignite** *NW Territories "C"* Moderator: **Sarah Hansen**
13:00	Terrestrial Salamanders in Managed Forests: Impacts of Harvest Practices on Oregon Slender salamander and Ensatina Occupancy and Abundance, Garcia, Tiffany	Spatial and Temporal Factors Associated with Nest Survival of Gray Flycatchers in Managed Ponderosa Pine Forests, Kozma Jeff	Dwarfing the Aquatic Giants: Shrinking Body Size of Top-Predator in Headwaters Under Climate Change, Arismendi, Ivan
13:20	Stream-buffer Effects on Aquatic Vertebrates in Forested Headwaters: 5-years after a 2nd Density Management Harvest, Olson, Dede	Using Citizen Science to Inform Species Distributions: Washington's Sagebrush Songbird Survey, Vander Haegen, Matt	Is Climate Change Increasing Predation on Hoary Marmots in North Cascades National Park, Whiles, Logan
13:40	Drought Conditions Affect Movement of Stream-living Salamanders (*Dicamptodon tenebrosus*), Arismendi, Ivan	Waterfowl Surveying and Wetland Restoration in the Channeled Scablands of Eastern Washington, Kaufman, Victoria	Mountain goats going where they are wanted (they know how to take a hint)., Harris, Richard
14:00	Condition-dependent Movement of Juvenile Northern Red-legged Frogs and Implications for Dispersal in a Changing Climate, Bredeweg, Evan	Washington State Common Loons: Multi-State Occupancy Modeling Using Citizen Science and Survey Data, Sipe, Hannah	Early Success of I-90 Wildlife Crossing Structures for Small Mammals in the Cascades., Ernest, Kristina
14:20	Larval Morphology of the Coastal Tailed Frog (*Ascaphus truei*) Differentiate Geographic Clades., Leppin, Mark	Effectiveness of Autonomous Recording Units for Monitoring Owls in the Central Cascades of Washington, Homyack, Jessica	Importance of Winter Snowpack to Oregon Spotted Frog Breeding Success at the Parsnip Lakes, Cascade-Siskiyou National Monument, Parker, Michael
14:45	**Break**		Agonistic Behavior in Female Oregon Spotted Frogs (*Rana pretiosa*)., Nyman, Stephen

Wednesday February 27th Meeting Schedule continued

	NW Herpetology *Fallen Timbers A&B* Moderator: **Aimee McIntyre**	**Avian Studies** NW *Territories "A"* Moderator*:* **Jessica Brown**	**Ignite** *NW Territories "C"* Moderator: **Sarah Hansen**
15:00	Snake Activity Monitoring after Dike Repair at a Coastal Hibernaculum., Matsuda, Brent	Results of the 2018 Western *Asio flammeus* Landscape Study (WAfLS) in the Western United States, Buchanan, Joseph	A History of Bullfrog Control in Sunriver., Wilmoth, Jodi
15:20	Giant Frogs of Bend—Chapter 2., Wolf, Tlell	Northern Spotted Owl (*Strix occidentalis caurina*) Occupancy Dynamics and Breeding Propensity in a Protected Area: Factors Related to Habitat, Weather and Barred Owl (*S. varia*) presence. Chestnut, Tara	note the above are 5 minute talks and do not run concurrently with other sessions
15:40	Symbiosis Between Green Algae and Northern Red-legged Frogs (*Rana aurora*), Rombough, Chris		
16:00	Foothill Yellow-legged Frog Assessment Model (FYFAM)., Ashton, Don		
16:20	Two Introductions and a Few Successful Breeders: Genetics of Invasive Bullfrogs in the Yellowstone River Floodplain, Montana, Bigham, Dan		
16:40			
17:00	**Resume workshop - Fallen Timbers B**		
17:00 19:00	**Poster Session Chehalis Ball Room -Organizer Randi Riggs**		

Thursday February 28th Meeting Schedule

Marine Mammal Symposium *Northwest Territory A* Moderator: **Alex Pavlinovic**		
8:55	Cetaceans	Return of the Giants of the Salish Sea: Increased occurrence of humpback whales into the inside waters of Washington State., John Calambokidis
9:15		Changes in abundance and status of the Pacific Coast Feeding Group of gray whales., John Calambokidis
9:35		Interannual Variability in the Acoustic Presence of Fin Whales (*Balaenoptera physalus*) in Relation to Environmental Conditions in the Southern Chukchi Sea Erica Escajeda
9:55		Harbor Porpoise in Washington's Inland Waters: Research Opportunities and Management Issues in a Recovering Population., Dave Anderson
10:10		Dolphins in Puget Sound, Washington: Observations of Unusual Species in this Region., Laurie Shuster
10:30	break	
10:50	Killer Whales	Southern Resident Killer Whales: Present and Future, Katie Jones
11:10		How to Assess Body Condition in Small Toothed Whales., Dr. Dawn Noren
11:30		Killer Whale Necropsies Provide Insight into Relationships Between Killer Whale Body Condition, Health, and Nutritional State., Dr. Dawn Noren
WATWS & SNVB Member Lunches		
13:00	Cetaceans	Large whale entanglements and responses in the Pacific Northwest., Doug Sandilands
13:25	New Sampling Methods	Water, Water Everywhere: Can eDNA from Seawater Provide Insight into Population Genetic Structure of Small Cetaceans?, Dr. Kim Parsons
13:45		Comparing manned to unmanned aerial surveys for cetacean monitoring in the Arctic: Methods and operational results., Dr. Robyn Angliss
14:05	break	
14:25	New Sampling Methods	Improving Methods For Data Collection Using Unmanned Aerial Surveys Of Marine Mammal Populations In The California Current Ecosystem., Jeff Harris
14:45	Marine Mustelids	Sea otter genetics update: Diversity, population structure and taxonomy, Dr. Shawn Larson
15:00		Influence of Occupation History and Habitat on Washington Sea Otter Diet., Jessica Hale
15:25	Pinnipeds	Return of the Guadalupe Fur Seal and Unusual Sightings of Artic Seals in the Pacific Northwest, Dyanna Lambourn
15:45		Steller Sea Lions: Why Did They Decline in Alaska and Increase in the Pacific Northwest?, Dr. Andrew W. Trites
16:05		Pinniped monitoring program at Bonneville Dam: a review of the last 15 years and update on recent advancements., Dr. Kyle Tidwell
16:25		Satellite Tag Tracking of Male California Sea lions in the Pacific Northwest to Assess Haul-out and Foraging Behavior in Navy Testing and Training Areas., Steven Jeffries
16:45	New Sampling Methods	It's not What You Think – Collecting DNA from the Spout of a Whale with a 'SnotBot' Drone, Dr. Scott Baker

Thursday February 28th Meeting Schedule continued

Time	Mammal Session *Northwest Territory C* Moderator: **Dave Clayton**		NW PARC Symposium *Fallen Timbers A&B* Moderator: **Katy Weil**	
8:40	Small Mammals	Are Highways Stressful for Pikas? Analysis of Stress Hormones of Ochotona princeps Living Adjacent to Interstate 90 in the Washington Cascade Range McIntyre, Thomas	eDNA in Herpetology	Development of a Fully-integrated eDNA Sampling System, Thomas, Austen
8:55		~~Genetic Monitoring of the Columbia Basin Pygmy Rabbit (*Brachylagus idahoensis*): From Captive Breeding to Wild Populations Nerkowski, Stacey~~		Validating the Use of ddPCR for eDNA Analyses of Amphibian Abundance., Cousins, Christopher
9:10		Distribution of porcupines in the Pacific Northwest and Evaluation of a Non-invasive Survey Method Appel, Cara		Casting a Broader Net: Using Multi-target Metagenomics to Capture Aquatic Biodiversity Data from Diverse Taxonomic Targets. Weitemier, Kevin.
9:25		Activity Patterns and Foraging Behavior of American Pikas (*Ochotona princeps*) Differs Between Craters of the Moon and Alpine Talus in Idaho Camp, Meghan		Comparing Multispecies eDNA to Traditional Approaches to Evaluate Species-level Aquatic Biodiversity in a Stream Network, Penaluna, Brooke
9:40		Patterns of Small Mammal Recolonization Following Elwha River Dam Removal. McCaffery, Rebecca		Remote Sensing of Habitat Restoration for the Columbia Spotted Frog. Pilliod, David
9:55	break			
10:10	Hoofed Mammals	Fuel Reduction Logging Influences Forage Resources and Nutrient Intake of Deer in Northeastern Washington Hull, Iver	NW PARC organization and business Forum	NW PARC: An Overview and Top Research and Conservation Priorities from the Northwest Chapter of Partners in Amphibian and Reptile Conservation. Weil. Katy
10:25		Mountain goat surveys at Mount St. Helens Bergh, Stefanie		NW PARC Organization and Business Forum
10:40		Moose Population Size and Demography in Northeastern Washington Harris, Richard		
10:55	*Homo sapiens* influences on NW mammals	Wildlife Response to Tourism in Glacier Bay National Park, AK, Sytsma, Mira		
11:10		Reconnecting Habitats: The Washington State Department of Transportation's Approach to Integrating Habitat Connectivity Principles into the State's Transportation System., Kalisz, Glen		
11:25		March Mammal Madness: a Story about Science & Social Media., Chestnut, Tara		
11:40		Wildlife Trafficking in the Pacific Northwest, Dodds, Jeanne		
11:55	WATWS & SNVB Member Lunches			

Time	Mammal Session *Northwest Territory C* Moderator: **Dave Clayton**		NW PARC Symposium *Fallen Timbers A&B* Moderator: **Katy Weil**	
13:00	Carnivores	Broad-Scale Influence of Biotic and Abiotic Drivers to Lynx Occupancy in Washington State Under Current and Future Climatic Conditions, King, Travis	Herpetological Disease	Optimizing and Evaluating Environmental DNA-based Detection of *Batrachochytrium salamandrivoran*s in Trade and Captive Settings., Yarber, Christian
13:15		Adaptive use of Nonlethal Strategies for Minimizing Wolf–Livestock Conflict, Stone, Suzzane		Evaluating the Susceptibility of Native Amphibians from Pacific States to the Fungal Pathogen Bsal. , Piovia-Scott, Jonah
13:30		Lynx Conservation in Washington: Combatting the Effects of Fire, Climate and a Small, Isolated Population, Lewis, Jeff		Shell Disease in Washington's Western Pond Turtles—A Quantitative Assessment Based on Computed Tomography. , Haman, Katie
13:45		The Cascade Fisher Reintroduction Project in WA: Progress in the South Cascades and Launching a New Reintroduction Project in the North Cascades, Lewis, Jeff		Differing Demographic Responses of Toad Populations to Regionally Synchronous and Declining Prevalence of Amphibian Chytrid Fungus., Hossack, Blake
13:50	break			
14:05	NW Bats	Collaborative Monitoring to Assess Declines in Northwestern Bat Populations via Bat Grid and NABat Monitoring Programs., Rodriguez, Roger	Western Pond Turtle Mini-Symposium w/ Bruce Bury	Longevity of the Western Pond Turtle (*Actinemys marmorata*) Based on Studies over 50 Years., Bury, Bruce
14:20		White-Nose Syndrome Surveillance: Assessing the Influence of DNA Concentration on Detection Probability from Bat Guano Samples, Urbina, Jenny		Western Pond Turtles (*Actinemys marmorata*): Clutch Sizes, Double Clutching, and Nesting Season in Washington, Bury, Bruce
/14:35		The U.S. National Response to White-nose Syndrome in 2019, Froschauer, Ann		Western Pond Turtles (*Actinemys marmorata*) at a Recreation Area in the Mid-Willamette Valley, Oregon: Life History, Algae Infestation and Conservation Status, Bury, Gwen
14:50		Implementation of bat monitoring and white-nose syndrome surveillance in the North Coast Cascades Network in response to disease detection in western Washington. Chestnut, Tara		Twin Lakes Turtles: A Single Lake Study (2010-2018)., Bettaso Jamie
15:05		Presence of Little Brown Myotis (*Myotis lucifugus*) Positively Associated with Trees and Negatively Associated with Artificial Light Within Waterfront Sites in Metro Vancouver, Claire, C. Toby		It's Turtles All the Way Down: Perspectives for the Western Pond Turtle (*Actinemys marmorata*) as a Long-lived Species in a Rapidly Changing Environment., Ashton, Don
15:20	break			

Contributed Posters

Posters will be displayed and presented in the Chehalis Ballroom the evening of Wednesday February 27th

 # indicates a student presentation

Presenter	Poster Title
Anderson, Scott	Mapping amphibian occurrence on the road system at Mount Rainier National Park
Appleby-Hall, Isaac#	Point Count Surveys Indicate a Decline in Raven Densities Following Control Efforts in Greater Sage-Grouse Habitat.
Bucher, Morgan #	Underestimation of Mesic Habitat May Call for Reassessment of Brooding Sage-grouse Habitat Preferences.
Chestnut, Tara	Observations of three Harlequin Duck ((*Histrionicus histrionicus*) nests in the southern Washington Cascade Range.
Cousins, Christopher#	Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery.
Dylla, Celeste#	Nest-Site Preferences of American Bushtits (*Psaltriparus minimus)* in an Urban Campus Setting.
Estes, Brooke#	Attitudes of California Wine Producers on the Use of Barn Owls (*Tyto alba*) as a Tool for integrated pest management
Fischer, Phillip	The Sustainability in Prisons Project (SPP): Engaging Incarcerated People in Wildlife Research and Recovery.
Foster, Alex	Characteristics of Adult Coastal Giant and Cope's Giant Salamanders of the Pacific Northwest.
Howell, Betsy	Interagency Pacific Marten (*Martes caurina*) Distribution Study on the Olympic Peninsula, Washington
Hunter, Ruth#	Optimal Distance for Insect Trap Placement in the Sage-grouse Habitat.
Jensen, Paul#	Relating Pellet Counts to Snowshoe Hare Density in Lynx-occupied Areas of Washington.
Keleher, Katrina#	Monitoring Habitat Connectivity on Washington State Route 26.
Macias, Cameron#	Cougar and Bobcat Population Estimation and Occupancy Modeling in the Lower Elwha Klallam Tribe's Historic Use Area.
McClarnon, Max#	Characteristics of a High Elevation Western Pond Turtle Population.
McIntyre, Aimee	Evaluating the Current Extent of Van Dyke's Salamander (*Plethodon vandykei)* Distribution Based on Historic Localities: A Collaborative Effort.
Neil, Anna	Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery.
Parker, Michael	Locating Oregon Spotted Frog Over-Wintering Sites at the Parsnip Lakes, OR.
Raley, Catherine M.	Selection of Rest Structures and Microsites by Fishers in the Cascade Range of southern Oregon
Rensel, Leah#	Winter Bat Activity at Maternity Sites in Western Washington
Rohrer, John	Physical Characteristics of Northern Pacific Rattlesnake Hibernacula in the Methow Valley, WA
Ryckman, Jordan#	Can Pika Haypiles in Disturbed Habitats Facilitate Other Generalist and Specialist Species?

Presenter	Poster Title
Salzer, Lori	Engaging the Public to Promote Bat Conservation in Washington.
Shipley, Lisa	Evaluating a Novel Method to Estimate Deer Densities in Forested Habitats
Smith, Tessa[#]	Do Fuel Treatment Applications in Forests Change Habitat Selection Factors for Fishers (Pekania pennanti)?
Staudenmaier, Anna[#]	A Comparison of Fundamental Nutritional Niches of White-tailed Deer (*Odocoileus virginianus*) and Mule Deer (*Odocoileus hemionus*).
Whitfield, Sheri	Creating Habitat for the Northern Sagebrush Lizard at Umatilla National Wildlife Refuge.
Williams, Olivia	Conservation Status, Research Needs, and Management Recommendations for the Olympic Mudminnow (Novumbra hubbsi), Washington State's Only Endemic Fish.
Wilson, Anjanette[#]	Setting the Stage for Connectivity Assessments: Small Mammals in Forest Habitats as Potential Users of Wildlife Crossing Structures

Presenters will be available to answer questions on Wednesday evening from 6:00-7:00pm

Thank You to our Volunteers!!!

WA-TWS

Lisa Dowling

Katy Stuart
Sara Hansen
Sarah Kindschuh
Bruce Thompson
Bill Vogel
Alex Pavlinovic
Victoria Kaufman
Bill Vogel

SNVB

Teal Waterstrat

Jessica Brown
Patrick Burke
Leah Rensel
Michelle Dragoo
Blake Hossack
Clara Wheeler
Chelsea Waddell
Randi Riggs

NW PARC

Katy Weil
Dede Olson

2019 Joint Annual Meeting Associated Workshops

Full Day Workshops ~ Monday and Tuesday

WILDLIFE HANDLING and CHEMICAL IMMOBILIZATION WORKSHOP

Instructor: Mark R. Johnson DVM, Global Wildlife Resources (https://wildliferesources.com)

Strengthen your comfort and confidence with wildlife chemical immobilization. Learn the latest drug combinations. Fine-tune your experience and field protocols. Global Wildlife Resources is teaching a 2-day workshop on Wildlife Handling and Chemical Immobilization held in association with the February 2019 joint annual meeting. The workshop is a slightly condensed version of the 3-day courses that GWR teaches across the U.S. and Canada. Dr. Mark Johnson is a dynamic instructor who teaches practical, field-based training to maximize human safety, field success, animal care, and professionalism that is the most current and extensive course content in North America. This 2- day course is authorized to provide 12 hours of credit for the TWS Certified Wildlife Biologist Renewal/Professional Development Certificate Program. This workshop can also be applied toward any state or federal certification program. Dr. Johnson has taught this class for the Washington Chapter before and we received tremendous feedback from previous participants. The 2 days will include lecture, discussion, videos, and a hands-on lab each day. A dart-gun lab provides opportunity for participants to practice a variety of drug-delivery systems. A needle and syringe lab teaches basic skills and improves old skills for working with syringes and needles, syringe poles, and performing IV injections for blood collection. The needle and syringe lab builds good habits to maximize human safety, animal care, and successful chemical immobilization. This course emphasizes care, respect, and compassion for every animal.

CONSERVATION COMMUNICATION WORKSHOP

Instructor: Dr. Bruce Thompson

This workshop will introduce and explore key facets of effective communication processes in natural resources conservation settings among a variety of resource professional backgrounds in a day-long interactive workshop to help participants think and judge as professionals.

Bonus! 1.5-hour Acoustic Monitoring Workshop ~ Thursday 15:30 -1700

There will be a free basics of acoustic monitoring for bats workshop hosted by Roger Rodriguez following the NW Bats talks. We will have a signup sheet at the registration desk Thursday morning for the first 20 participants! *Stay tuned for more!*

Half Day Workshops ~ Friday

NATURAL SCIENCE ILLUSTRATION

Instructor: Anne Yen (https://anneyen.com/home.html)

Have you ever wanted to draw but felt intimidated by the blank page? Have you ever been inspired to depict the nature and wildlife you work so intimately with? Has the thought "but I'm a scientist" stopped you from expressing your artistic side? Don't despair! In this hands-on workshop, artist and scientist Anne Yen will break down the barriers between art and science and get you to draw and express yourself artistically on paper. Oftentimes in popular media and culture, art and science are juxtaposed in opposition with each other: right brain vs. left brain, creativity vs. exactitude, fantasy vs. fact. However, art and science are quite complementary and throughout history, art, especially natural science illustration, plays a vital role in science communication and conservation advocacy. In a no-fear and judgement-free space, practice drawing through simple exercises, develop an eye for line, shadow and tone, and explore ways to use art to communicate your own scientific work and passion for nature. Feel free to bring a photograph, specimen or natural artifact to illustrate. Natural objects will also be on hand to practice sketching.

~~FEDERAL WILDLIFE LAW~~ CANCELLED

~~**Hosted by** William O. Vogel and Patrick Burke~~

~~This 1/2 day workshop will over the basics of Federal wildlife laws including when the Federal government has jurisdiction and how Federal laws are made and administered. It will provide an overview of many Federal environmental laws, but will focus on a few such as the Migratory Bird Treaty Act, Marine Mammal Protection Act, Bald Eagle Protection Act, and the Endangered Species Act.~~

The Wildlife Society will allow a maximum of 27 Continuing Education Units (CEUs) in Category I of the Certified Wildlife Biologist® Renewal/Professional Development Certificate Program for participation in the Washington Chapter of The Wildlife Society and Northwestern Vertebrate Biologists' 2019 Joint Annual Conference.

Comparing Manned to Unmanned Aerial Surveys for Cetacean Monitoring in the Arctic.
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Manned aerial surveys are routinely used to assess cetacean distribution and density, often over large geographic areas. Unmanned aircraft systems (UAS) have been identified as a technology that could augment or replace manned aerial surveys for cetaceans. To understand what research questions involving cetacean distribution and density can be addressed using manned and UAS technology in the Arctic, we conducted paired aerial surveys for cetaceans near Utqiaġvik (Barrow), Alaska. Abundance estimates of cetaceans were similar using the different methods, but the level of uncertainty in the abundance estimates using imagery from UAS were substantially higher. This work has contributed significantly to our understanding of the operational challenges, analytical complexities, and financial realities of using long-range UAS in a remote environment

Distribution of Porcupines in the Pacific Northwest and Evaluation of a Non-invasive Survey Method.
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Recent evidence suggests that populations of North American porcupines (*Erethizon dorsatum*) may be declining in parts of their range, including the Pacific Northwest. Establishing baseline historical and contemporary distributions of porcupines is necessary for initiating monitoring efforts and, if necessary, informing strategic conservation actions. We compiled 1,293 occurrence records of porcupines in Washington, Oregon, and northern California from 1908 to 2018. Using maximum entropy modeling (Maxent), we created historical and contemporary distribution models based on porcupine records from 1981–2010 and 2012–2018, respectively. Our models suggested a shift in the occupied environmental niche of porcupines in the Pacific Northwest away from forested areas and towards desert scrub and grassland vegetation communities in recent years. In addition, we tested a non-invasive survey method for determining porcupine presence and monitoring their status over time. Our trials suggested that sodium-soaked wood blocks may provide an inexpensive and minimally non-invasive technique to detect porcupines, but further testing is needed to understand its effectiveness and limitations.

Drought Conditions Affect Movement of Stream-living Salamanders (*Dicamptodon tenebrosus*).
Ivan Arismendi*, *Department of Fisheries and Wildlife, Oregon State University, Nash Hall 104, Corvallis, OR, 97331; Ivan.Arismendi@oregonstate.edu*

Understanding the extent to which species' life histories and behavior are shaped by the contraction and expansion of stream networks is a critical step in evaluating the potential impacts of the recent warming climate in headwater streams. The study of how in-stream vertebrates' population demography is affected by specific environmental cues during seasonal low flow will provide insights into answering this question. In particular, the contrast between low and high density of aquatic vertebrates can be used as a surrogate of a natural-low versus extreme-low

streamflow conditions due to climate change respectively. Here, we conducted an experiment in natural stream reaches to examine patterns of movement of Coastal Giant Salamander (*Dicamptodon tenebrosus*). The experiment includes two 25m stream reaches with natural (reference) and high densities of animals (treatment). We used pit-tags and mobile tracking techniques to map daily movement of 54 marked individuals. We estimated home ranges as well as habitat overlap among individuals. Our preliminary findings suggest that under high animal density conditions, such us during periods of drought, competitive interactions lead to a large displacement of individuals. Our experiments provide insights for a mechanistic understanding of links between hydroclimate and biota.

Dwarfing the Aquatic Giants: Shrinking Body Size of Top-Predator in Headwaters Under Climate Change. Ivan Arismendi*, Stan Gregory, Randy Wildman, Linda Ashkenas*; Department of Fisheries and Wildlife, Oregon State University, Nash Hall 104, Corvallis, OR, 97330; Ivan.Arismendi@oregonstate.edu*

Here, we present long-term information from continuous annual surveys of Coastal Giant Salamander (*Dicamptodon tenebrosus*) populations from the HJ Andrews Experimental Forest, OR. We have strong evidence that the size of salamanders have consistently decreased over time due to climate change.

Harbor Porpoise in Washington's Inland Waters: Research Opportunities and Management Issues in a Recovering Population. David Anderson*, *Cascadia Research, 218 1/2 W 4th Ave., Olympia, WA 98501*; *DAnderson@cascadiaresearch.org;* Laurie Shuster, *Cascadia Research, 218 1/2 W 4th Ave., Olympia, WA 98501*; *Laurie.Shuster@gmail.com;* Joseph R Evenson, *Washington Department of Fish and Wildlife; joseph.evenson@dfw.wa.gov* Jessica L Huggins, *Cascadia Research, 218 1/2 W 4th Ave., Olympia, WA 98501*; *JHuggins@cascadiaresearch.org;* John Calambokidis, *Cascadia Research, 218 1/2 W 4th Ave., Olympia, WA 98501*; *calambokidis@cascadiaresearch.org*

Once the most common cetacean in Washington's inland marine waters, Harbor Porpoise (*Phocoena phocoena)* numbers declined drastically in the years following WWII. They were thought to be extirpated from the Puget Sound, and had greatly reduced numbers in the Strait of Juan de Fuca and San Juan Islands. Increases in abundance were first noted in the early 1990s in the northern waters of Washington, with animals reaching southern Puget Sound by 2005. The population has continued to increase throughout the inland waters with a minimum population estimate of over 8,300 animals in 2015. Recovery of the inland Washington harbor porpoise stock raises many interesting management questions and research opportunities. The increasing harbor porpoise population could alter the ecosystem balance by acting as both predators (consuming large quantities of smaller fish and invertebrates) and prey (for Bigg's killer whales and sharks). Collaborations between researchers in Washington and California, where San Francisco Bay has experienced a similar pattern of harbor porpoise disappearance and return, are examining similarities and differences in porpoise behavior including foraging, mating and boat interactions.

Foothill Yellow-legged Frog Assessment Model (FYFAM). Don Ashton*, *McBain Associates, 980 7th Street, Arcata CA 95521; ashton.don@gmail.com*; Scott McBain, *McBain Associates, 980 7th Street, Arcata CA 95521; Scott@mcbainassociates.com*; Steve Railsback, *Lang, Railsback, and Associates, 250 California Ave, Arcata CA 95521; Steve@langrailsback.com*

The Foothill Yellow-legged Frog (*Rana boylii*, FYF) relies on river edgewaters for reproduction, timing its oviposition with hydrograph cycles to minimize scour and desiccation risks to eggs and tadpoles while maximizing first-year development time for offspring. Individual frogs initiate breeding using a suite of environmental cues. Dams can decouple the hydrology, hydraulics, and thermal regimes from other natural environmental cues, hampering oviposition choices of breeding FYF, increasing scour and desiccation risk, and thus diminishing reproductive success. Managing water resources for biotic benefits downstream requires better insight on how organisms such as FYF will respond to alternative flow release schedules. The Foothill Yellow-legged Frog Assessment Model (FYFAM, developed using support from US Forest Service) uses water temperature, depth, and velocity outputs from hydrologic, hydraulic, and water temperature models to assess potential differences in cohort success under various hydrograph scenarios. FYFAM uses cell-specific environmental inputs and probabilities to simulate decisions by virtual frogs and tadpoles and predicts developmental rate of eggs and tadpoles through metamorphosis on a daily time step. Number of froglets produced per breeder and median date of metamorphosis are the primary output metrics, but many secondary metrics are useful in evaluating results. We will describe the model and explain how to interpret model outputs for two potential management actions: 1) alternative dam release hydrographs, and 2) alternative channel restoration site designs. These examples draw from rivers in California where FYFAM is providing insights on how flow management and channel restoration can influence reproductive success for this imperiled, river-breeding frog.

It's Turtles All the Way Down: Perspectives for the Western Pond Turtle (*Actinemys marmorata*) as a Long-lived Species in a Rapidly Changing Environment. Don Ashton, *McBain Associates, 980 7th Street, Arcata, CA 95521; ashton.don@gmail.com;* R. Bruce Bury, *1410 NW 12th Street, Corvallis, OR 97330; burybr@peak.org*; Gwen W. Bury, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97330; gbury@ oregonstate.edu.*

With the species' status in review at state and federal levels, western pond turtle conservation has gained momentum across its range, but is this attention too little too late? A changing climate is blamed for increasing drought severity and duration, increasing high-intensity wildfires, and a prolonged fire season. The bauplan (body plan) of the Western Pond Turtle has proved resilient over millions of years, but can it help the species persist through the environmental changes predicted to unfold across the west over the next century? Will we witness their extinction at our hand? Drawing on >50 years of research experience with Western Pond Turtles in northern California, as well as reported range wide demographic trends and life history features, we will provide perspectives on its ecology and management and recovery in natural populations. Population estimates are crucial to determine trends and more robust statistically than observational evidence. We need to increase the number of studies using population estimates with mark-recapture techniques, establish long-term sampling in a network range wide, and determine losses of nests and hatchlings. An emphasis on its life history and population trends are crucial for understanding meta-population effects of rapid environmental change on a long-lived semi-aquatic vertebrate.

It'snot What You Think—Collecting DNA from the Spout of a Whale with a 'SnotBot' Drone. C. Scott Baker*, Angie Sremba, Logan Pallin, *Marine Mammal Institute, Oregon State University, 2030 SE Marine Science Drive, Newport OR 97365; scott.baker@oregonstate.edu; srembaa@oregonstate.edu; lpallin@ucsc.edu;* Shannon Atkinson, *University of Alaska*

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Unmanned aerial vehicles (UAVs) or drones are finding a role in an increasing number of wildlife studies. For whales and dolphins, UAVs offer the potential to collect high-definition video and photographs with little or no disturbance. Through photogrammetry, these images can be used for assessment of physiological condition, individual health and scarring from past entanglement. Here we assessed the potential for using a 'SnotBot' drone to collect genetic samples from the spout of blue and humpback whales from southeast Alaska, the Gulf of California, the Gulf of Maine and the coast of Gabon. The primary objective was to link the aerial images to the individual identification and sex of the whale by 'DNA profiling', allowing integration with extensive life history records available from some of these regional populations. A parallel effort attempted to extract hormones for assessing stress and pregnancy. For the trials, a UAV was fitted with sterile Petri dishes and flown into the vaporous exhalation of the whale. We tested several methods for preserving the spout samples in the field and for subsequent extraction of DNA in the laboratory. The results confirmed the potential for using a SnotBot to collect DNA of sufficient quality and quantity for sequencing of mtDNA haplotypes, sex identification and individual identification by microsatellite genotyping.

Twin Lakes Turtles: A Single Lake Study (2010-2018). Jamie B. Bettaso*, *Lower Trinity Ranger District, Six Rivers National Forest, POB 68, Willow Creek, CA 95573; jamiebettaso@gmail.com*; Justin M. Garwood, *California Department of Fish and Wildlife, 5341 Erikson Way, Arcata, CA 95521, justin.garwood@wildlife.ca.gov*; Ryan M. Bourque, *California Department of Fish and Wildlife, 619 2nd Street, Eureka, CA 95501; ryan.bourque@wildlife.ca.gov*; Christopher J. West, *Senior Wildlife Biologist, Yurok Tribe, Wildlife Program, Natural Resources Division, 190 Klamath Blvd, Klamath, CA 95548; cwest@yuroktribe.nsn.us*

Long-term demographic studies of long-lived species provide important information on population structure but often present logistical challenges to field biologists. We implemented a nine year mark-recapture study on a population of western pond turtles (*Actinemys marmorata*) at a single 3.5 hectare shallow, montane lake in Humboldt County of northern California. The lake is unique given its relative isolation and undisturbed montane setting (1148 meters) making it ideal for population monitoring. From 2010 to 2018, we conducted 25 site visits to obtain demographic parameters including: sizes, growth patterns, adult operating sex ratios, juvenile to adult ratios, and observations of nesting site mortality. We estimated population size using Schnabel methods, leading to density estimates. We also estimated the population biomass and relate it to previously reported data for this species. We also assisted a larger study exploring pathogens as a threat to the species across their range. Understanding of western pond turtle life history aspects can be difficult to ascertain without multiple-year efforts.

Two Introductions and a Few Successful Breeders: Genetics of Invasive Bullfrogs in the Yellowstone River Floodplain, Montana. Daniel M Bingham*, *Cramer Fish Sciences 7525 NE Ambassador Pl. Suite C, Portland, OR 97220; dan.bingham@fishsciences.net;* Adam Sepulveda, *United States Geological Survey, Northern Rocky Mountain Science Center 2327 University Way, Suite 2 Bozeman, Montana 59715; asepulveda@usgs.gov;* Sally Painter, *The University of*

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We analyzed seven microsatellites in invasive American bullfrogs (*Lithobates catesbeiana*) from the Yellowstone River floodplain, Montana, to describe genetic population structure, make inferences about locations of introductions, and characterize patterns of invasion. Microsatellites corroborate mitochondrial DNA results from previous research and suggest at least two independent introductions from genetically divergent populations followed by massive spread. One introduction is associated with the upstream extent of the invasion, and the other more broadly with downstream populations. Bullfrogs from the downstream introduction are highly successful invaders, as gene flow from this genetic group is apparent in nearly all sites. Downstream, long-distance invasion from the upstream introduction is also apparent. We found strong evidence for genetic bottlenecks in two locations, which may indicate they are the original locations of introduction and perhaps sources of bullfrogs in the region. We observed a pattern of isolation by distance among sample sites after correcting for independent introductions, suggesting genetic drift affects genetic structure of bullfrogs in the region. Finally, all sites are characterized by very small effective numbers of breeders (Nb< 50), which may indicate a small number of adults drive the invasion by generating massive propagule pressure.

Condition-dependent Movement of Juvenile Northern Red-legged Frogs and Implications for Dispersal in a Changing Climate. Evan M. Bredeweg*, *Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331; evan.bredeweg@oregonstate.edu;* Tiffany S. Garcia, *Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331; tiffany.garcia@oregonstate.edu;* Anita T. Morzillo, *Department of Natural Resources and the Environment, University of Connecticut, U-4087, 1376 Storrs Road, Storrs, CT 06269; anita.morzillo@uconn.edu;* Nathan Schumaker, *Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331; nathan.schumaker@gmail.com*

Movement is a fundamental process through which animals interact with their environment. Animals with complex life histories often have multiple habitat needs that are scattered throughout a landscape and connected by movement. Assumptions about amphibian movement, an understudied aspect of amphibian biology, are now being critically evaluated to improve our conservation of this imperiled group of species. The direct, indirect, and carry-over effects of environmental factors influencing dispersal between isolated populations and habitats are of conservation concern, particularly as climate change influences precipitation gradients and, therefore, habitat availability and connectivity. Using an experimental approach, we explored carryover effects of larval habitat drying and direct effects of terrain moisture on the movement behavior of juvenile Northern Red-legged Frogs (*Rana aurora*). We found that juvenile body size and terrain moisture (wet or dry) were the strongest factors shaping movement behavior. The carryover effect of larval hydroperiod impacted juvenile movement by significantly altering size at metamorphosis and subsequent compensatory growth patterns. To assess how these factors scale up to impact populations, we developed a spatially-explicit, individual-based model using the HexSim simulator. This model allowed us to incorporate our experimental results into current and predicted climate scenarios. We found that landscape conditions resulting from future climates significantly delayed movement from natal patches but increased population connectivity in clumped landscapes. There is significant ground to cover in

our exploration of amphibian movement, and projects that span fieldwork, experiments, and simulation are key to building validated and relevant understand of the spatial ecology of amphibians.

Results of the 2018 Western *Asio flammeus* Landscape Study (WAfLS) in the Western United States. Joseph B. Buchanan, *Washington Department of Fish and Wildlife, 1111 Washington Street Southeast, Olympia, WA 98501; joseph.buchanan@dfw.wa.gov*

In North America, the Short-eared Owl (*Asio flammeus*) inhabits grasslands and similar open cover types in Alaska, Canada and the northern coterminous United States. A recently published status assessment suggested a substantial decline in its range-wide abundance, but acknowledged uncertainty because Breeding Bird Survey data are likely inadequate to assess trends in an owl species that breeds in early spring. Compounding this uncertainty, the species exhibits dramatic temporal and spatial variability in distribution and abundance, which makes assessing population status difficult. To better assess the status of the species and to address aspects of habitat use, we developed a regional project that used volunteer naturalists to collect survey data across eight western states. In 2018, the first year of the range-wide survey effort, 622 volunteers conducted road-based surveys on 368 transects in our study area of about 217 million acres in California, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Short-eared Owls were detected on 57 transects. Preliminary results indicated that probability of detection declined with increasing Julian date, increasing wind speed, and greater percentage of area grazed. Probability of presence increased with an increasing amount of stubble agriculture and the proportion of the survey in cropland. We generated a map of the predicted occurrence of Short-eared Owls using Maximum Entropy modeling that incorporated 28 climatic, geographic and land cover attributes. Upon completion, the results of this three-year project should provide a greater spatial and temporal understanding of distribution, habitat use and abundance of Short-eared Owls.

Longevity of the Western Pond Turtle (*Actinemys marmorata*) Based on Studies over 50 Years. *R. Bruce Bury*, 1410 NW 12th St., Corvallis, OR 97330; burybr@peak.org; Gwen W. Bury, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; buryg@oregonstate.edu; Don T. Ashton, McBain Associates, 980 7th St., Arcata, CA 95521; ashton.don@gmail.com; James Bettaso, Six Rivers National Forest, USDA Forest Service, Willow Creek, CA 95573; jbettaso@fs.fed.us; David J. Germano, Department of Biology, California State University, CA 93311; dgermano@csub.edu*

There is keen attention being focused on the status and population features of the Western Pond Turtle (*Actinemys marmorata*) because it is now under review for Federal listing. We have studied the species for over five decades starting in 1968 in Hayfork Creek, northern California. Here, we report on longevity of turtles based on five visits from 2008-2018 that yielded 457 captures (new and recaptures). We recaptured 18 turtles marked ≥30 y earlier, including three that we marked 40 y earlier, two at 41 y, four at 43 y, and one record of 50 y. The latter individual was 5 y old when marked in 1968 and 55-y old female in June 2018 (with a radiograph that revealed 9 eggs). The old-aged individuals (≥40 y) were rare in the population (<5% of adults), although we do not know how many more very old turtles occur in this population. This is a robust population because most (61%) were juveniles (≤12 y old). Further, numbers of turtles appear stable with no major changes over five decades. Our evidence suggests that some Western Pond Turtles may live 55 or more years in the wild and females can remain

reproductive at least to that age. This new information demonstrates the need for long-term protection, management, and recovery efforts for populations of Western Pond Turtles.

Western Pond Turtles (*Actinemys marmorata*): Clutch Sizes, Double Clutching, and Nesting Season in Washington. R. Bruce Bury*, *1410 NW 12th St., Corvallis, OR 97330; burybr@peak.org;* Frank and Kate Slavens, *P.O. Box 645, Lyle, WA 98635; frank@pondturtle.com;* Gwen W. Bury, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97330; buryg@oregonstate.edu*

There are no published records of reproductive features in Western Pond Turtles *(Actinemys marmorata)* in Washington. Thus, we investigated these features to add key life history information to the biology and conservation of the species. We attached radio transmitters to adult females in southern Washington just east of the Columbia River Gorge and followed individuals from early May to mid-July over 14 field seasons. We found 1,450 eggs in 235 nests (mean = 6.2 eggs/nest). The range was 1-12 eggs, but most nests (86%) had 4-8 eggs. There were 14 double clutches with more eggs (mean = 6.64; range 4-11) in the first clutch and fewer (mean = 5.14; range 4-9) in the second round. The interval between a mid-June and early July peak (44% fewer nests) was 28 days (range 22-31). We recorded some individuals over multiple years with one found over seven years varying at 3-7-5-6-8-5-6 eggs per season. There was no apparent pattern. Many of these eggs were incubated in captivity to provide hatchlings for a State program to raise turtles to larger sizes and release them into the wild. Overall, female *A. marmorata* in Washington State appear to deposit eggs annually and some had double clutches, which was unknown this far north in its range.

Western Pond Turtles (*Actinemys marmorata*) at a Recreation Area in the Mid-Willamette Valley, Oregon: Life history, algae infestation and conservation status. Gwendolynn W. Bury*, Arianna Ilharreguy, Ivan Arismendi, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon 97331; buryg@oregonstate.edu*; R. Bruce Bury, *1410 NW 12th St., Corvallis, OR 97330; burybr@peak.org*.

Luckiamute Natural Recreation Area is located in the central Willamette Valley, OR. There are two ponds on the property, one is managed as a fishing area, the other for wildlife. The staff mow identified Western Pond Turtle (*Actinemys marmorata*) nesting habitat, and place basking structures in the ponds. Since starting studying the area in 2012, we have now marked 61 individuals. Most of them were large-size adults, but 22% were younger than 7 years and 45% younger than 12 years of age. They grew at moderate rates, reaching 120 mm CL in 6 yrs. Radiographs of 11 adult females revealed a mean clutch of 6.0 eggs (range 5-8), which is similar to patterns observed in southern Washington. Unlike other populations, Luckiamute turtles had high infestation (85% occurrence) of the filamentous green alga, *Arnoldiella chelonum.* The eastern pond has the larger population, but last year was shallow and overgrown with algae and aquatic plants due to water shortage. The western pond is easily accessed, and the focus of our recent studies. We have started a set of interconnected studies of basking behavior and environmental correlates. This study encompasses Bluetooth-enabled sensors glued to turtle shells, placed near and in the pond, plus weekly observations, and timed-photo capture. Western Pond Turtles have not been observed basking since late October. Overall, the Luckiamute turtle population seems to be robust and we hope to track its status and ecology over future years.

Return of the Giants of the Salish Sea: Increased occurrence of humpback whales into the inside waters of Washington State. John Calambokidis*, Kiirsten Flynn, Gretchen Steiger, Elana Dobson,, *Cascadia Research Collective, 218½ W 4th Ave., Olympia WA 98501; Calambokidis@CascadiaResearch.org;* Mark Malleson, *Center for Whale Research, P.O. Box 1577, Friday Harbor WA 98250;* Brian Gisborne, *Juan de Fuca Express, Victoria, BC V8V 2G5;* Susan Berta, *Orca Network, 485 Labella Vista Way, Freeland WA 98249*.

Humpback whales were previously common in the Salish Sea and were largely eliminated by whalers based from a whaling station on southern Vancouver Island from 1907 to 1910 who hunted whales through the winter months. Cascadia Research and collaborators have conducted long-term studies of humpback whales along the US West Coast since the 1980s and documented their steady recovery from whaling; population increased at about 7-8% per year at least through about 2010 when there were some indications the population may have recovered to near pre-whaling numbers. In the late 2000s, we documented increased sighting reports of humpback whales in inside waters of Washington and extending into Puget Sound. Some of these whales also stayed through the winter months. Humpback whales have now become common in the Salish Sea and become a focus of some whale-watch operations on both the Washington and British Columbia side of the border (especially when killer whales are absent). We used photographic identification to investigate humpback whale movements and matches of identification photographs to other areas reveals that these whales travel to a mix of breeding areas including Hawaii, Mexico, and Central America in winter months. Matches also show many of these whales using inside waters represent whales that had been using outside offshore waters, suggesting a shift over time into inside waters. We speculate that humpback whales, which show site fidelity to specific regions, only returned to these former feeding areas when their recovering population size forced their expansion into inside waters.

Changes in abundance and status of the Pacific Coast Feeding Group of gray whales. John Calambokidis* and Alie Perez, *Cascadia Research Collective, 218½ W 4th Ave., Olympia WA 98501; Calambokidis@CascadiaResearch.org*.

A subgroup of the eastern North Pacific gray whale population that spending the spring through fall feeding in the Pacific Northwest from Norther California to British Columbia has been given the name the Pacific Coast Feeding Group (PCFG). These seasonally resident gray whales appear to be distinct from the overall E North Pacific population, based on repeat photo-identification sightings and mitochondrial DNA patterns. With support from National Marine Fisheries Service, we have conducted annual assessment of abundance and trends based on a collaborative effort gathering individual photographic identification of whale primarily since 1998. Mark-recapture calculations indicate a stable abundance estimate of about 200 whales though 2017. While there were some indications of outside immigration to this group from the overall gray whale population in the late 1990s, our more recent data indicates recruitment is primarily internal with new recruits to the population largely documented as offspring of known long-time PCFG mothers. The status and dynamics of this population have become of greater management importance with the proposed resumption of whale hunting by the Makah Tribe.

Activity Patterns and Foraging Behavior of American Pikas (*Ochotona princeps*) Differs Between Craters of the Moon and Alpine Talus in Idaho. Meghan Camp, *School of the Environment, Washington State University, Pullman, WA 99164; meghan.camp@wsu.edu*; Lisa A. Shipley*, *School of the Environment, Washington State University, Pullman, WA 99164;*

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Range contractions in the Great Basin over the last century suggest American pikas might be highly sensitive to climate change. However, documentation of pikas residing at relatively warmer, low-elevation sites has recently shed new light on the possible resilience of pika populations to warmer ambient conditions when they have access to cooler microhabitats for thermoregulation. To provide insight into possible behavioral mechanisms of adaptation to warmer habitats, we investigated activity patterns, foraging behavior, and space use of a population of pikas living in an atypical, warmer habitat at Craters of the Moon National Monument and Preserve, an extensive lava flow surrounded by high desert grassland and sagebrush communities in southern Idaho. We compared their behavior to that of a population in a typical, alpine habitat at Grays Peak in the nearby Pioneer Mountains in Idaho. Pikas were the least active midday when the surface temperatures were highest, and the insulating effect of the lava tubes was most pronounced. Pikas at Craters of the Moon spent less time haying and displayed fewer territorial behaviors than pikas at Grays but filled a similar number of haypiles. The vegetation community was less diverse and sparser at Craters than at Grays, and consequently, vegetation that was consumed and cached reflected these differences. Our results expand the body of literature on American pikas at their environmental limits and this study is the first step in identifying the unique suite of behaviors pikas use to persist in a seemingly inhospitable environment at Craters of the Moon.

Implementation of bat monitoring and white-nose syndrome surveillance in the North Coast Cascades Network in response to disease detection in western Washington. Tara Chestnut, *Mount Rainier National Park, Ashford, WA 98304; tara_chestnut@nps.gov.*

In response to the 2016 *Pseudogymnoascus destructans* (Pd) detection in Washington State, the National Park Service (NPS) North Coast Cascades Network implemented bat monitoring and white-nose syndrome (WNS) surveillance following recommendations outlined in the NPS Pacific West Region WNS response plan. The primary goals were to identify known bat colonies, conduct WNS surveillance, and assess bat species occurrence in network parks using acoustic monitoring. To identify known bat colonies, we surveyed park natural resource and maintenance staff to identify buildings where bats have been observed and compiled data from the 2000 NPS Natural Resources Challenge inventory. We conducted direct Pd/WNS sampling by swabbing bats in the hand, and passive Pd surveillance by placing clean plastic sheeting at known sites and collecting fresh guano. Finally, we implemented acoustic monitoring at all seven NCCN parks and an elevational study of bat occurrence at Mount Rainier National Park. We report on the preliminary results and lessons learned in project implementation.

March Mammal Madness: a Story about Science & Social Media. Tara Chestnut, *National Park Service, Mount Rainier National Park, Ashford, WA, USA*, tara_chestnut@nps.gov; Patrice K Connors, *University of Utah, Salt Lake City, UT, USA*; Jessica E Light, *Texas A&M University, College Station, TX, USA*; Brian P Tanis, *Oregon State University, Corvallis, OR, USA*; Joshua A Drew, *Columbia University, New York, NY, USA*; Chris N Anderson, *Dominican University, River Forest, IL*, USA; Anali M Perry, *Arizona State University, Tempe, AZ, USA* Charon E. Henning, *Odd Angel LLC, Bushnell, FL, USA;* Mary Casillas, *Texas A&M University, College Station, TX, USA;* Katie Hinde, *Arizona State University, Tempe, AZ, USA*, katie.hinde@asu.edu

Since 2013, the blog "Mammals Suck… Milk" has featured a virtual combat competition among 65 species of animals in a virtual tournament called March Mammal Madness, in honor of the NCAA College Basketball March Madness Championship Tournament. The competition started as a thought experiment among colleagues and has become a pedagogical innovation that engages people from around the globe by creatively integrating scientific literature, original artwork, and digital technologies. Briefly, the winners of simulated animal battles are determined by a probabilistic function of the two species' attributes within a preselected or randomized habitat. Scientific literature is cited to substantiate likely outcomes should the two species encounter one another. Battles are "live-tweeted" by a team of scientists and battle summaries are available afterwards through various virtual media, including Facebook and a library guide created by Arizona State University. Throughout the multi-week competition, participants learn about biological concepts including inter-species interactions, how natural selection has shaped adaptations, conservation management, and the significance of both arts and sciences in education. Here, we summarize the success of the latest championship (#2018MMM) and early outreach of the current tournament (#2109MMM) by estimating the potential impact of broadcasting research through social media and classrooms, and by sharing reactions from participants. Our estimates strongly suggest that more people are participating in the championship every year, likely promoting one goal of the competition to inspire awe for the natural world.

Presence of Little Brown Myotis (*Myotis lucifugus*) Positively Associated with Trees and Negatively Associated with Artificial Light Within Waterfront Sites in Metro Vancouver.

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Anthropogenic activities can influence the presence and distribution of bats. We conducted this study to assess the influence of human development (changes to vegetation) and activity levels (artificial light and noise) on little brown myotis (*Myotis lucifugus*), a species listed as Endangered under the Canadian *Species at Risk Act*. We conducted surveys at 14 sites adjacent to the Fraser River and Burrard Inlet within Metro Vancouver to examine these factors within waterfront areas adjacent to fresh water and marine environments. We selected sites along a gradient of disturbance and anthropogenic activity levels (e.g., modified vegetation, light, noise). Time-constrained (15 minute) nocturnal (within three hours of sunset) surveys were conducted at each site using an Echo Meter Touch microphone alongside sound and light meters on three nights in each of July and September 2016. Surveys found little brown myotis was the most prevalent and widely distributed bat across the study area with detections recorded at 11/14 sites (79%). The first record of a Mexican free-tailed bat (*Tadarida brasiliensis*) in mainland British Columbia was recorded during the surveys. Stepwise regression models (GLM) found little brown myotis presence was positively associated with tree (>20 cm DBH) habitat and negatively associated with ambient light. Additionally, little brown myotis was detected more often within fresh water as compared to marine sites and was detected more frequently during surveys conducted in July (i.e., maternity period) as compared to September (i.e., migration/pre-hibernation period). Noise levels were not significantly related to the presence of little brown myotis.

Validating the Use of ddPCR for eDNA Analyses of Amphibian Abundance. Christopher Cousins*, Tiffany Garcia, Evan Bredeweg, Taal Levi, Jennifer Allen, *Oregon State University, 2820 SW Campus Way, Corvallis, OR 97331; cousinsc@oregonstate.edu; tiffany.garcia@oregonstate.edu; evan.bredeweg@oregonstate.edu; taal.levi@oregonstate.edu; allejenn@oregonstate.edu*

The management and conservation applications of environmental DNA (eDNA) include confirming species occupancy and monitoring for invasive or rare/endangered species. Recently, the technology has been extended to estimate population abundance, primarily using quantitative real-time PCR (qPCR) to establish a relationship between amplified DNA concentration and both counts of individuals and their total biomass in the system. Multiple studies have shown droplet-digital PCR (ddPCR) offers increased accuracy and precision for quantification of eDNA, which could improve estimates of species abundance and biomass. Importantly, these advantages increase with low eDNA concentrations. Studies using ddPCR suggest that eDNA is more predictive of species abundance than biomass, such that eDNA may be more practically used to estimate animal counts. To test these assumptions, we designed a controlled laboratory experiment using multiple larval age classes of American Bullfrogs (*Lithobates catesbeianus)* held in static control water. Our null hypothesis was that many small individuals produced the same amount of DNA as a few large individuals, thus confounding the direct relationship between abundance and eDNA concentration. Using treatments with varying numbers of individuals and standardized total biomass, we collected eDNA samples at 3 and 36 hours and quantified the amount of DNA amplified using ddPCR. eDNA concentration was positively correlated with abundance, but larval age was a stronger predictor of eDNA concentration. The results challenge the accuracy of abundance estimates using this technique and suggest that multiple factors could influence the amount of detectable DNA in a system.

Wildlife Trafficking in the Pacific Northwest. Jeanne Dodds*, *Endangered Species Coalition, P.O Box 65195, Washington, DC, 20035; jdodds@endangered.org*

This presentation will summarize current research concerning the status and scope of illegal wildlife trafficking in the Pacific Northwest. Wildlife trafficking is a significant and under-recognized regional issue, impacting native Northwest species such as Black Bear, (*Ursus americanus*); shellfish, including Pacific Geoduck (*Panopea generosa*); and Mule Deer, (*Odocoileus hemionus*). Issues of significance include a rising regional and global market for illegally traded species, declining species populations as a consequence of illegal hunting, limited enforcement capacity and weak penalties for traffickers. Along with the poaching and non-legitimate marketing of Pacific Northwest species, the presentation will touch on the 2015 Washington Animal Trafficking Act and provide examples of regional participation in the international wildlife trade.

Early Success of I-90 Wildlife Crossing Structures for Small Mammals in the Cascades Kristina Ernest*, *Central Washington University, 400 E University Way, Ellensburg, WA ErnestK@cwu.edu*

WSDOT is constructing > 20 major wildlife crossing structures in I-90 on the eastern slopes of the Cascades. At the first completed terrestrial wildlife undercrossing, four small mammal species – all habitat generalists – were live-captured in 2017. During 2018 we captured an additional species – a forest specialist – in the crossing structure.

Interannual Variability in the Acoustic Presence of Fin Whales (*Balaenoptera physalus*) in Relation to Environmental Conditions in the Southern Chukchi Sea. Erica Escajeda*, Kate Stafford, Rebecca Woodgate, Kristin Laidre, *University of Washington, 1122 Northeast Boat St, Seattle, WA 98105; escajeda@uw.edu; kate2@uw.edu; woodgate@apl.washington.edu; klaidre@uw.edu*

Fin Whales (*Balaenoptera physalus*) migrate to the Chukchi Sea to feed on seasonally-abundant prey in the summer. Fin Whale presence in the region exhibits high interannual variability and may reflect varying environmental conditions. Using acoustic recordings from three moored hydrophones, we identified Fin Whale calls during the open-water season (July–November) from 2009–2015 and investigated potential environmental drivers of Fin Whale interannual variability. We examined in-situ ocean temperature and salinity data, satellite-derived sea surface temperatures and sea ice melt/formation patterns in the Chukchi Sea and Bering Strait region. In addition, we estimated the water mass presence at each mooring using published temperature and salinity boundaries. Detections of Fin Whale calls were highest in 2012 and 2015, and the majority of detections (96%) were recorded at the mooring located at the confluence of the nutrient-rich Anadyr and Bering Shelf water masses, ~35 km north of Bering Strait (site A3). Interestingly, the two years with the highest detections had very different environmental conditions at this site. Colder temperatures, low salinities, and slow water speeds prevailed in 2012 while high temperatures and salinities, faster water speeds and thus higher transport through the Bering Strait prevailed in 2015. Additionally, the results of a chi-squared test of independence suggest that the occurrence of Fin Whale calls is dependent on the occurrence of water masses at the mooring site ($p < 0.001$). The disparity between 2012 and 2015 suggests there may be multiple combinations of environmental factors that draw Fin Whales into the Alaskan Arctic.

WNS National Response in 2019. *Ann Froschauer, *U.S. Fish and Wildlife Service 510 Desmond Dr SE # 102, Lacey, WA 98503; ann_froschauer@fws.gov,* Bronwyn Hogan, *U.S. Fish and Wildlife Service 2800 Cottage Way, Sacramento, CA 95825; bronwyn_hogan@fws.gov,* Kimberly Dickerson, *U.S. Fish and Wildlife Service 5353 Yellowstone Rd, Suite 308A Cheyenne, WY 82009; Kimberly_Dickerson@fws.gov,* Jennifer Smith-Castro, *U.S. Fish and Wildlife, 16639 W Hardy Rd, Houston, TX 77060; jennifer_smith-castro@fws.gov,* Jonathan Reichard, and Jeremy Coleman, 300 Westgate Center Dr, Hadley, MA 01035; *jonathan_reichard@fws.gov; jeremy_coleman@fws.gov*

White-nose syndrome (WNS) has been a fixture in research and conservation efforts for North American bats since its appearance in 2007. The causative fungus *Pseudogymnoascus destructans (Pd)* is now present in at least 36 states and 7 provinces in North America, where 11 bat species have been confirmed with the disease and 6 others identified bearing *Pd* without disease. Framed by sister plans in the U.S. and Canada, the community of scientists and stakeholders have propelled comprehensive planning and response actions to establish topic-focused working groups to address research and management needs for WNS. The U.S. Fish and Wildlife Service is the lead federal agency coordinating the response in the U.S., and since 2008 the agency has provided millions in research and capacity grants to institutions, conservation organizations, and government agencies to address WNS. Scientists are contributing to our understanding of this disease from all angles, including life history and ecology of *Pd*, the dynamics of fungal infection and transmission, and bat hibernation physiology and immunology

in their search for a way to control the fungus and conserve native bats. In 2019, the Service plans to offer funding opportunities for state-initiated management actions, high priority research, development of disease treatments, and innovative ideas to stop the impacts of WNS. Through the working groups of the WNS National Plan, we will produce guidance for surveillance and diagnostics, decision frameworks for management of bats and their habitats, resources for monitoring bat populations, and outreach materials in support of national priorities.

Moose Population Size and Demography in Northeastern Washington. James Goerz, *University of Montana – Missoula, Montana Cooperative Wildlife Research Unit, Missoula, MT 59812;* Jared Oyster, *Washington Department of Fish and Wildlife, Spokane, WA 99216; Pennsylvania Game Commission, Harrisburg, PA;* Rich Harris*, *Washington Department of Fish and Wildlife, Olympia, WA 98501; Richard.harris@dfw.wa.gov*

Newcomers to the state, moose (*Alces alces shirasi*) increased in abundance and distribution throughout northeastern Washington from the 1970s through 2013. In that year, the Washington Department of Fish and Wildlife and the University of Montana began a cooperative study of moose demography in 2 adjacent study areas north of Spokane, Washington (one with wolf packs, one without). We followed the fate of 46 GPS-collared cow moose (and their calves) in the northern area, and 27 in the southern study area captured during Decembers of 2013, 2014, and 2016. Our estimates of mean annual adult female survival were similar in the 2 study areas, but causes of death differed. Mean annual calf survival was 0.11-0.31 in the northern study area, and 0.48-0.68 in the southern study area (depending on assumptions). Estimated mean fecundity (calves/females in early summer) was 0.56 in the north and 0.70 in the south. Point estimates of the annual growth rate (λ) for each area were 0.75—0.84 for the northern and 0.94—0.99 for the southern area. Concurrently, we used a Bayesian hierarchical approach to helicopter-based mark-recapture distance sampling to estimate moose abundance for all of northeastern Washington. We tallied 166 detections of moose groups along 2,241 km of systematically placed line transects within 29 survey blocks selected using a stratified-random design. We estimated moose density over the entire survey area as 0.49/km^2 (95% credible interval = 0.33–0.67/km^2). Extrapolated to the 10,513-km^2 survey area, we estimated 5,169 moose (95% credible interval = 3,510–7,034) prior to the decline.

Terrestrial Salamanders in Managed Forests: Impacts of Harvest Practices on Oregon Slender salamander and Ensatina Occupancy and Abundance. Tiffany Garcia*, *Oregon State University, 104 Nash Hall, College of Agricultural Sciences, Corvallis OR 97330; tiffany.garcia@oregonstate.edu*; A.J. Kroll, *Weyerhaeuser, 785 N 42nd Street, Springfield, OR 97478; AJ.Kroll@weyerhaeuser.com*; Claudine Reynolds, *Port Blakely Tree Farm, Olympia, WA 98501; creynolds@portblakely.com*; Josh Johnson, *Weyerhaeuser, Lebanon, OR 97355; Josh.Johnson@weyerhaeuser.com*; David Shaw, *Oregon State University, College of Forestry, Corvallis, OR 97331; dave.shaw@oregonstate.edu*

Understanding how sensitive taxa respond to timber harvest practices is a critical component of sustainable forest management. We used multi-scale models to estimate occupancy and abundance of the Oregon slender (*Batrachoseps wrighti*) and Ensatina (*Ensatina eschscholtzii*) salamander, two terrestrial, forest-associated salamanders, to harvest practices in the western Oregon Cascades, USA. The Oregon slender salamander is strongly associated with decaying downed wood. In contrast, Ensatina are relatively common and show less dependency on downed wood. Our Before/After, Control/Impact experiment used a staggered design in

which a subset of 88 stands were harvested in each year of the 6 year study. The impact of harvest was estimated from the expected pre-to-post change in occupancy and abundance on harvested sites relative to control sites. Treatment effect estimates for Oregon slender salamanders indicated lower mean values on harvested plots relative to control conditions, but with uncertainty due to posterior credible intervals that included 0. Ensatina salamanders also showed reduced mean occupancy and abundance values in harvested plots relative to controls, but with enough certainty to conclude a short-term negative response to harvest. Occupancy and abundance for both Oregon slender and Ensatina salamanders increased with downed wood counts at the plot level. This information will assist in the status assessment of Oregon slender salamanders, as the species was petitioned for listing under the Endangered Species Act.

not presenting **Environmental DNA Detection of Amphibians: Lessons Learned in the First Decade.** Caren S. Goldberg*, *Washington State University, School of the Environment, 100 Dairy Road, Pullman, WA 99164; caren.goldberg@wsu.edu.*

The field of environmental DNA (eDNA) detection of vertebrates has been growing exponentially, with over 200 papers published in the last few years. To bring this powerful new technique into use for conservation, a series of challenges needs to be overcome: maximizing detection, minimizing contamination, and interpreting uncertainty. I used empirical results of eDNA analyses conducted by my research group for 28 amphibians in lotic and lentic systems across the western U.S., in Florida, and internationally to inform a synthetic understanding of eDNA detection for rare amphibians. Important lessons learned include: 1) contrary to early expectations, eDNA of vertebrates is not uniformly distributed even in small wetlands (<0.1 ha) and declines quickly with distance from source in streams; 2) eDNA detection probability increases with temperature as ectothermic animals become more active and decreases as temperatures reach degradative conditions (~25°C); 3) eDNA signal can disappear quickly when animals leave lotic systems to bask; 4) some species are more difficult to detect than others, even within taxonomic groups; and 5) eDNA production among and within individuals is highly variable. Even when sampling designs are highly informed by these issues, eDNA signals from low-density populations can be inconsistent and difficult to distinguish from background noise. This uncertainty presents a challenge for conservation and management decision-making, as well as for regulatory application. I will discuss how other countries have addressed these issues and some challenges and opportunities for developing analogous efforts for amphibians listed under the U.S. Endangered Species Act.

not presenting **Detecting Rare Amphibians in Sierra Nevada Meadows with Backpack eDNA Sampling.** Caren S. Goldberg*, *Washington State University, School of the Environment, 100 Dairy Road, Pullman, WA 99164; caren.goldberg@wsu.edu;* Karen Pope, *USFS Pacific Southwest Research Station, 1700 Bayview Dr., Arcata, CA 95521*; kpope@fs.fed.us; Nicolette Nelson, Jonah Piovia-Scott, *Washington State University, School of Biological Sciences, 14204 NE Salmon Creek Ave., Vancouver, WA 98686; nicolette.nelson@wsu.edu; jonah.piovia-scott@wsu.edu*

Environmental DNA detection of amphibians can be an efficient and effective survey method in stream and wetland systems. However, recent work has demonstrated that eDNA does not travel far from the source, presenting a challenge for eDNA detection of rare species in complex aquatic systems such as meadows. In the summer of 2017, we conducted visual encounter surveys (VES) and used a backpack sampler (ANDe; Smith-Root) to collect

concurrent eDNA water filter samples from 65 sites in 15 Sierra Nevada meadows. Sample volumes ranged from 380 mL to more than 2 L per filter and took 3-20 minutes to collect. Samples were analyzed using species-specific qPCR assays for *Rana sierrae, R. cascadae, R. catesbeiana,* and *Pacifastacus leniusculus*. Within meadows, we detected *R. sierrae at* 19 sites: 4 with eDNA only, 1 by VES only, and 14 with both methods. Detections for *R. cascadae* were similar, with 5 sites detected by eDNA only, no sites with VES only, and 11 sites with both methods. We also detected *R. catesbeiana* and *P. leniusculus* at the one sampling site each where they were visually observed. There was some evidence that the number of individuals detected in the VES survey was related to the amount of target species eDNA in the sample ($p=0.07$) but sites with low VES detections had a wide range of eDNA amounts from the target species, leading to overall low explanatory power of this relationship ($r^2=0.07$). This method provides an efficient way to detect rare amphibians in complex aquatic systems.

Influence of Occupation History and Habitat on Washington Sea Otter Diet. Jessica R. Hale*, *School of Aquatic and Fishery Sciences, University of Washington, 1122 NE Boat Street, Seattle, WA 98105; jrh33@uw.edu;* Kristin L. Laidre, *School of Aquatic and Fishery Sciences, University of Washington, 1122 NE Boat Street, Seattle, WA 98105, and Polar Science Center, Applied Physics Laboratory, University of Washington, 1013 NE 40th Street, Seattle, WA 98105; klaidre@uw.edu;* M. Tim Tinker, *Department of Ecology and Evolutionary Biology, University of California, Center for Ocean Health, 100 Scheffer Road, Santa Cruz, CA 95060, and Nhydra Ecological Consulting, Head of St. Margaret's Bay, NS; ttinker@nhydra.com;* Ronald J. Jameson, *United States Geological Survey, Western Ecological Research Center, 7801 Folsom Boulevard, Suite 101, Sacramento, CA 95826; ronaldjam@comcast.net;* Steven J. Jeffries, *Washington Department of Fish and Wildlife, Wildlife Science Program, Marine Mammal Investigations, 7801 Phillips Road SW, Lakewood WA 98498; Steven.Jeffries@dfw.wa.gov;* Shawn E. Larson,*Seattle Aquarium, 1483 Alaskan Way, Seattle, WA 98101; S.Larson@seattleaquarium.org;* James L. Bodkin**,** *U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, AK 99508, USA; jldbodkin@gmail.com.*

Habitat characteristics are primary determinants of nearshore marine communities. However, biological drivers like predation can also be important for community composition. Sea otters (*Enhydra lutris sspp*.) are a salient example of a keystone species exerting top-down control on ecosystem community structure. The translocation and subsequent population growth and range expansion of the northern sea otter (*Enhydra lutris kenyoni*) in Washington State over the last 5 decades has created a spatio-temporal gradient in sea otter occupation time and density, and acts as a natural experiment to quantify how sea otter occupation history and habitat type influence sea otter diet. We collected focal observations of sea otters foraging at sites across the gradient, in varying habitat types between 2010 and 2017. We quantified sea otter diet composition and diversity, and long-term rates of energy gain across the gradient. We found that sea otter diet diversity was positively correlated with cumulative sea otter density, while rate of energy gain was negatively correlated with cumulative density. Additionally, we found that habitat type explained 1.77 times more variance in sea otter diet composition than sea otter cumulative density. Long-term diet studies can provide a broader picture of sea otter population health in Washington State.

Shell Disease in Washington's Western Pond Turtles—A Quantitative Assessment Based on Computed Tomography. Katherine Haman*, Lisa Hallock, Lameace Kalisz, Ilai Keren,

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Shell disease in Washington's Western Pond Turtles (*Actinemys marmorata*) has the potential to limit the recovery of this state endangered species. Though the etiology of the shell disease is unknown at this time, there is an association with a fungal pathogen closely related to the pathogen that causes snake fungal disease. The overall impact of this disease on the recovery and conservation of Western Pond Turtles in Washington remains under investigation. To monitor the prevalence, disease progression, treatment success, and overall impacts of the disease on reproductive success of affected individuals, we developed a method for disease assessment based on computed tomography scans. This assessment allows us to quantify both the severity and extent of shell disease in individual turtles as well as clearly identify the prevalence of this disease in Washington populations of Western Pond Turtles. For this talk, we will focus on the assessment protocol and preliminary results from turtles that have had repeat CT scans over several years. We will highlight the usefulness of the assessment in monitoring disease progression in turtles that have been treated compared to those which have not. We will also discuss the use of this assessment to investigate the impacts of shell disease on reproductive success and thus its potential impacts on population recovery. In conclusion, we will review what is known to date regarding shell disease in Western Pond Turtles in Washington and mitigation efforts currently underway.

lmproving Methods for Data Collection Using Unmanned Aerial Surveys of Marine Mammal Populations in the California Current Ecosystem. Jeff Harris*, *Alaska Fisheries Science Center, NOAA, 7600 Sand Point Way Northeast, Seattle, WA 98115; jeff.harris@noaa.gov*

The addition of unmanned aerial systems (UAS) to historical survey techniques is enhancing the quality of data collected on marine mammal population demographics. During the 2018 pupping season, the California Current Ecosystems Marine Mammal division (CCEP) compared pup count data between UAS and historical (ground, vessel based, and aerial) counting methods of three species of pinniped. Pup counts using a UAS for Steller Sea Lions (*Eumetopias jubatus*), California Sea Lions (*Zalophus californianus*) and Northern Fur Seals (*Callorhinus ursinus*) increased accuracy of the counts while minimizing disturbance to pinnipeds as well as numerous species of nesting sea birds. While analyzing images collected at each rookery location, other relevant demographic data can be efficiently extracted, such as brand and tag identification, entanglement rates, and age and sex distribution in the rookery. Another management application of UAS surveys used by CCEP in 2018 was the assessment for evidence of entanglement in a foraging aggregation of humpback whales. A combination of fluke identification photos while simultaneously collecting aerial imagery allowed for a thorough assessment of 81 individual whales for both evidence of interaction with a gill-net fishery and body condition. UAS will continue to be used by CCEP to increase the quality of data collected and minimize disturbance to populations.

Mountain Goats Going Where They Are Wanted (They Know How to Take a Hint). Rich Harris*, *Washington Department of Fish and Wildlife, Olympia, WA 98501; Richard.harris@dfw.wa.gov;* Patti Happe, *Olympic National Park, Port Angeles*

In March 2017, we presented on plans to translocate mountain goats (*Oreamnos americanus*) from the Olympic Peninsula to selected portions of the North Cascades (primarily on U.S. Forest Service-administered lands). We will provide an overview of the initial translocations that occurred in September 2018, as well as our plans for additional work in summer 2019.

Casting a Broader Net: Using Multi-target Metagenomics to Capture Aquatic Biodiversity Data from Diverse Taxonomic Targets. Laura Hauck, Brooke Penaluna, Richard Cronn, *Pacific Northwest Research Station, USDA Forest Service, 3200 Southwest Jefferson Way, Corvallis, OR 97331*; *lhauck@fs.fed.us*; *bepenaluna@fs.fed.us*; *rcronn@fs.fed.us;* Kevin Weitemier*, Tiffany Garcia, *Oregon State University, Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis, OR 97331*; *Kevin.Weitemier@oregonstate.edu*; *Tiffany.Garcia@oregonstate.edu*

Environmental DNA (eDNA) assays for single- and multi-species detection show promise for providing standardized assessment methods for diverse taxa, but techniques for evaluating multiple taxonomically-divergent assemblages are in their infancy. Here, we evaluated whether microfluidic multiplex metabarcoding and next-generation sequencing could identify diverse aquatic and riparian assemblages from 48 taxon-general and taxon-specific metabarcode primers per assay. eDNA screening was paired with electrofishing along a stream continuum to evaluate congruence between methods. A fish hatchery located in the transect provided a barrier to upstream passage of hatchery species, and a point source for one non-native species (White Sturgeon, *Acipenser transmontanus*).

Microfluidic metabarcoding detected all 13 species observed by electrofishing, with overall accuracy of 86%. Taxon-specific primers were more successful than taxon-general primers at classifying sequences to species. Taxon-specific and taxon-general markers detected a transition of downstream sites dominated by multiple fish species, to upstream sites dominated by a single species; however, we failed to detect similar transitions in amphibians along the same transect. White Sturgeon was only detected at the hatchery outflow, indicating eDNA transport was not detectable at ~2.4 km. Overall, we identified 878 predicted taxa, with most sequences (49.8%) derived from fish (Actinopteri, Petromyzontidae), Oomycetes (21.4%), Arthropoda (classes Insecta, Decapoda; 16.6%), and Apicomplexan parasites (3.83%). Taxa accounting for ~1% or less of sequences included freshwater red algae, diatoms, amphibians, and beaver. Our work shows that microfluidic metabarcoding can survey multiple phyla per assay, providing fine discrimination required to resolve closely-related species, and enabling data-driven prioritization for multiple forest health objectives.

Effectiveness of Autonomous Recording Units for Monitoring Owls in the Central Cascades of Washington. Jessica A. Homyack*, *Weyerhaeuser Company, 505 North Pearl St, Centralia, WA 98531; Jessica.homyack@weyerhaeuser.com;* Matt Hane, *Weyerhaeuser Company, P.O. Box 275, Springfield, OR 97477;* Storm Beech, *Weyerhaeuser Company, 505 North Pearl St, Centralia, WA 98531;* Michael J. Rochelle, *Weyerhaeuser Company, 34904 Brewster Rd, Lebanon, OR 97355*

Following the listing of Northern Spotted Owl (NSO, *Strix occidentalis caurina*) as threatened under the Endangered Species Act and the enactment of the Northwest Forest Plan, many landowners implemented call-back survey programs to detect presence and monitor reproduction. Landowners use this information on NSO to reduce risk of take from harvests or

other management activities. The development of automated devices that passively record NSO calls may increase efficiency and worker safety, reduce overall survey costs, and facilitate examining ecological interactions among multiple owl species. Thus, to understand whether a shift in survey methods is warranted, we are evaluating performance of Autonomous Recording Units (ARUs) relative to traditional owl surveys. We sampled 16 historic territories of NSO in the Central Cascades of Washington and selected a single call station to monitor owls in 2018 with both traditional call-back surveys and ARUs. During traditional surveys, survey personnel listened for >10-minutes and used digital recordings of NSO calls to elicit a call-back response. Additionally, we deployed ARUs for 3 months and programed them to record 2 hours at dusk and dawn nightly, and at an additional, randomly selected 2-hour period during night-time hours. We are estimating occupancy and detection of NSO and Barred Owls (*Strix varia*) from acoustic data files analyzed with Kaleidoscope software. We will compare detection probabilities and occupancy between traditional and bioacoustic surveys to estimate effectiveness of a potential alternative survey type.

Differing Demographic Responses of Toad Populations to Regionally Synchronous and Declining Prevalence of Amphibian Chytrid Fungus. Blake Hossack, Ken Honeycutt, *USGS-Northern Rocky Mountain Science Center, Missoula, MT 59801*; *blake_hossack@usgs.gov; rhoneycutt@usgs.gov;* Rebecca McCaffery, *USGS-Forest and Rangeland Ecosystem Science Center, Port Angeles, WA 98362*; Robin Russell, *USGS-National Wildlife Health Center, Madison, WI 53711; rmccaffery@usgs.gov*

Batrachochytrium dendrobatidis (Bd), a fungal pathogen that causes amphibian chytridiomycosis, has been implicated in amphibian population declines globally. Some of the earliest evidence that Bd caused declines came from Boreal Toad (*Anaxyrus boreas*) populations in the western USA. However, >20 years after the pathogen was first described, there are still surprisingly few long-term studies that have estimated the effect of Bd on survival in the wild. To provide greater understanding of how Bd affects survival and how threats vary spatially and temporally, we incorporated disease sampling into 3 long-term (range: 9–13 yrs) capture-mark-recapture studies of Boreal Toads in western Montana. We also measured patterns of temporal synchrony in Bd prevalence among populations, quantified changes in population-level Bd prevalence over time, and the examined potential role of co-occurring Columbia Spotted Frogs (*Rana luteiventris*) in driving infection dynamics. We found remarkable variation in the effect of Bd on apparent survival, despite all toad populations being part of similar amphibian communities and experiencing similar climates. Temporal trends in apparent survival among populations did not correspond with the estimated effect of Bd infection on individuals, but there were common patterns in mean annual prevalence of Bd across populations within years that resulted in a strong synchrony in disease dynamics across the region. There were also strong population-level trends in Bd prevalence that did not seem clearly related to trends in temperature, dynamics of Boreal Toads, or *R. luteiventris*. Our results illustrate the complexity in understanding and predicting Bd dynamics in multi-host communities.

Fuel Reduction Logging Influences Forage Resources and Nutrient Intake of Deer in Northeastern Washington. Iver T. Hull, *School of the Environment, Washington State University, Pullman, WA 99164; iver.hull@wsu.edu*; Lisa A. Shipley*, *School of the Environment, Washington State University, Pullman, WA 99164; shipley@wsu.edu*; Stephanie L. Berry, *School of the Environment, Washington State University, Pullman, WA 99164;*

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Fire suppression over the last 100 years has resulted in densely-stocked forests with continuous overstories and heavy fuel loads in the interior western United States. Because these conditions promote severe wildfires that threaten human safety and alter natural forest communities, land managers have implemented fuels reduction treatments such as commercial thinning and prescribed burning to reduce chances of wildfire and promote healthy forests. These treatments reduce canopy cover and increase light penetration to the forest understory, which can improve forage resources for native wild herbivores. Therefore, we examined the biomass of understory vegetation and the nutrient intake of tractable mule and white-tailed deer across treated and untreated stands ranging from 0 – 100% canopy cover and 1 – 20 years post-thinning in the Colville National Forest of northeastern Washington. Forage biomass was higher in treated than untreated stands, decreased with overstory canopy cover, and increased curvilinearly with time since treatment, with peak biomass at < 14 yr post-treatment. Variables that reflected temperature and moisture gradients were also included in best-fit landscape predictive models. Daily digestible nutrient intake of deer increased with understory biomass, and met summer maintenance requirements for adult deer, whereas diet quality met lactation requirements. Deer selected diets that primarily consisted of nutritious deciduous shrubs and forbs promoted by open canopies. Our findings suggest that fuels reduction treatments, especially those reducing canopy to < 50%, benefit native wild herbivores by providing more abundant and nutritious forages that meet requirements for reproduction for at least for 2 decades post-treatment.

Satellite Tag Tracking of Male California Sea lions in the Pacific Northwest to Assess Haul-out and Foraging Behavior in Navy Testing and Training Areas. Steven Jeffries, Dyanna Lambourn, Josh Oliver, *Washington Department of Fish and Wildlife, 7801 Phillips Road SW, Lakewood WA 98498; Steven.Jeffries@dfw.wa.gov*; Robert DeLong, Sharon Melin, Jeff Harris, Pat Gearin, Tony Orr, Jeff Laake, *NMFS, Marine Mammal Laboratory, Alaska Fisheries Science Center in Seattle WA 98115*.

We conducted this study of California sea lions in Puget Sound for the Navy to 1) estimate number of sea lions using their facilities and 2) describe their behaviors for estimating MMPA takes. We counted sea lions weekly at four Navy facilities to estimate abundance and use patterns. We estimated the number of sea lions using Navy facilities was 788 (99% CI: 534-1186). Numbers using Navy facilities were highest during fall and winter, followed by spring, then near zero in summer. We also captured adult male sea lions at NAS Bremerton in December and January 2014/2015 and 2015/2016 and at Clam Bay in February 2016 to deploy Argos-linked Satellite Dive Recorders (SDRs) on 30 animals. Each SDR collected data on location, dive depth and proportion of time in the water. Deployments ranged from 8 to 184 days depending on animal. We recorded a total of 59,645 hourly locations, 234,034 dives and 12,786 hours of haul out behavior. For the instrumented sea lions, 11 remained in Puget Sound for up to four months with most foraging near capture locations; however, two travelled to Hood Canal and used Navy facilities at Bangor. The other 19 sea lions left within a month and moved to BC waters (8) or to WA/OR coast (11). Mean dive depths in Puget Sound were less than 20 m (max = 348 m). In other regions, mean dive depths were similar with maximum = 444 m. Dive durations averaged less than 4 minutes (max > 10 min).

Southern Resident Killer Whales: Present and Future. Katie Jones*, *Center for Whale Research, 355 Smuggler's Cove Road, Friday Harbor, WA 98250; katie@whaleresearch.com*

Since 1976 the Center for Whale Research (CWR) has collected detailed data on the health of the Southern Resident killer whales (SRKW) and has been a leading voice pushing for their conservation and protection. The data collected by the CWR includes photo identification surveys of both SRKW and transient (mammal-eating) killer whales which has allowed all individuals in the population to be identified. This unique long term dataset has given insight into the social structure, reproduction, behavior, and health of the whales. Through its work the CWR has been pivotal in securing legislation to protect the SRKW and continues to petition for the needs of the whales and the ecosystem as a whole.

This presentation will outline the current population demographics and fecundity of SRKW and what this data might indicate in terms of the long-term survival prospects for the population. Current threats to SRKW will be discussed with emphasis on the main threat to the population - lack of their preferred prey, Chinook salmon. New research endeavors will also be highlighted. CWR's goal is to monitor the Southern Resident orcas through the entire lifespan of a generation of known-age whales and although we have been collecting data for over 40 years we are only about half way to reaching this goal. The continued long term monitoring of this population is essential to provide the science needed for evidence based decision making to ensure the long-term health, recovery, and conservation of these magnificent creatures.

Reconnecting Habitats: The Washington State Department of Transportation's Approach to Integrating Habitat Connectivity Principles into the State's Transportation System. Glen P. Kalisz*, Kelly McAllister, *Washington State Department of Transportation, 310 Maple Park Avenue Southeast, Olympia, WA 98504; kaliszg@wsdot.wa.gov*; *McAllKe@wsdot.wa.gov*

Habitat connectivity is essential to maintaining healthy ecological processes and viable wildlife populations. While transportation infrastructure is often considered a barrier to wildlife movement, the Washington State Department of Transportation (WSDOT) is committed to making the highway system more permeable for wildlife. I will discuss WSDOT's efforts to incorporate habitat connectivity principles into the stewardship of the state's transportation system, including the basis for determining where on our sizeable highway system we can justify spending public dollars on improving highway conditions for wildlife, and how we should integrate habitat connectivity into our fish barrier corrections and other projects. I will highlight examples of WSDOT's accomplishments around the state and address components of our crossing structure monitoring program including the use of infrared trail cameras to collect and analyze data; as well as what we have learned about species' preferences for different types of habitat connectivity infrastructure. I will describe how we determine structure sizing, when and where to use jumpouts, wildlife fencing, and cattle guards, and provide some general recommendations for increasing the permeability of our highway system.

Waterfowl Surveying and Wetland Restoration in the Channeled Scablands of Eastern Washington. Victoria Kaufman*, *Washington Department of Fish & Wildlife, 2315 N Discovery Pl, Spokane Valley, WA 99216; featherblueLLC@gmail.com*; Matthew Wilson, *Washington Department of Fish & Wildlife, 1701 S 24th Ave, Yakima, WA 98902; matthew.wilson@dfw.wa.gov*; Tina Blewett, *Ducks Unlimited Inc., One Waterfowl Way, Memphis, TN 38120; tblewett@ducks.org*

The Intermountain West Joint Venture (IWJV) extends across eleven states and includes 18 separate wetland landscapes, all actively managed to increase natural resources and populations of priority bird species. IWJV management areas are an amalgamation of public and private lands, owned and operated by the Washington Department of Natural Resources, Bureau of Land Management, as well as corporate and private ownerships. The approach of IWJV outreach, surveying, and restoration management is a multifaceted, iterative process requiring constant adaptive management practices. Adaptive management plans call on an array of professional skills from biologists, engineers, land preservation specialists, and an informed community of farm-based landholders. In Washington, IWJV areas include the Channeled Scablands and Turnbull Wetlands, both seasonally flooded sagebrush steppe habitats with historic or current farming activity. These areas also play a significant role as stop-over habitat for hundreds of thousands of duck and geese species. Beginning in 2016 and continuing through 2020, spring waterfowl surveys have been a collaborative effort by government agencies and conservation organizations. Aerial and ground surveys gauge waterfowl density and quantify preferred wetland habitats of surveyed species. Results from ground and aerial survey data support continued prioritization of restoring threatened wetlands in both the Channeled Scablands and Turnbull Wetlands of Eastern Washington from drainage, soil-exhaustion, and over-grazing. Duck species of interest appear to thrive in shallow flooded agricultural fields, known as sheetwater ag., and these ephemeral flooded areas are managed to maximize desirable steppe flora that provide reliable food sources and seasonal refuge to migrating populations.

Broad-Scale Influence of Biotic and Abiotic Drivers to Lynx Occupancy in Washington State under Current and Future Climatic Conditions. Travis King*, Daniel Thornton, *Washington State University, 1775 NE Stadium Way, Pullman, WA 99164; Travis.w.king@wsu.edu, daniel.thornton@wsu.edu*

In Washington, the threatened Canada lynx (Lynx canadensis) is a sensitive indicator species for impacts of climate change. Increases in temperature and declines in snow extent and depth may reduce lynx foraging efficiency and result in competition with other terrestrial predators. Additionally, increases in frequency or intensity of forest fires associated with climate change may temporarily eliminate suitable lynx habitat. Despite these threats, our understanding of current lynx distribution in Washington is based on a series of small-scale studies focused solely in the state's "best lynx habitat". To gain a better understanding of distribution and the impact of biotic and abiotic drivers on large-scale lynx occupancy patterns, we conducted the largest systematic occupancy survey of lynx in Washington to date, utilizing a spatially extensive camera-trapping array covering 7000 km^2 of predicted lynx habitat. We used the resulting broad-scale database of rigorous presence-absence data to develop single-season occupancy models that indicate the influence of abiotic and biotic drivers on current state wide patterns of lynx occupancy and predict likely future lynx distribution based on climate change forecasts. Our results show lynx occupancy across the Washington landscape is fairly restricted and dictated largely by abiotic factors, disturbance regimes, and distance from source populations in Canada. Further, future predictions demonstrate a substantial northward retraction of lynx range in Washington by 2100. Our results add to the growing deliberations on federal status listings for this state endangered species, and help refine future management and monitoring of lynx to ensure continued population persistence within Washington.

Spatial and Temporal Factors Associated with Nest Survival of Gray Flycatchers in Managed Ponderosa Pine Forests. Jeffrey M. Kozma*, *Yakama Nation, Timber, Fish and Wildlife/Fisheries Resource Management, P.O. Box 151, Toppenish, WA 98948; kozj@yakamafish-nsn.gov;* Andrew J. Kroll, Jamie Thornton, *Timberlands Strategy & Technology, Weyerhaeuser, 220 Occidental Avenue S, Seattle, WA 98104; AJ.Kroll@weyerhaeuser.com, Jamie.Thornton@weyerhaeuser.com*

The Gray Flycatcher (*Empidonax wrightii*) breeds in a variety of habitats in the arid and semi-arid regions of the western United States. Detailed information on their breeding biology is lacking, especially in the recently expanded northern portion of their range where they nest in Ponderosa Pine (*Pinus ponderosa*) dominated forests. During May–July 2014 and 2015 we surveyed for singing male Gray Flycatchers, monitored flycatcher nests and measured vegetation at nest sites in ponderosa pine forests with a history of timber harvest. We used a logistic-exposure model fit within a Bayesian framework to model the daily survival probability of flycatcher nests. Predation accounted for 90% of failed nests while Brown-headed Cowbirds (*Molothrus ater*) accounted for only 3% of nest failures. We found evidence of a positive association between daily nest survival and both nest height and distance of nest substrate to the nearest tree. We found no support for other spatial covariates but did find evidence that period survival rate was higher during the nest building stage than the incubation and nestling stages. Higher nests may be less exposed to terrestrial predators and nests in trees that are farther from other trees may be less exposed to arboreal predators such as jays (Corvidae) and squirrels (Sciuridae) that may search for nests in patches with connected canopies.

Return of the Guadalupe Fur Seal and Unusual Sightings of Artic Seals in the Pacific Northwest. Dyanna. M. Lambourn*, Steve. J. Jeffries, *Washington Department of Fish and Wildlife, 7081 Phillips Lakewood WA 98498; Dyanna.Lambourn@dfw.wa.gov; Steven.Jeffries@dfw.wa.gov;* Erin D'Agnese, Woutrina Smith, *School of Veterinary Medicine, One Health Institute, University of California, Davis, One Shields Ave, Davis CA, 95616; erdagnese@ucdavis.edu; wasmith@ucdavis.edu;* Kristin Wilkinson, *NOAA/NMFS, 7600 Sand Point Way NE, Seattle WA 98115; Kristin.Wilkinson@noaa.gov;* Jessica Huggins, *Cascadia Research, 218 ½ W 4th Ave, Olympia WA 98501; JHuggins@cascadiaresearch.org;* James Rice, *Oregon State University, Marine Mammal Institute, Hatfield Marine Science Center, Newport OR; Jim.Rice@oregonstate.edu;* Deborah Duffield, *Portland State University, Portland OR 97207; duffieldd@pdx.edu;* Michael Grigg; *Laboratory of Parasitic Diseases, National Institute of Health, NIAID, 4 Center Drive, MSC0425, Bethesda MD 20892; griggm@niaid.nih.gov;* Stephen A. Raverty; *British Columbia Ministry of Agriculture and Food, Animal Health Center, 1767 Angus Campbell Road, Abbotsford, British Columbia V3G 2M3; Stephen.Raverty@gov.bc.ca*

In modern times, the occurrence of Guadalupe Fur Seals (GFS) (*Arctocephalus townsendi*) in the Pacific Northwest had generally been considered a rare event, although there is historical evidence of their presence in the Ozette archaeological site of the northwest coast from 1500 to 1700 A.D. Since that time, only two records exist prior to 2005, both in 1992. Since 2005, there have been 199 recorded strandings of GFS in Oregon and Washington; occurring annually from 2005 to 2018. In 2012, strandings totaled a high of 56. Additionally, there have been numerous confirmed live sightings of GFS off the Washington coast since 2007, providing further evidence that this species may be returning to the Pacific Northwest portion of its former

range. The re-emergence of this population in the Pacific Northwest is a testament to the effective implementation of the Marine Mammal Protection Act and Endangered Species Act.

Two species of Artic pinnipeds (Ribbon and Ringed Seals) have also recently been documented in Pacific Northwest. Contrary to the GFS, there is no evidence that this region is part of their historical range and these occurrences are considered to be anomalous and possibly related to warming ocean conditions. As the climate continues to change there may be continued sighting of these Artic ice seals in the future.

Sea Otter Genetics Update:Diversity, Population Structure and Taxonomy. Shawn Larson*, *Curator of Conservation Research, The Seattle Aquarium, 1483 Alaskan Way, pier 59, Seattle, WA 98101; s.larson@seattleaquarium.org*

Sea otters (*Enhydra lutris)* were once abundant along the nearshore areas of the north Pacific Rim from northern Japan to Baja California, Mexico. Starting in 1741 the Pacific maritime fur trade eliminated sea otter populations throughout nearly all of their range and by 1910 resulted in 13 small scattered populations, totaling less than 1% of their original abundance. Previous work found lower genetic diversity in sea otters sampled in the early 1990s compared to pre-fur trade samples. Sea otter populations were re-sampled between 2008-2011 throughout much of their range and analyzed using 20 microsatellite markers. Here we report genetic diversity and population structure compared to samples collected 20 years earlier. Genetic diversity was found to increase in most sampled locations but particularly in those founded by translocations founded by more than one population and those experiencing immigration from adjacent groups. We also investigated taxonomic relationships between populations. There are currently three recognized sea otter subspecies based on skull morphology: Russian (*E.l. lutris*), Northern (*E.l.kenyoni*), and Southern (*E.l. nereis*). Microsatellite and the mitochondrial DNA D loop variability suggest there may be more than three taxonomically distinct populations.

Larval Morphology of the Coastal Tailed Frog (*Ascaphus truei*) Differentiate Geographic Clades. Mark Leppin*****, *Oregon State University, Department of Integrative Biology, Corvallis, OR 97331; leppinm@oregonstate.edu*; Gwen W. Bury, *Oregon State University, Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis, OR 97331*; R. B. Bury, (*Emeritus) U.S. Geological Survey, current address: 1410 NW 12th Street, Corvallis, OR* 97330.

Molecular data, both published and unpublished, indicates that the Coastal Tailed Frog (*Ascaphus truei*) consists of 4 clades south of the Columbia River. For that region, we compared the oral apparatus of larvae to determine if their morphological features reflect the pattern observed in genetic clades. We examined nine morphological characters in >400 larvae from >40 populations with approximately 60% of our material based on museum specimens. Also, we compared intrapopulation chronological variation in two populations which had samples taken about 20 years apart; these were similar. Our analyses indicate presence of at least three clades south of the Columbia River based on the number of posterior tooth rows and number of teeth along the third posterior tooth row. One of these morphological traits may be useful for field identification of these clades.

Lynx Conservation in Washington: Combatting the Effects of Fire, Climate and a Small, Isolated Population. Washington Lynx Conservation Strategy Team, *Washington Department of Fish and Wildlife, Olympia, WA 98501; Jeffrey.Lewis@dfw.wa.gov;*

DWerntz@conservationnw.org; *Gary.Bell@dfw.wa.gov; Scott.Fitkin@dfw.wa.gov; Scott.Fisher@dnr.wa.gov; Daniel.Thornton@wsu.edu*; and *Karen.Hodges@ubc.ca.*

Lynx (*Lynx canadensis*) once occupied the high-elevation spruce, fir, and pine forests of northern and northeastern Washington in Okanogan, Ferry, Stevens, and Pend Oreille Counties. Despite protection from trapping since 1991, and state (1993) and federal (2000) listings as a threatened species, the conservation status of the lynx has only worsened. Since the lynx was listed, its range has contracted to the west and it is now restricted to western Okanogan County. The causes for this contraction are poorly understood. Within the last twenty years, an unprecedented number of large fires has occurred within western Okanogan County. Currently, lynx occupy 4 localized areas within western Okanogan county and lynx persistence in these areas is threatened by continued habitat loss and fragmentation via wildfires, and limited immigration from British Columbia. In the summer of 2018, fires occurred within each of these 4 occupied areas. A number of lynx conservation strategies have been proposed and implemented in the last 5 years, but large fire events outpace these protections and conservation actions and are not expected to become less severe in the future. We propose ongoing and heightened protections of remaining lynx habitats and prioritization of those known to be occupied. We also promote ongoing occupancy surveys to determine where lynx currently occur in this fast-changing landscape, so as to target conservation actions where they can be most effective. We provide details on these approaches and challenges as we consider what recent events could mean for lynx persistence in Washington.

The Cascade Fisher Reintroduction Project in Washington: Progress in the South Cascades and Launching a New Reintroduction in the North Cascades. Jeffrey C. Lewis*, *Washington Department of Fish and Wildlife, Olympia, WA 98501; Jeffrey.Lewis@dfw.wa.gov;* Tara Chestnut, *Mount Rainier National Park, Ashford, WA 98304; Tara_Chestnut@nps.gov;* Jason Ransom, *North Cascades National Park, Sedro Woolley, WA 98284; Jason_I_Ransom@nps.gov;* David Werntz, *Conservation Northwest, Bellingham, WA 98225; dwerntz@conservationnw.org.*

Fishers (*Pekania pennanti*) are a mid-sized member of the weasel family that once occurred in the coniferous forests of Washington but were extirpated in the early and mid-1900s as a result of over-trapping, habitat loss, and predator eradication programs. To restore fishers in Washington, we reintroduced 90 fishers to Olympic National Park (2008-2010), 73 fishers to the South Cascades (2015-2018), and we recently initiated (in December 2018) a fisher reintroduction to the North Cascades Ecosystem. Our recent findings in the South Cascades indicated that the large majority of released fishers (all had radio-transmitters) remained within the reintroduction area, >50% of females established home ranges in the first year following release, annual survival rates for fishers ranged from moderate to high, and females are reproducing. While these are initial and preliminary findings, they are positive and consistent with successful reintroductions. We will also share details about numerous, substantial changes in our reintroduction strategies (i.e., new source population, partners, operations, and research opportunities) that are part of the reintroduction now underway in the North Cascades, where we plan to release 80 or more fishers between 2018 and 2020.

Northern Spotted Owl (*Strix occidentalis caurina*) Occupancy Dynamics and Breeding Propensity in a Protected Area: Factors Related to Habitat, Weather and Barred Owl (S. varia) presence. Anna O. Mangan, *Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon, USA,*

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The federally threatened Northern Spotted Owl (*Strix occidentalis caurina*) occurs on public lands throughout the Pacific Northwest, including Mount Rainier National Park (MRNP), Washington, USA. MRNP provides an ideal place to evaluate potential impacts of climate change and the invasive Barred Owl (*Strix varia*) on Northern Spotted Owl demographics because it has virtually no history of timber harvest or large forest disturbance within its boundaries since the park's creation in 1899. We used a multi-state, multi-season occupancy model to investigate the effects of Barred Owl presence, local and regional weather, and habitat characteristics on Northern Spotted Owl occupancy dynamics and breeding propensity at MRNP from 1997-2016. Occupancy of spotted owl territories in MRNP has declined by 50% in the last 20 years and rates of occupancy by breeding spotted owls decreased to a low of 25% in 2016. Occupancy rates were higher on territories with steeper terrain. Breeding propensity was lower when Barred Owls were detected, but higher when early nesting season temperatures during March and April were higher. Detection probabilities for breeding Spotted Owls decreased when Barred Owls were present in the territory. Other habitat characteristics were not associated with Spotted Owl occupancy dynamics, which likely reflected the long history of conservation in the park, with old-growth forest predominating in most areas. This study illustrates the strong relationship between the presence of Barred Owls and Spotted Owl demographics and breeding site selection on protected lands where habitat loss through timber harvest and wildfire has not occurred.

Snake Activity Monitoring after Dike Repair at a Coastal Hibernaculum. Brent M. Matsuda*, *Hatch, 1066 West Hastings Street, Vancouver, BC, Canada V6E 3X2; brent.matsuda@hatch.com,* Lorraine Andrusiak, *SNC-Lavalin Inc., 8648 Commerce Court, Burnaby, BC V5A 4N6; Lorraine.Andrusiak@snclavalin.com,* Erin Clement, *City of Delta, 4500 Clarence Taylor Crescent, Delta, BC V4K 3E2; EClement@delta.ca,* Purnima Govindarajulu, *BC Ministry of Environment, Ecosystems Branch, 3930 Braefoot Road, Victoria, BC V8P 3T2; Purnima.Govindarajulu@gov.bc.ca,* Katie Bell, *565 Broadway Street, Victoria, BC V8Z 2G3; kahbell04@gmail.com*

In February 2015, 577 gartersnakes were removed during dike repairs in Delta, BC and overwintered at an off-site facility. They were released back to the dike post-construction in spring 2015, coinciding with natural hibernation emergence. Of the 494 snakes released, 192 snakes had Passive Integrated Transponder (PIT) tags inserted in them. Post-release surveys conducted during this period recorded 263 snakes in the area. Surveys were repeated in fall 2015 to assess movement back to the hibernaculm for overwintering, and in spring 2016 to assess post-hibernation emergence. Combined, 84 of 379 snakes caught had been previously PIT-tagged and 29 new snakes tagged. Adjusting for multiple captures, 65% were recaptures indicating strong site fidelity. 91% were Western Gartersnakes (*Thamnophis elegans*), 7% were

Northwestern Gartersnakes (*Thamnophis ordinoides*), and 2% were Common Gartersnakes (*Thamnophis sirtalis*). 71% were adults, 20% were neonates and 9% juveniles. During the surveys, 49% were caught on the same dike transect and 37% were incidental catches. Many incidentals occurred on transects but were caught after the transect survey had ended so were recorded as incidentals. Almost all neonates were caught incidentally by overturning cover objects on the dike. The high number of recaptures during spring emergence and mating indicates that snakes still use the site for hibernation and the number of neonates indicates that breeding is successfully occurring post-construction. The short duration of this study does not reflect population stability, survival rates, or other population parameters, which can only be assessed with continued long-term monitoring and data collection.

Patterns of Small Mammal Recolonization Following Elwha River Dam Removal. Rebecca McCaffery*, Kurt Jenkins, *USGS-Forest and Rangeland Ecosystem Science Center, 600 E. Park Ave, Port Angeles, WA 98362; rmccaffery@usgs.gov*; *kurt_jenkins@usgs.gov*; Kim Sager-Fradkin, *Lower Elwha Klallam Tribe, 760 Stratton Road, Port Angeles, WA 9836; kim.sager@elwha.org*

Terrestrial wildlife communities have been overlooked components of ecosystem restoration following dam removal, but are part of the river restoration process. The removal of large dams results in significant ecological disturbance, including the exposure of substrate on the former reservoirs behind the dams. Restoration of those lakebeds involves a successional process of revegetation and animal recolonization. We investigated patterns of small mammal recolonization following the removal of two large dams on the Elwha River on the Olympic Peninsula. From 2014 to 2016, we live-trapped small mammals in grid plots along transects located perpendicular to the river on both lakebeds. We also collected data on vegetation, substrate, and overstory characteristics in each study plot. We used community occupancy models to estimate species diversity and composition over time and in association with habitat characteristics. We used mark-recapture models to estimate density of two *Peromyscus* species. We captured 14 species representing 9 genera over the three years, with *P. maniculatus* and *P. keeni* dominating captures. While the two *Peromyscus* species were found in all habitat types, shrew and vole species were restricted to plots that contained a vegetative overstory. Mice had a strong association with bare plots containing little to no vegetation, as well as habitats containing downed logs. These data provide a valuable baseline for understanding the patterns and trajectory of small mammal recolonization and use of dewatered reservoirs following large-scale dam removals. This work also highlights the importance of considering terrestrial wildlife as key players in these large scale restoration projects.

Are Highways Stressful for Pikas? Analysis of Stress Hormones of *Ochotona princeps* Living Adjacent to Interstate 90 in the Washington Cascade Range. Thomas McIntyre*, Kristina Ernest, *Department of Biological Sciences, Central Washington University, 400 East University Way, Ellensburg, WA 98926; thomas.mcintyre@cwu.edu; ErnestK@cwu.edu;* Meghan Camp, Lisa Shipley, *Department of Natural Resource Sciences, Washington State University, PO Box 642812, Pullman, WA 99164; meghan.camp@wsu.edu; shipley@wsu.edu*

Human-modified landscapes disrupt ecosystem connectivity, harming many wildlife populations. Some wildlife species live in modified habitats along roads, but their fitness in these stressful environments is poorly understood. Chronic stress alters behavior, reduces reproduction rates, and has been linked to reduced survival. In the Cascade Range of central Washington,

American pikas (*Ochotona princeps*) have colonized anthropogenic rock embankment used for stabilization along Interstate 90 (I-90), but no research to date has determined the fitness or success of this population. We used basal stress levels to infer the overall health of a population. We extracted fecal glucocorticoid metabolite (GCM) concentrations from fresh fecal samples to determine chronic stress levels in pikas along I-90 compared with those living in similar rock embankment in a rails-to-trails state park, and in natural talus patches. GCM concentrations varied between the 3 populations. In our preliminary analysis, animals in the I-90 populations had the lowest GCM levels, potentially indicating a suppressed stress response due to their chronic exposure to stressors. We also assessed the correlation of potential stressors at a subset of sites by measuring environmental temperatures, elevation, and noise levels. A generalized linear mixed model was used to determine differences in GCM concentrations among habitats and assess the potential effects of these environmental variables on stress. Our results offer insights into pika success in potentially stressful environments and may provide a good indicator of stress levels expected for pikas as they colonize wildlife crossing structures now being constructed to improve wildlife connectivity across I-90.

not presenting **Genetic Monitoring of the Columbia Basin Pygmy Rabbit (Brachylagus idahoensis): From Captive Breeding to Wild Populations.** Stacey A. Nerkowski*, Janet L. Rachlow, Lisette P. Waits, *Department of Fish and Wildlife Sciences, University of Idaho, Moscow, ID 83844*; *staceyn@uidaho.edu, jrachlow@uidaho.edu, lwaits@uidaho.edu*; Stephanie M. DeMay, *Department of Fisheries, Wildlife & Conservation, University of Minnesota, St. Paul, MN 55112*; Jon A. Gallie, *Washington Department of Fish and Wildlife, 1550 Alder St NW, Ephrata, WA 98823; Jon.Gallie@dfw.wa.gov*; Paul A. Hohenlohe, *Department of Biological Sciences, University of Idaho, Moscow, ID 83844; hohenlohe@uidaho.edu*; Jennifer R. Adams, *Laboratory for Ecological, Evolutionary and Conservation Genetics, University of Idaho, Moscow, ID 83844; adamsj@uidaho.edu*

Loss and fragmentation of habitat due to agricultural conversion has led to the near extirpation of the disjunct pygmy rabbit (PYRA) population in the Columbia Basin (CB) of Washington State (WA). In 2003, the CB PYRA was listed as a distinct population segment under the Endangered Species Act. In 2001, sixteen CB rabbits were taken from the last remaining population in Sagebrush Flat (SBF), WA to start a captive breeding program, and Idaho rabbits were added to counteract the effects of inbreeding. Rabbits were moved to semi-wild breeding enclosures at SBF (2011), and since then ~1947 mixed ancestry rabbits have been released into the wild. Thus far, one population of wild PYRA has been re-established in SBF and attempts at establishing two additional populations began in 2018. Monitoring of reintroduced populations is crucial in evaluating the progress and success of the PYRA reintroduction effort within central WA. Genetic samples have been taken from all enclosure/released rabbits and fecal pellets have been collected during winter burrow surveys. Microsatellite genotyping and DNA fingerprinting of these samples have been used to determine a minimum count of wild rabbits and the proportion of released versus those born in the wild. The number of active burrows has increased since from 100 (2011) to 346 (2018). The results of this study will provide critical information on the success of the reintroduction efforts and provide information for future conservation and management efforts.

Killer Whale Necropsies Provide Insight into Relationships Between Killer Whale Body Condition, Health, and Nutritional State. Dawn P. Noren*, *Marine Mammal and Seabird*

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Southern Resident Killer Whales (*Orcinus orca*) face many threats, and assessing individual body condition and health is a management priority. Data collected during necropsies can be used to understand relationships between body condition and health. Straight body length, body girth at the anterior dorsal fin insertion, and blubber thickness measured at three standard sites (dorsal, mid-lateral, and ventral surfaces) were used to assess body condition of stranded Killer Whales. Body condition index (BCI) was calculated from two measurements (body girth at the anterior dorsal fin insertion: straight body length). Blubber samples were also collected to assess blubber lipid content. The results show that body condition indices are influenced by age, reproductive status, and health. Killer Whale blubber thickness increases with body length. Female reproductive status as well as cause of death (starvation, disease, trauma) are related to both BCI and blubber thickness. For example, blubber thickness and BCI of both chronically diseased and starved Killer Whales are significantly lower than those of Killer Whales that died from acute trauma. Blubber lipid content tends to increase with BCI, and thus not surprisingly, an individual that died from trauma had the greatest blubber lipid content. Interestingly, the leading causes of death for nine Southern Resident Killer Whale carcasses recovered since 2002 are trauma and reproductive issues. This study demonstrates that morphometric indices of body condition alone cannot be used to differentiate starving from diseased Killer Whales and establishes a better understanding of relationships between body condition and health in free-ranging Killer Whales.

Agonistic Behavior in Female Oregon Spotted Frogs (*Rana pretiosa*). Stephen Nyman*, *Whatcom County Amphibian Monitoring Program, 1058 West Smith Road, Bellingham, Washington 98226; stephen@whatfrogs.org*

I present the first report of intraspecific agonistic behavior in adult female Oregon Spotted Frogs (*Rana pretiosa*) witnessed at a wetland pool in the Samish River watershed, Whatcom County, Washington on October 10, 2018. Slow motion analysis of recorded video provides evidence of a stereotyped form of aggression and a possible visual or acoustic display, behaviors not previously documented in female North American ranids. I suggest that the interaction represented site tenacity associated with access to prey, and outline further studies needed to determine whether agonistic behavior affects individual spacing or seasonal habitat use in Oregon Spotted Frog.

Stream-buffer Effects on Aquatic Vertebrates in Forested Headwaters: 5-years after a 2nd Density Management Harvest. Deanna H. Olson*, *US Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us*; Adrian

Ares, *Virginia Tech, Blacksburg, VA*; Klaus J. Puettmann, *College of Forestry, Oregon State University, Corvallis, OR 97331*

The Density Management and Riparian Buffer Study of western Oregon examines upland thinning approaches to accelerate development of late-successional forest conditions, while retaining headwater stream habitats and biota. Eight secondary-forest sites on lands administered by the Bureau of Land Management have been thinned twice (430-600 trees per hectare [tph] to 200 tph to 85 tph), with 64 stream reaches included in an examination of the effects of four different riparian buffer treatments on instream and bank vertebrates. Non-metric multidimensional scaling ordination and multi-response permutation procedure (MRPP) supported a greater effect of hydrological flow characterization (hydrotype; i.e., spring and summer surface flow types) on aquatic vertebrates than forest harvest and buffer type. MRPP analyses showed a significant effect of buffer treatments on counts of all fish together, all amphibians, stream-breeding amphibians as a group, sculpins, coastal giant salamanders, and torrent salamanders (southern and Columbia, combined). There were higher animal counts in the 1-site potential tree height riparian buffer treatment (1-Tree, ~ 70 m) than three other buffers: variable-width buffer (~15-m minimum width); streamside-retention buffer (~6 m); and thin-through buffer (2-tree riparian buffer [~145 m] thinned to 150 tph, stream disturbance avoided). Indicator species analyses showed species associations with buffers: torrent salamanders with controls (streams in unthinned uplands); northern red-legged frogs with streamside-retention buffers; and Oregon slender salamanders with thin-through buffers. Effects of sequential forest management entries and possible lag effects on relatively long-lived animals with sensitive status remain key concerns.

Importance of Winter Snowpack to Oregon Spotted Frog Breeding Success at the Parsnip Lakes, Cascade-Siskiyou National Monument. Michael S. Parker, *Biology Program, Southern Oregon University, Ashland, OR 97520*; *parker@sou.edu.*

Sixteen years of egg mass surveys at the Parsnip Lakes provides sufficient observations to explore the relationship between interannual precipitation variability and breeding effort/success. Breeding effort is not correlated with total annual or total winter precipitation, but is strongly positively correlated with December-March snowfall. Total egg mass abundance and number of oviposition sites within and among ponds increase with increased snowfall due to more open water habitat and reduced standing vegetation at oviposition sites, and greater opportunities for dispersal among sites and ponds.

Water, Water Everywhere: Can eDNA from Seawater Provide Insight into Population Genetic Structure of Small Cetaceans? Kim M. Parsons, *Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA Fisheries, 7600 Sand Point Way NE, Seattle, WA 98115; kim.parsons@noaa.gov*

Although research methodologies for collecting genetic samples are numerous, some species are particularly elusive and conventional methods of tissue sampling has left critical gaps in population assessments. This is particularly true for the smallest of cetaceans in the family Phocoenidae. One of the smallest cetaceans in the Northern Hemisphere, Harbor Porpoise (*Phocoena phocoena*) are distributed throughout shallow coastal waters in the North Pacific. In Alaska, this preference for nearshore waters makes them highly vulnerable to incidental fisheries bycatch and the effects of habitat degradation. Concern for localized impact on undefined Harbor

Porpoise stocks motivated population genetic analyses using archived tissue samples; however, sample sizes were severely limited in key geographic areas and efforts to supplement strandings and fisheries bycatch with remotely collected tissue biopsies has proved challenging for these small and elusive cetaceans. By exploiting the naturally shed cellular debris in seawater and the power of next generation sequencing, we developed a novel approach for generating population level mitochondrial sequence data from environmental DNA (eDNA) using surface seawater samples. We generated mitochondrial sequence data for 41 Harbor Porpoise eDNA samples using next generation sequencing. These mtDNA haplotypes can be incorporated into a traditional framework for examining genetic diversity among Harbor Porpoise in the coastal waters of Southeast Alaska and evaluating evidence for stock structure. This indirect sampling tactic for characterizing stock structure of small and endangered marine mammals has the potential to revolutionize population assessment for otherwise inaccessible marine taxa.

Comparing Multispecies eDNA to Traditional Approaches to Evaluate Species-level Aquatic Biodiversity in a Stream Network. Brooke Penaluna, Laura Hauck, Richard Cronn, *Pacific Northwest Research Station, USDA Forest Service, 3200 Southwest Jefferson Way, Corvallis, OR 97331*; *bepenaluna@fs.fed.us*; *lhauck@fs.fed.us*; *rcronn@fs.fed.us;* Tiffany Garcia, Kevin Weitemier*, *Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331*; *Tiffany.Garcia@oregonstate.edu*; *Kevin.Weitemier@oregonstate.edu*

Aquatic biodiversity has long-been a proxy for assessing environmental change. Traditional approaches for measuring aquatic biodiversity, however, have not been very comprehensive or standardized, and they can be time-consuming, expensive, and limited to certain taxa and habitats. Alternatively, environmental DNA is revolutionizing how we can survey biodiversity in streams by offering a rapid, accurate, and standard assessment of multiple aquatic species from various taxa. Here, we compare detection of multiple aquatic species using eDNA metabarcoding of taxon-general and taxon-specific primers using microfluidic multiplexed PCR and high-throughput sequencing to traditional approaches of electrofishing to understand the utility of multiplexed eDNA counts as a qualitative and semi-quantitative proxy for species-level identification of aquatic biodiversity. We evaluate the detection of multiple aquatic species of fish, amphibians, invertebrates, and pathogens in four neighboring stream networks below and above where fish reside in the network in the Trask Watershed in northern Coastal Oregon. In this study, we are able to assess whether streams that are hotspots in productivity of fish are also hotspots in their upstream tributaries for amphibians. Our study also allows us to examine questions about assay performance, such as reproducibility, minimum detection limits, and the ability to estimate global aquatic biodiversity at individual sites and the global network. Our work broadens the scope of eDNA research by allowing for data-driven prioritization of conservation actions for multiple aquatic species.

Remote Sensing of Habitat Restoration for the Columbia Spotted Frog. David S. Pilliod*, *US Geological Survey Forest and Rangeland Ecosystem Science Center, 970 Lusk Street, Boise, ID 83706; dpilliod@usgs.gov;* Mark B. Hausner, *Division of Hydrologic Sciences, Desert Research Institute, Reno, NV; Mark.Hausner@dri.edu;* Rick D. Scherer, *Conservation Science Partners Inc., Fort Collins, CO; scherer.rick.d@gmail.com;* Chad Mellison, *US Fish and Wildlife Service, Reno, NV; chad_mellison@fws.gov*

In central Nevada's Toiyabe Mountains, recent drought conditions and habitat degradation have threatened local populations of the Columbia Spotted Frog (*Rana luteiventris*). To mitigate these threats, resource managers constructed a series of ponds along several reaches of a small stream where spotted frogs were known to breed. We assessed the riparian vegetation response of these restoration projects and then related this response to annual survival and recruitment rates of frog populations. We first established the pre-restoration relationships between annual precipitation and Landsat-based normalized difference vegetation index (NDVI). We then tested the post-restoration data to identify changes in those relationships that we could attribute to habitat restoration activities. Finally, we used the NDVI values as predictors in a population model to assess the effect of annual NDVI (as a proxy for near-surface water availability) on the demography of local frog populations. Preliminary results suggest that it is possible to quantify the effects of restoration activities on riparian vegetation (i.e., frog habitats) using these remote sensing approaches. Annual survival and recruitment rates of adult frogs were variable through time, but preliminary results suggest that some of this variability could be explained by habitat restoration activities.

Mountain Goat Surveys at Mount St. Helens. Nathaniel D. Reynolds, Erik White, *Cowlitz Indian Tribe, PO Box 2547 Longview, WA 98632; nreynolds@cowlitz.org, ewhite@cowlitz.org;* Stefanie Bergh*, *Washington Department of Fish and Wildlife, PO Box 484, White Salmon, WA 98672; stefanie.bergh@dfw.wa.gov;* Eric Holman, Nicholle Stephens, *Washington Department of Fish and Wildlife, 5525 South 11th St, Ridgefield, WA 98642; eric.holman@dfw.wa.gov, nicholle.stephens@dfw.wa.gov;* James M. Wainwright (ret.), *Mount St. Helens National Volcanic Monument, 42218 NE Yale Bridge Rd, Amboy, WA 98601*

After receiving anecdotal reports of an increasing population of Mountain Goats (*Oreamnos americanus*) in the Mount St. Helens and Mount Margaret Backcountry areas of Washington State, a cooperative group of staff and volunteers from the Cowlitz Indian Tribe, Washington Department of Fish and Wildlife (WDFW), Mount St. Helens Institute, and US Forest Service developed a ground-based survey protocol to estimate this population. Surveys were conducted each August from 2014 through 2018, with multiple teams surveying concurrently, using hiking routes to access assigned viewpoints. After each survey, sighting maps and observation times were reviewed to resolve double-counting between teams. We determined minimum population sizes each year and observed a generally increasing trend with a peak count of 169 in 2018. Immediately following the 2017 ground survey, WDFW conducted a helicopter survey in the same areas, using a sightability model (Rice and others 2009) to estimate the goat population, revealing 246 goats. While our ground survey trend shows an increasing population over time, aerial survey is a more accurate, though more expensive, methodology. Based on a population of >200 goats in 2017, WDFW established 2 new mountain goat tags for this population, and these were successfully hunted in fall 2018.

Evaluating the Susceptibility of Native Amphibians from Pacific States to the Fungal Pathogen *Bsal*. Jonah Piovia-Scott*, John Romansic, *School of Biological Sciences, Washington State University, 14204 NE Salmon Creek Ave, Vancouver, WA 98686; jonah.piovia-scott@wsu.edu; john.romansic@wsu.edu;* Matt Gray, Davis Carter, Deb Miller, *Center for Wildlife Health, University of Tennessee, 2431 Joe Johnson Drive, Knoxville, TN 37996; mgray11@utk.edu; ecarte27@utk.edu; dmille42@utk.edu*

The fungal pathogen *Batrochochytrium salamandrivorans* (*Bsal*) poses a serious threat to native amphibians, especially salamanders, in the Pacific Northwest and throughout North America. *Bsal* is thought to have originated in East and Southeast Asia and spread to Europe through the pet trade, where it is responsible for dramatic declines in some European salamander species. *Bsal* is not known to have colonized North America, a global center for salamander biodiversity. Our study seeks to provide a detailed assessment of the risk *Bsal* poses to native amphibians in Pacific states by evaluating susceptibility using controlled laboratory exposure experiments. To date, we have conducted such trials for six species (or subspecies) native to Pacific states: *Taricha granulosa, T. torosa, Ensatina eschscholtzii klauberi, E. e. xanthoptica, Pseudacris regilla*, and *Plethodon dunni*. Some species were found to be highly susceptible, such as *E. e. klauberi*, while others carried high levels of infection with only low or moderate levels of mortality, such as the two *Taricha* species. Taken together, our results provide insight into the risk *Bsal* poses to native amphibians, as well as the regional epidemiological dynamics that may occur if this pathogen invades western North America.

Collaborative Monitoring to Assess Declines in Northwestern Bat Populations via Bat Grid and NABat Monitoring Programs. Roger Rodriguez*, *Northwestern Hub for Bat Population Research and Monitoring, Oregon State University-Cascades, 1500 SW Chandler Avenue, Bend, OR 97702; roger.rodriguez@osucascades.edu;* Thomas J. Rodhouse, *U.S. National Park Service, Upper Columbia Basin Network Inventory & Monitoring Program, 1500 SW Chandler Avenue, Bend, OR 97702; tom_rodhouse@nps.gov;* Pat Ormsbee, *U.S. Forest Service (retired), Eugene, OR;* Kathryn Irvine, *U.S. Geological Survey, Northern Rocky Mountain Science Center, 2327 University Way, Suite 2, Bozeman, MT 59715; kirvine@usgs.gov;* Jenny Barnett, *US Fish & Wildlife Service Region 1 Inventory & Monitoring Program, 64 Maple Street, Burbank, WA 99323; jenny_barnett@fws.gov;* Sarah Reif, *Oregon Department of Fish and Wildlife, 4034 Fairview Industrial Drive SE, Salem, OR 97302; sarah.j.reif@state.or.us*

The original interagency Bat Grid, led by the U.S. Forest Service and with participation by many partners across Oregon and Washington from 2003-2010, established baseline distributional data for bats throughout Oregon and Washington and provided the foundation for the North American Bat Monitoring Program (NABat). In 2016-2018, collaborative acoustic bat monitoring (referred to locally as "Bat Grid 2.0") was continued across Oregon and Washington by state and federal partners at original Bat Grid survey locations and at new locations selected via the NABat master sample. One primary objective was to enable comparisons between 2003-2010 Bat Grid 1.0 baseline and current probabilities of occurrence to evaluate potential population declines in light of the regional expansion of wind energy developments during the intervening years and the recent arrival of white-nose syndrome (WNS) to Washington. Within a Bayesian occupancy modeling framework, we used the occurrence probabilities estimated after 2010 as informative priors to update and map new posterior distributions with data from 2016-2018 for several species including *Myotis lucifugus* and *Lasiurus cinereus* considered to be vulnerable to these emerging threats. We discuss the emerging trends from these results and outline next steps. We emphasize that model uncertainty and only three years of additional data make these findings provisional and best considered as testable hypotheses that guide conservation decisions including allocation of resources for further research and monitoring.

Symbiosis Between Green Algae and Northern Red-legged Frogs (*Rana aurora*). Chris Rombough*, *Rombough Biological, PO Box 365, Aurora, OR 97002; rambo2718@yahoo.com;*

Laura Trunk, *Jackson Bottom Wetlands Preserve, 2600 SW Hillsboro Hwy., Hillsboro, OR 97123; laura_trunk@hillsboro-oregon.gov*

The role of algae in amphibian egg jelly has been debated for nearly a century. In 2017 and 2018, we conducted detailed field measurements of oxygen concentrations within Northern Red-legged Frog (*Rana aurora*) egg masses. Our data revealed that, contrary to current belief, the egg jelly of *R. aurora* is largely impermeable to ambient dissolved oxygen. Instead, the development and survival of the embryos in our study was dependent on the growth of green algae within the egg jelly itself. Successful development of *R. aurora* embryos to hatching is determined by a complex interaction between temperature, illumination, and timing of spawning. We will discuss some of the implications of our results, how cool they are, and our work on related species.

Large Whale Entanglements and Responses in the Pacific Northwest. Doug Sandilands*, *SR3 Sealife Response Rehab and Research, #101 - 2255 Harbor Ave SW Seattle, WA; 98126; dsandilands@sealifer3.org*

From 1994 to 2017, there were an average of four large whale entanglements reported in Washington and Oregon. In 2018, there was a notable increase of 19 credible reports of large whale entanglements. The Pacific Northwest Large Whale Entanglement Response Network (PNWLWERN) is a network of seven organizations that respond to entangled whales. Responses focus on removing all of the life-threatening gear on the whale and collecting documentation of the whale, entanglement and entangling gear to better understand how entanglements occur. The network provides information learned from entanglement responses to managers and fishermen to help develop solutions to prevent entanglements. This talk will summarize the PNWLWERN, recent entanglement reports, and the type of information collected during responses.

Washington State Common Loons: Multi-state Occupancy Modeling Using Citizen Science and Survey Data. Hannah A. Sipe*, *Quantitative Ecology and Resource Management Graduate Program, University of Washington, 1122 NE Boat St, Seattle, WA, 98105*; *sipeh@uw.edu*; Sarah J. Converse, *U.S. Geological Survey, Washington Cooperative Fish and Wildlife Research Unit, School of Environmental and Forest Sciences (SEFS) & School of Aquatic and Fishery Sciences (SAFS), University of Washington, 1122 NE Boat St, Seattle, WA, 98105; sconver@uw.edu*

The Common Loon (*Gavia immer*) is a migratory aquatic bird found throughout the year in Washington State, i.e. in marine waters during the winter or fresh waterbodies during the summer. A low-lifetime reproductive rate and high summer site-fidelity make this species particularly sensitive to habitat degradation and human disturbance; as such, Washington State has listed the common loon as a state Sensitive Species. However, little is known about Common Loon distribution or the factors affecting distribution within Washington State. Given the size of the area of interest, obtaining the data necessary for a robust analysis of Common Loon occupancy presents a challenge. Citizen science eBird data is easily available in large quantities and can be used in distribution modeling. Through integrating professional survey data with citizen science eBird data in a multi-state occupancy model, the distribution and habitat associations of summer Common Loons were formally evaluated. Preliminary results show a probability of occupancy for the state (around 25%) and the probability of reproduction is low (around 10%), with low probability of detection in the non-breeding state and high probability of detection in the reproductive state. Further results of the occupancy model fit to the survey and eBird data, significant habitat associations, and detection-effort relationships determined during modeling will be presented. Issues relating to the use of eBird data in the context of this

application will also be discussed. Understanding distribution, and the factors influencing it, will help management make informed conservation decisions for Common Loons in Washington.

Adaptive use of Nonlethal Strategies for Minimizing Wolf–Livestock Conflict. Suzanne A. Stone*, *Department of Field Conservation, Defenders of Wildlife, 1130 17th St. NW, Washington, D.C. 20036, sstone@defenders.org;* Stewart W. Breck, *United States Department of Agriculture – Wildlife Services – National Wildlife Research Center, 4101 LaPorte Ave., Fort Collins, CO 80521; swbreck@gmail.com;* Jesse Timberlake, *Department of Field Conservation, Defenders of Wildlife, 1130 17th St. NW, Washington, D.C. 2003;* Peter M. Haswell, *School of Biological Sciences, Bangor University, Bangor, Gwynedd LL57 2UW, United Kingdom;* Fernando Najera, *Faculty of Veterinary Medicine, Complutense University of Madrid, 28040 Madrid, Spain;* Brian S. Bean, *Lava Lake Land & Livestock, LLC and Lava Lake Institute for Science & Conservation, 215 N. Main Street, Suite 204, Hailey, ID 83333;* Daniel J. Thornhill, *Department of Biological Sciences, Auburn University, 101 Rouse Life Sciences Building, Auburn, AL 36849*

Native predators are often killed to protect livestock, which can undermine wildlife conservation efforts and create conflicts among stakeholders. In Washington, wolves (*Canis lupus*) are currently recolonizing parts of their historic range. While livestock losses to wolves represent a small fraction of overall livestock mortality, the response to these depredations results in widespread conflicts including significant lethal wolf control efforts to protect livestock for producers. A variety of nonlethal methods have proven effective in reducing livestock losses to wolves in small-scale operations but in large-scale, open-range grazing operations, nonlethal management strategies are often presumed ineffective or infeasible. Our study in Idaho demonstrates that nonlethal techniques can be effective at large scales through adaptive nonlethal predator deterrents and animal husbandry techniques (i.e., terrain, proximity to den or rendezvous sites, avoiding overexposure lights or sound devices that could result in wolves losing their fear of that device, etc.). Over the 7-year study period comparing losses between the study Protected Area (PA) and the Adjacent Unprotected Area (NPA), wolf depredation of sheep were 3.5 times higher in the NPA than in the PA. Furthermore, no wolves were lethally controlled within the PA but were frequently killed in the NPA. Sheep depredation losses to wolves in the PA were just 0.02% of the total number of sheep present, the lowest loss rate among sheep-grazing areas in wolf range statewide. Similar cattle protection measures that effectively minimize losses to wolves and bears will also be presented.

Wildlife Response to Tourism in Glacier Bay National Park, AK. Mira Sytsma*, Laura Prugh, Beth Gardner, *University of Washington School of Environmental and Forest Sciences, 3715 W Stevens Way NE, Seattle, WA 98195; mirasytsma@gmail.com; lprugh@uw.edu, bg43@uw.edu*; Tania Lewis, *National Park Service, 1 Park RD, Gustavus AK 99826; tania_lewis@nps.gov*

Visitation to Glacier Bay National Park (GLBA) is very low compared to most national parks, but has nearly doubled in the past 20 years, leading to undocumented impacts of tourism on wildlife activity patterns and space use. We studied wildlife responses to tourism using 40 remote cameras installed at 10 study sites that were categorized as either areas where tour vessels drop off tourists on the shore (treatment), or areas where the vessels do not drop off tourists (control). The four mammals studied were Brown bear (*Ursus arctos*), Black bear (*Ursus americanus*), Moose (*Alces alces*), and Gray wolf (*Canis lupus*). Black bear detection increased

in high use areas, but they shifted their activity to avoid humans temporally. Moose increased activity around humans, but did not respond to human use spatially. Wolves demonstrated activity patterns consistent with avoidance of humans and detections decreased with increasing human activity. Brown bear were not impacted spatially or temporally by humans. Detection for all species dropped to below one photo/week when the number of human photos/week across sites reaches 26, indicating a threshold value for disturbance to wildlife. This study demonstrates that wildlife responses to humans were detectable in a system with very low use, indicating that true baselines for estimating anthropogenic impacts may be difficult to obtain. The findings from this study will be used to assist park management in making yearly decisions regarding tour vessels and visitor access in GLBA to ensure significant resource degradation does not occur in popular tourist destinations.

Development of a Fully-integrated eDNA Sampling System. Austen C. Thomas*, Jesse Howard, Phong Nguyen, *Smith-Root, 16603 NE 50th Avenue, Vancouver, WA 98686; athomas@smith-root.com; jhoward@smith-root.com; pnguyen@smith-root.com;* Tracie A. Seimon, *Wildlife Conservation Society, 2300 Southern Blvd., Bronx, NY 10460; tSeimon@wcs.org;* Caren S. Goldberg, *School of the Environment, Washington State University, Pullman, WA 99163; caren.goldberg@wsu.edu*

Environmental DNA (eDNA) sampling is being rapidly adopted by agencies as a low-impact means of species detection in aquatic environments. Until recently, eDNA sampling technology has consisted of tools designed for other scientific fields such as groundwater monitoring and microbiology. Here, we present the development of a purpose-built eDNA sampling system designed to improve the sterility and efficiency of eDNA sampling. The system also gives the user control of important filtration parameters (e.g., pressure, flow rate, filter pore size) that affect eDNA capture. Pilot studies with the system indicate a peak in filtration efficiency at a flow rate threshold of 1.0 L/m, and we found that 5 µm filters captured significantly more target eDNA than 1 µm filters when the water volume was maximized. Results also suggest that high filtration pressures may reduce eDNA retention, which implies that pressure should be standardized to avoid biasing detection data. Lastly, we report on our efforts to develop a biodegradable filter housing to reduce plastic waste associated with eDNA sampling.

Pinniped Monitoring Program at Bonneville Dam: A Review of the Last 15 Years and Update on Recent Advancements. Kyle S. Tidwell*, Brett A. Carrothers, Kristen N. Bayley, Lindsay N. Magill, and Bjorn K. van der Leeuw. *U.S. Army Corps of Engineers, Portland District, Fisheries Field Unit, Bonneville Lock and Dam, Cascade Locks, OR 97014; Kyle.S.Tidwell@usace.army.mil*

California sea lions (CSL; *Zalophus californianus***)** and Steller sea lions (SSL; *Eumetopias jubatus*) aggregate at the base of Bonneville Dam, where they feed on Pacific salmon and steelhead (*Oncorhynchus spp.*) This season we monitored the traditional spring period (January – May), and for the first time, we sampled the fall and winter months (August – December). We conducted point counts to enumerate the minimum daily abundance of sea lions. To estimate the number of fish consumed, we conducted surface observations of sea lion foraging events using a stratified random sampling procedure and bootstrapped weekly (strata) estimates to provide confidence intervals of the mean number of fish killed by each species of sea lion. During the fall and winter period we documented high levels of abundance and

residency for SSLs, and novel consumption impacts to all available runs of Pacific salmon and White Sturgeon (*Acipenser transmontanus*). During the spring monitoring period we found that SSLs are now the most abundant pinniped at Bonneville, occurring for 11 months out of the year. In contrast, the abundance and residency metrics for CSLs declined again this year. The consumption of spring Chinook was slightly less than the previous year (2.9% of the run), but the impacts to winter Steelhead, provided due to the fall and winter monitoring, found that 6.8% of the run was consumed. The increased presence of SSLs and reduced abundance of CSLs suggest the predator dynamics have changed but the impacts remain and are expanding to different runs and different fish species.

Steller Sea Lions: Why Did They Decline in Alaska and Increase in the Pacific Northwest?
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Theories put forward to explain the increase of Steller Sea Lions in the Pacific Northwest and their decline in the Aleutian Islands and Gulf of Alaska have been difficult to test—and have led to a series of captive experiments, field studies and mathematical models to gain insight into this perplexing mystery. Collectively, these studies point to shifts during the 1970s in the quality and quantities of prey available to sea lions—and the impact that energy-poor prey have on the survival and birth rates of sea lions. Young sea lions cannot acquire sufficient energy from abundant low-quality prey (i.e., Pollock, Cod, and Atka Mackerel in Alaska) and have to suckle for 1 or 2 years longer than normal until their energy needs are low enough to be met by stomachs full of low-energy prey. In contrast, sea lions eating fattier higher-quality prey such as Sardines and Herring in the Pacific Northwest can wean in their first year and successfully transition to caloric-rich fish. Pups that take longer to wean reduce the reproductive fitness of their mothers and are likely more susceptible to predation by Killer Whales. Energy density of prey can have a greater impact on the population dynamics of marine species than prey biomass, and should be given greater consideration in ecosystem models and ecological studies. These findings also highlight the importance of combining field studies with captive research and mathematical models to fully understand the ecological changes that are underway in the North Pacific Ocean.

White-Nose Syndrome Surveillance: Assessing the Influence of DNA Concentration on Detection Probability from Bat Guano Samples.
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Emerging infectious diseases pose a major threat to global biodiversity. Among vertebrates, bats are acutely affected by a fungal pathogen implicated in population declines across North America. *Pseudogymnoascus destructans* (Pd) the causative agent of White-Nose Syndrome (WNS) in bats was first confirmed in the western United States by the Washington Department of Fish and Wildlife (WDFW) on March 31, 2016 in a Little Brown Bat (*Myotis lucifugus*). However, the current distribution of WNS in the region and potential species affected are unknown. Large-scale and noninvasive surveillance would be facilitated by the detection of Pd in bat guano, but the efficacy of this approach is not yet established due to uncertainty in how

the detection probability of Pd declines over time. To address this, we experimentally characterized DNA degradation rates in guano samples.

In six different sites at Mount Rainier National Park for each of three replicates, we inoculated ~1 gram of autoclaved guano with 1 ml of inoculum at five concentrations of genomic DNA (ng/ul) of Pd. After sampling all sites at five regular intervals (~14 days), we quantified the number of genomic equivalents per sample using quantitative-PCR. Our results show that Pd can be detected through time in samples inoculated with the highest concentration of the pathogen. Conversely, in samples inoculated with the lowest concentration of the pathogen, Pd was only detected during the first sampling events (~15 days). These results provide insight into sampling timing and frequency to detect Pd in guano and improve surveillance and monitoring efforts.

not presenting **Stress-mediated Risk Effects of Wolves on Free-ranging Cattle: Can Prey Gut Microbiome Predict Stress Response in Predator-prey Interactions?** Azzurra Valerio*, Mariacristina Valerio, Luca Casadei*; School of the Environment, Washington State University, 100 Dairy Road, Pullman, WA 99164; azzurra.valerio@wsu.edu; mariacristina.valerio@uniroma1.it; luca.casadei@uniroma1.it.*

As Wolves (*Canis lupus*) recolonize their former range in Western United States, encounters with free-ranging cattle (*Bos taurus*) are expected to increase in frequency. Understanding the physiological state of cattle, as a response to stress imposed by the presence of wolves (stress-mediated risk effects), will help to predict the effect of predators on their prey beyond direct consumption (density-mediated effects). Traditional measure of stress hormones (fecal glucocorticoids [GCM]), provide inconclusive results when applied on free-living animals. Since recent findings have shown that stress and anxiety-related behaviors influence the composition and the function of the gut microbiome we contrasted the fecal metabolome, a functional read-out of the gut microbiome, of cattle before and after known wolf encounters. To this end, we conducted a pilot study in northeastern Washington where we fit GPS collars equipped with proximity sensors on 2 wolves in 2 wolf packs, and on 40 range cows in 4 separate livestock herds. We collected fecal samples (N=452) from cows every 2 weeks and after each wolf-cow encounter recorded by the proximity sensors. We extracted cattle metabolic profiles from fecal samples by means of ^{1}H-nuclear magnetic resonance spectroscopy. Our results indicated that significant metabolic pathway shifts occurred in cattle before and after interactions with wolves, while GCM concentrations did not change. We conclude that by using new cutting-edge technologies such as metabolomic analysis and proximity sensors, we improved our understanding of the physiological state of the prey after interactions with predators.

Using Citizen Science to Inform Species Distributions: Washington's Sagebrush Songbird Survey. Matthew Vander Haegen*, *Washington Department of Fish and Wildlife, Natural Resources Building, P.O. Box 43200, Olympia, WA 98504; matt.vanderhaegen@dfw.wa.gov;* Christi Norman, *Audubon Washington, 5902 Lake Washington Blvd, Seattle, WA 98118; cnorman@audubon.org;* Trina Bayard, *Audubon Washington, 5902 Lake Washington Blvd, Seattle, WA 98118; tbayard@audubon.wa*

Agricultural conversion and fragmentation have reduced the amount of habitat suitable for shrubsteppe-associated passerines in Washington. National surveys are largely ineffective at documenting changes in the distribution of these species and state wildlife agencies lack the resources to survey for them effectively. Beginning in 2014, the Washington Department of Fish

and Wildlife partnered with Audubon Washington to develop a community science project focused on surveying for sagebrush-obligate and shrubsteppe-associated passerines in 16 counties in eastern Washington. The Sagebrush Songbird Survey has engaged 11 Audubon Chapters and has provided the opportunity for chapter members to participate in all aspects of the survey from locating and evaluating sites using ArcGIS Online to surveying remote sites and engaging with landowners. Over 100 volunteers from Audubon Chapters and other bird conservation NGOs have received training to safely navigate to sites and conduct standardized bird surveys. These trained observers have completed surveys at 283 sites on public and private lands and entered >20,000 project-specific records in eBird. Audubon staff and chapter volunteers work directly with private landowners and leaseholders, engaging them through invitations to participate in surveys and sharing project goals. Data from this project will inform state databases used for land management and conservation planning and allow analysis of factors influencing bird distributions.

Linking Multiple Types of Southern Resident Killer Whale (*Orcinus Orca*) Diet Data with Different Integration Windows to Estimate the Relative Importance of Prey Resources. Amanda Warlick*, *School of Aquatic and Fisheries Sciences, University of Washington, 1122 NE Boat St, Seattle, WA 98105; awarlick@uw.edu*; Eric Ward, *Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, 2725 Montlake Blvd E, Seattle, WA 98112; eric.ward@noaa.gov;* Sandra O'Neill, *Environmental and Fisheries Sciences Division, Northwest Fisheries Science Center National Marine Fisheries Service, 2725 Montlake Blvd E, Seattle, WA 98112;* Brad Hanson, *Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, 2725 Montlake Blvd E, Seattle, WA 98112;* Gina Ylitalo, *Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, 2725 Montlake Blvd E, Seattle, WA 98112*

Understanding the foraging ecology and energetic needs of Southern Resident killer whales is critical for informing ongoing management and conservation strategies designed to recover the population. Directly estimating diet composition of large, free-ranging animals is challenging, and opportunistic sampling may introduce biases. Further, different sources of diet information integrate over different temporal windows (from single feeding events to several weeks). It is therefore beneficial to combine disparate diet data for a more comprehensive understanding of population-level diet. In this study, we examine interannual variability and seasonal differences in $\delta^{13}C$ and $\delta^{15}N$ stable isotope samples from 2004-2016 taken from 90 whales in the J, K, and L pods. Additionally, we use a subset of these data to demonstrate the integration of three diet data sources into a single chained Bayesian mixing model that can result in improved parameter estimation through the development of informative priors. Results indicate that $\delta^{15}N$ and $\delta^{13}C$ have varied annually and seasonally, potentially reflecting a change in nutritional status or the seasonal availability of preferred prey species. Diet composition estimates derived using the integrated model show that different diet data sources can yield both similar and divergent estimates depending on the relative contribution of the given prey species to overall whale diet. This work highlights the importance of considering the feeding window represented by the given source of diet data and can contribute to our understanding of whether nutritional stress may be affecting this depleted population.

NW PARC: An Overview and Top Research and Conservation Priorities from the Northwest Chapter of Partners in Amphibian and Reptile Conservation. Katy Weil,

Conservation Program, Metro Parks and Nature, 600 NE Grand Avenue, Portland OR 97232; katy.weil@oregonmetro.gov; Deanna H. Olson, *US Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331; dedeolson@fs.fed.us*

The Northwest Chapter of the national organization Partners in Amphibian and Reptile Conservation (NW PARC) began in 2008 and encompasses Alaska, Idaho, Montana, Oregon, Washington, Wyoming as well as British Columbia and Alberta. PARC is a bottom-up organization with five regions and eight state chapters and our work focuses on conserving amphibians, reptiles, and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public-private partnerships. Our membership includes individuals from government and nongovernmental organizations, conservation groups, museums, the trade industry, environmental education centers, energy and forestry industries, and herpetological societies. In addition to organizing an annual regional meeting each year focusing on different themes such as community science, inventory and monitoring, and field identification techniques, the NW PARC steering committee and membership are involved in developing reference materials on amphibians and reptiles for professional and general audiences; recognizing outstanding individuals in the Northwest region for their contributions to herptile conservation; and serving on committees to address specific issues such as disease, education and outreach, transportation and mortality, and the designation of priority areas to conserve species and habitats. In 2019, our meeting will focus on eDNA and disease research progress for amphibians. We look forward to connecting with new and current members to collaborate in idea development for future workshops and meetings.

Is Climate Change Increasing Predation on Hoary Marmots in North Cascades National Park. Logan Whiles*, *School of the Environment, Washington State University, Pullman, WA, 99164*

Climate change is expected to contract ranges and reduce population size of high elevation obligates such as Hoary Marmots (*Marmota caligata*). In the North Cascades National Park Complex, marmots have experienced a > 50% decline over the last 10 years, and these declines may be driven by a combination of changing abiotic and biotic conditions. Using remotely-sensed snow data, marmot point-counts, behavioral observations, camera trapping, and genetic analysis of carnivore scat, our project examines whether reduced snowpack increases subalpine access by carnivores, in turn increasing predation rate on marmots.

A History of Bullfrog Control in Sunriver. Jodi Wilmoth, *3 Rivers Environmental, 55701 Swan Road, Bend, OR 97707; jodiwilmoth@icloud.com*

A dedicated group of scientists and volunteers work throughout the year in the Sunriver, Oregon area to support Oregon Spotted Frog (*Rana pretiosa*) recovery by controlling one of the world's worst invasive species, the American Bullfrog (*Lithobates catesbeianus*). The group employs a variety of techniques over several private properties to establish a bullfrog control zone, which provides the Oregon Spotted Frog a respite from this aggressive predator.

Giant Frogs of Bend—Chapter 2. Tlell Wolf, Jesse Short, Jay Bowerman*, *P.O. Box 4248, Sunriver, OR 97707; tlellwolf@gmail.com; jessoregon@gmail.com; jbowerman@bendbroadband.com*

A tiny pond in Bend, Oregon, already known for its giant adult Oregon Spotted Frogs (*R. pretiosa)*, has now yielded the first observations of significant juvenile growth between

metamorphosis and first winter. By October of 2017, some recently metamorphosed *R. pretiosa* had increased in length more than 20%, and more than tripled in weight. We present data and video evidence that support the hypothesis that an unusual combination of conditions, including warm temperature, early metamorphosis, and exceptional food resources contributed to the extraordinary growth and size at this site.

Optimizing and Evaluating Environmental DNA-based Detection of *Batrachochytrium salamandrivorans* in Trade and Captive Settings. Christian Yarber*, Caren Goldberg, Allan Pessier, & Jesse Brunner. *Washington State University, Pullman, WA 99164. christian.yarber@wsu.edu; caren.goldberg@wsu.edu; pessier@vetmed.wsu.edu; jesse.brunner@wsu.edu.*

Batrachochytrium salamandrivorans (Bsal) is an emerging fungal pathogen that threatens global salamander diversity. Its introduction into Europe through the pet trade from Southeast Asia caused rapid declines of ≥95% in some populations with no signs of recovery. Laboratory studies show numerous species not yet affected in the wild are lethally susceptible, and while Bsal has not been detected outside of Europe or Asia, its continued expansion through international trade appears inevitable. We know strong biosecurity and surveillance practices will be crucial to preventing the further spread and impacts of Bsal, but sampling enough animals within a shipment to detect Bsal with confidence using individual-based methods is simply unfeasible when the volume of animals to screen is so high (e.g. millions of live amphibians into US yearly). A rapidly developing technique that samples DNA shed into water and substrates – environmental DNA (eDNA)—offers a promising alternative to individual-based methods since it can, theoretically, sample from all animals in a shipment simultaneously. We conducted a series of laboratory experiments with Bsal spiked water to determine best practices for collecting Bsal eDNA: our initial findings suggest filtering results in 5 to 10-fold higher yields of Bsal DNA than centrifugation, the 95% limit of detection for Bsal when filtering is between 10 and 100 zoospores, and DNA recovery appears to scale linearly with water volume filtered. We conclude with a discussion of future experiments that address important considerations for how well our methods extend to real-world trade scenarios.

Developing New Satellite Tags for Large Whales: Improving Duration and Minimizing Impacts. Alexandre N. Zerbini*, *Cascadia Research Collective, 218 ½ W 4th Ave, Olympia, WA, 98501; Marine Ecology and Telemetry Research, 2468 Camp McKenzie Tr NW, Seabeck, WA, 98380; Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS/NOAA, 7600 Sand Point Way, Seattle, WA, 98115-6349; alex.zerbini@noaa.gov; azerbini@gmail.com*

The use of satellite tags has improved our understanding about cetacean behavior and spatial-temporal overlap with anthropogenic activities. Duration of transmissions depends on the method used to attach tags to the animals. For baleen/sperm whales, tags anchoring below the blubber provide longer durations, but are of greater risk for the health of the tagged individual. Here, results from a study designed to assess impacts of tags to whales and to understand causes of tag failure will be described. “Implantable” tags have been deployed in Gulf of Maine Humpback Whales (*Megaptera novaeangliae*) because their strong site fidelity, long feeding ground residency, and high observer effort result in repeated sightings of tagged animals. Tag flaws documented in early deployments indicated the need for improvements in this methodology. These flaws resulted in short transmission durations and in negative physiological effects to individuals. Modifications in the satellite tag design were performed to resolve the

flaws, including (1) changes in the anchoring system tip, retention devices, and anchor articulation and (2) removal of an interface between the transmitter and the anchor. Also, the use of novel 3D metal printing processes to manufacture integrated tags resulted in more robust designs ($p=0.033$). Deployments of new tags resulted in greater transmission duration ($p=0.021$) and in lower probabilities of observing severe physiological reactions (e.g., persistent swelling, $p = 0.012$). This study highlights the importance of developing tagging technology in association with observational studies and provides new tag designs that are structurally stronger and safer for use with large cetaceans.

# Indicates a student presenter

Presenter	Poster Title
Anderson, Scott	Mapping amphibian occurrence on the road system at Mount Rainier National Park
Appleby-Hall, Isaac[#]	Point Count Surveys Indicate a Decline in Raven Densities Following Control Efforts in Greater Sage-Grouse Habitat.
Bucher, Morgan [#]	Underestimation of Mesic Habitat May Call for Reassessment of Brooding Sage-grouse Habitat Preferences.
Camp, Meghan	Evaluating a Novel Method to Estimate Deer Densities in Forested Habitats
Cousins, Christopher [#]	Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery.
Dylla, Celeste[#]	Nest-Site Preferences of American Bushtits (*Psaltriparus minimus)* in an Urban Campus Setting.
Estes, Brooke[#]	Attitudes of California Wine Producers on the Use of Barn Owls (Tyto alba) as a Tool for integrated pest management
Fischer, Phillip	The Sustainability in Prisons Project (SPP): Engaging Incarcerated People in Wildlife Research and Recovery.
Foster, Alex	Characteristics of Adult Coastal Giant and Cope's Giant Salamanders of the Pacific Northwest.
Howell, Betsy	Interagency Pacific Marten (Martes caurina) Distribution Study on the Olympic Peninsula, Washington
Hunter, Ruth[#]	Optimal Distance for Insect Trap Placement in the Sage-grouse Habitat.
Jensen, Paul[#]	Relating Pellet Counts to Snowshoe Hare Density in Lynx-occupied Areas of Washington.
Keleher, Katrina[#]	Monitoring Habitat Connectivity on Washington State Route 26.
Macias, Cameron[#]	Cougar and Bobcat Population Estimation and Occupancy Modeling in the Lower Elwha Klallam Tribe's Historic Use Area.
McClarnon, Max[#]	Characteristics of a High Elevation Western Pond Turtle Population.
McIntyre, Aimee	Evaluating the Current Extent of Van Dyke's Salamander (*Plethodon vandykei)* Distribution Based on Historic Localities: A Collaborative Effort.
Neil, Anna	Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery.

Presenter	Poster Title
Parker, Michael	Locating Oregon Spotted Frog Over-Wintering Sites at the Parsnip Lakes, OR.
Raley, Catherine M.	Selection of Rest Structures and Microsites by Fishers in the Cascade Range of southern Oregon
Rensel, Leah[#]	Winter Bat Activity at Maternity Sites in Western Washington
Rohrer, John	Physical Characteristics of Northern Pacific Rattlesnake Hibernacula in the Methow Valley, WA
Ryckman, Jordan[#]	Can Pika Haypiles in Disturbed Habitats Facilitate Other Generalist and Specialist Species?
Salzer, Lori	Engaging the Public to Promote Bat Conservation in Washington.
Smith, Tessa[#]	Do Fuel Treatment Applications in Forests Change Habitat Selection Factors for Fishers (*Pekania pennanti*)?
Staudenmaier, Anna[#]	A Comparison of Fundamental Nutritional Niches of White-tailed Deer (*Odocoileus virginianus*) and Mule Deer (*Odocoileus hemionus*).
Whitfield, Sheri	Creating Habitat for the Northern Sagebrush Lizard at Umatilla National Wildlife Refuge.
Williams, Olivia	Conservation Status, Research Needs, and Management Recommendations for the Olympic Mudminnow (*Novumbra hubbsi*), Washington State's Only Endemic Fish.
Wilson, Anjanette[#]	Setting the Stage for Connectivity Assessments: Small Mammals in Forest Habitats as Potential Users of Wildlife Crossing Structures

2019 Poster Abstracts WATWS, SNVB, NWPARC Joint Annual Meeting

Mapping Amphibian Occurrence on the Road System at Mount Rainier National Park. Anthony S. Anderson*, *Mount Rainier National Park, Ashford, WA 98304*; *scott_anderson@nps.gov*; Darin D. Swinney, *Mount Rainier National Park; darin_swinney@nps.*gov; Rebecca A. Lofgren, *Mount Rainier National Park; rebecca_a_lofgren@nps.gov.*

We set out to map amphibian presence along several roads at Mount Rainier National Park (MORA) to help mitigate road-related impacts to amphibians. These impacts include vehicle collisions, annual road maintenance activities, and Federal Highways restoration projects. We conducted night road surveys from 2014 to 2016 following rain events in the spring through fall months on 44 miles of road. Our objectives were to (1) detect all amphibians present on the road during our surveys, and (2) identify amphibian hot spots. We conducted most surveys by vehicle at speeds averaging 5 mph which enabled us to detect juvenile frogs and small plethodontid salamanders. Amphibians encountered were identified to species, measured, locations recorded, and road-killed individuals collected. We detected 1009 amphibians between 2014 and 2016 with 42.4 % of those encountered road-killed. Twelve of 14 species known to occur at MORA were found on park roads during these surveys including 2 species of concern (*Plethodon larselli* and *P. vandykei*). The most common species detected were Coastal Tailed Frogs (*Ascaphus truei*), which accounted for 58.7 % of all amphibian species encountered (584 total, 47.1% road-killed). We identified several amphibian hotspots associated with wetland features. The mapping project has served as a resource for park management to mitigate impacts of road rehabilitation projects on amphibians, and to evaluate site specific options at known amphibian hotspots to mitigate impacts of road-associated maintenance operations.

Point Count Surveys Indicate a Decline in Raven Densities Following Control Efforts in Greater Sage-Grouse Habitat. Isaac Appleby-Hall*, *Whitworth University, 300 West Hawthorne Road, Spokane, WA 99251; iappleby-hall21@my.whitworth.edu*; Grant Casady, *Whitworth University; gcasady@whitworth.edu.*

The Greater Sage-Grouse (*Centrocercus urophasianus*) is an integral component of the sagebrush ecosystem because of their numerous predator-prey relations. For example, their eggs are taken by gopher snakes and Ravens, their chicks are hunted by owls and raptors, and they themselves are a yearlong food source for coyotes and badgers. The Common Raven (*Corvus corax*) is one predator that has recently become more of an issue to Sage-Grouse populations. Raven populations have tripled in the last thirty years, resulting in an increase in Sage-Grouse predation. With local Washington Sage-Grouse populations dwindling in numbers, efforts are being implemented to protect the surviving populations. One instance of those efforts is predator removal. The Washington Department of Fish and Wildlife (WDFW) has carried out Raven removal in the past, and has tracked Raven population trends over the subsequent years. It is important to accurately measure the impact of past predator population control in order to assess appropriate future actions. We analyzed Common Raven populations in order to find a more accurate estimated density of the Sage-Grouse predators near a lek in Lincoln County, Washington. We found that Raven population densities declined immediately after control efforts during a time of the year when densities are typically high.

Underestimation of Mesic Habitat May Call for Reassessment of Brooding Sage-grouse Habitat Preferences. Morgan Bucher*, *Whitworth University, 300 West Hawthorne Road, Spokane, WA 99251; mbucher20@my.whitworth.edu;* Ruth Hunter; *Whitworth University,; rhunter21@my.whitworth.edu*; Isaac Appleby-Hall; *Whitworth University; iappleby-hall21@my.whitworth.edu*; Dr. Grant Casady; *Whitworth University; gcasady@whitworth.edu*.

The sagebrush steppe ecosystem of North America is home to the Greater Sage-Grouse (*Centrocercus urophasianus*), and has been subject to a large amount of habitat fragmentation. Habitat fragmentation, along with other environmental factors, has impacted mesic regions and contributed to the decline in sage-grouse numbers in Washington. Literature agrees that Greater Sage-Grouse frequent such mesic areas during the brooding period. The Lincoln County, Washington population of Greater Sage-Grouse has been monitored in terms of their relative distance from mesic sites, with the conclusion that during the brooding period this specific group does not frequent mesic areas when compared to random points. This was assessed with a vegetation map produced using NAIP and World View-1 imagery from 2011. We traveled to randomly-selected mesic sites on public lands and measured mesic area extent using precision GPS. Data were collected in Lincoln County in June and July of 2018. While the vegetation polygon map was fairly accurate at detecting the location of mesic areas, it tended to underestimate the size of these areas. Previous conclusions about the proximity of brooding sage-grouse to mesic sites in Lincoln County should be reassessed in light of the potential underestimation of mesic extent.

Observations of three Harlequin Duck (*Histrionicus histrionicus*) **nests in the southern Washington Cascade Range.** Roy Morris, *roymorris10@gmail.com*; Russ Gibbs, Tara Chestnut, *tara_chestnut@nps.gov, National Park Service, Mount Rainier National Park, Ashford, WA, USA.*

Knowledge of species' natural history is critical to development of professional expertise and informing conservation priorities, yet basic life history information is lacking for many species. Even when global information is available, local natural history information to mitigate threats may still be lacking. The Harlequin Duck (*Histrionicus histrionicus*) is a small sea duck considered by the International Union for the Conservation of Nature (IUCN) to be "Apparently Secure – G4 N4" globally and nationally but in the United States it is considered "Imperiled" or "Critically Imperiled – S2B S1" at the state level throughout most of the southern portion of its breeding range. The Harlequin Duck Working Group identified breeding surveys as a key inventory need for the Pacific population, specifically in the Washington Cascade Range. We conducted opportunistic nest surveys at Mount Rainier National Park from 2001 to 2018 and report on the nest site descriptions of three Harlequin Duck nests detected in 2005 (n=2) and 2018 (n=1). Prior to this, only one Harlequin Duck nest was reported from Mount Rainier National Park in 1920.

Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery. Chris Cousins, Mark Leppin, Anna Neill*, Matt Radin, *Oregon State University Herpetology Club, 2820 SW Campus Way, Corvallis, OR, 97330; cousinsc@oregonstate.edu, leppinm@oregonstate.edu, welshan@oregonstate.edu, radinm@oregonstate.edu,* Deanna H. Olson, *U.S. Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us.*

Wildfire disturbances are increasing in frequency in the Pacific Northwest. Fire refugia for vertebrates, both aquatic and terrestrial, are understudied. Wetlands with associated meadow habitats may act as resilient wildfire refugia for herpetofauna, which could be important components of local food webs, helping to reestablish ecological connections during post-fire recovery. We examined amphibian occurrence in wetland-meadow complexes embedded within known recent wildfire areas in comparison to areas without wildfire, to examine potential resilience of wetland refugia and their fauna to fire events. To study this, in 2018, the Oregon State Herpetology Club in conjunction with the U.S. Forest service surveyed wetland-meadow complexes for amphibians using a combination of timed visual surveys and dip-net sampling in the Sisters Ranger District, Deschutes National Forest, Oregon. Nine study sites were chosen based on occurrence of meadow habitats adjacent to wetlands and fire history, inclusive of sites within the Milli, Pole Creek, B&B Complex, and Airport fires, 2003 to 2017. Sites also varied in some habitat features, having permanent or ephemeral water sources. Large quantities of amphibian larvae and metamorphs were found at several of the seasonally wet sites, regardless of fire history, suggesting that these habitat types are important breeding habitat and animals there are potentially resilient to fire disturbance. In particular, some sites appeared to be particularly important for either amybstomatids or anurans, or both. Our experience allows for a refinement of sampling protocols for future surveys and establishes a baseline understanding of species diversity in the area.

Nest-Site Preferences of American Bushtits (*Psaltriparus minimus)* in an Urban Campus Setting. Celeste Dylla*, *Biology Department, Seattle University, 901 12th Avenue, Seattle WA 98122; dyllac@seattleu.edu*; Hannah Samsen, *Biology Department, Seattle University;* Rebecca Hartley, *Biology Department, Seattle University.*

In an urban environment, the nest-site preferences of songbirds are affected by a variety of novel factors, including anthropogenic noise and an altered landscape of tree species. We investigated the nest-building locations of American Bushtits (*Psaltriparus minimus*) on the campus grounds of Seattle University in spring 2018. Based on prior observations, we hypothesized that bushtits prefer to nest in non-native cedars over other coniferous tree species. We also hypothesized that nest sites would be situated in areas of campus away from the noisier surrounding streets. In order to test these hypotheses, eight bushtit nests were located during campus surveys, and bird behaviors were noted at each nest for ten minutes once or twice weekly from March to July. Individual Blue Atlas Cedar (*Cedrus atlantica),* Deodar Cedar (*Cedrus deodara*), and other large coniferous trees were mapped and their locations compared to nest-building sites. Using the noise meter app Decibel X, we monitored ambient noise levels for one minute each on two separate autumn days at 20 locations throughout the study area. We found that although there are many large conifers on campus, bushtits displayed an overwhelming nesting preference towards non-native cedars. We suggest that bushtits may be choosing nest sites based on branch or needle architecture, insect food availability, proximity to nest-building materials (spider webs, moss, and lichen), or social learning. Bushtits seemed to avoid building nests along the exterior of campus, where ambient noise levels were significantly higher and could potentially hinder reproductive success.

Attitudes of California Wine Producers on the Use of Barn Owls (*Tyto alba*) as a Tool for Integrated Pest Management. Brooks Estes*, *Humboldt State University, Environment & Community Program, 1 Harpst St., Arcata, CA 95521; bre14@humboldt.edu;* Matthew Johnson, *Humboldt State University, Department of Wildlife,1 Harpst St., Arcata, CA 95521; mdj6@humboldt.edu.*

California is the epicenter of the United States wine industry, producing 85% of the nation's wine in 2017. Wine is unique as an agricultural commodity, being strongly tied to place and with nuances of quality being prized above quantity. This concern for quality leads to significant micro-management of outside influences, and one constant challenge is pest management. Pest management is often a highly toxic and destructive endeavor; new and innovative natural options are increasingly necessary to prevent continued environmental degradation. The wine industry is ideally positioned to pioneer and widely adopt such techniques, because what is good for the land is generally considered good for the wine. One technique that has been gaining in popularity is the use of barn owl (*Tyto alba*) boxes in vineyards for the reduction of rodent pests as part of integrated pest management (IPM) approaches. Ongoing spatial ecology research is looking at the potential efficacy of these owls in reducing rodent numbers in California vineyards. However, beyond the efficacy of the owls themselves, better understanding how to increase the adoption of such techniques more broadly requires an understanding of the views and beliefs of wine producers. This poster discusses a survey project investigating the connection between the use of barn owl boxes, general pest management practices, and environmental knowledge, values, and attitudes. The project is in its early phases; therefore, this poster will focus on survey composition and distribution techniques, in addition to any preliminary data.

The Sustainability in Prisons Project (SPP): Engaging Incarcerated People in Wildlife Research and Recovery. Philip Fischer*, *251 Rainbow Rock Ln, Naches WA, 98937; pcfischer@gmail.com;* Jessica Brown, *10638 Mill Rd, Yelm WA,*

98597; bright.jessica.h@gmail.com; Kelli Bush, *The Evergreen State College; bushk@evergreen.edu;* Teresa Lorenz, USDA *Forest Service, Pacific Northwest Research Station, 3625 93rd Ave. SW, Olympia WA 98512; tlorenz@fs.fed.us.*

The complexity and scope of species recovery efforts necessitates creative thinking and broader engagement. Incarcerated people have been overlooked for their interest in science education, creative thinking, problem solving, and a desire to make positive contributions. The Sustainability in Prisons Project (SPP) is a program designed to address some of these issues. It is a partnership founded by The Evergreen State College and Washington State Department of Corrections (WADOC). It enables collaborations among incarcerated people, biologists, corrections staff, and academics. SPP has been able to increase education and training for incarcerated people while assisting agencies in species research and recovery. We will present two SPP partnership examples. The first example is partnership with the U.S. Forest Service to identify threats to cavity nesting birds that are state species of concern. This project entails technicians assisting with the review of ~60,000 hours of video from a large scale research study. In the second example we will describe a project led by the Washington Department of Fish and Wildlife where incarcerated technicians assist in recovery of western pond turtle (*Actinemys marmorata*). Following acute veterinary care for diseased shell tissue, turtles arrive at one of two participating prisons where technicians provide extended care until turtles are released back into the wild. Our aim with this poster is to raise awareness of education and training opportunities that benefit incarcerated people, biologists, and wildlife.

Characteristics of Adult Coastal Giant and Cope's Giant Salamanders of the Pacific Northwest. Alex D. Foster*, *USDA Forest Service Pacific Northwest Research Station, 3625 93rd Avenue Southwest, Olympia, WA 98512; alexfoster@fs.fed.us*; Lawrence L.C. Jones, *Southwest Zoologists' League, Tucson, Arizona; gilaman@comcast.net.*

Cope's Giant (*Dicamptodon copei*) and Coastal Giant (*D. tenebrosus*) salamanders are members of a family (Dicamptodontidae) that is endemic to the Pacific Northwest. Coastal Giants are relatively widespread from northern California to southwestern British Columbia, while Cope's has a more limited range in western Washington and northwestern Oregon. Both are sympatric within the range of *D. tenebrosus*, except only Cope's occurs on the Olympic Peninsula. Both are aquatic species in their larval stage, and are often present in the same stream. They may be paedomorphic (especially *D. copei*), but may metamorphose into a terrestrial adult form. Confusion exists in the identification between metamorphosed adults. We collected 23 metamorphosed adults of both species from sympatric areas in western Washington. The animals were transported to a lab where they were photographed in several aspects including dorsal, ventral, and lateral views, using both full body and close up views under standardized lighting. The animals were measured including weight, total and SVL length, length of limbs, length of tail, width of head, etc. Tissue was taken and DNA results were acquired. We will describe morphologic and phenotypic characteristics between adults of both species. In addition we will describe environmental and habitat characteristics where each individual was found. This work will contribute to the developing state of knowledge of the mechanisms of coexistence, habitat, and microhabitat use by each species.

Interagency Pacific Marten (*Martes caurina*) Distribution Study on the Olympic Peninsula, Washington. Betsy Howell*, *Olympic National Forest, USDA Forest Service, 295142 Highway*

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Pacific Martens (*Martes caurina*) remain relatively common at high elevations in much of the Pacific Northwest, yet their distribution and status on Washington's Olympic Peninsula is uncertain. Only 10 reliable Marten detections were documented from the late 1970s to 2017, including 4 from remote-camera surveys from 2015 to 2017, and 6 from animals encountered opportunistically (late 1970s to 2015). The discovery of a dead juvenile female in 2008 indicates that Martens were reproducing on the Peninsula within the last decade. To evaluate the current distribution and status of Martens, we conducted high-density camera surveys in 2015 and 2016 in coastal habitats in Olympic National Park (ONP) and high-elevation forests in ONP and Olympic National Forest (ONF). A total of 193 camera stations yielded nearly 400,000 photographs, but only 1 station detected a Marten, in the upper Hoh watershed of ONP. In 2017, we installed 6 high-elevation camera stations coupled with automated scent dispensers to keep sites functional throughout the winter. We checked these stations in 2018, determining that 2/6 detected Martens—again in the upper Hoh. We also installed 24 additional cameras and 12 scent dispensers in summer 2018 in areas near historical and current Marten records at high elevations; these camera sites will be checked in summer 2019. We employed detection dog teams in late summer and fall 2018 to search trails in ONF for Marten scats. These teams collected 48 scats from 15/22 trails surveyed. Of these 48, DNA obtained from 40 was suitable for species identification; no Martens were detected. Available evidence suggests that Martens are absent from the lower elevations of the Olympic Peninsula and occur at very low densities at higher elevations. Thus, they appear to be at substantial risk of extirpation. Additional broad and fine-scaled surveys to collect genetic information will be needed to fully understand the trend in Marten populations on the Peninsula and develop appropriate conservation strategies.

Optimal Distance for Insect Trap Placement in the Sage-grouse Habitat. Ruth Hunter*, *Whitworth University, 300 W Hawthorne Road, Spokane, WA 99251; rhunter21@my.whitworth.edu;* Morgan Bucher, *Whitworth University; mbucher20@my.whitworth.edu;* Isaac Appleby-Hall, *Whitworth University; iappleby-hall21@my.whitworth.edu.*

The Greater Sage-grouse (*Centrocercus urophasianus*) feeds on certain types of insects such as ants and beetles (Drut et al. 1994). When evaluating Sage-grouse habitat, it is helpful to have a way of measuring the presence of preferred insects in some areas relative to others. One method for taking insect surveys is the use of pitfall traps. In order to avoid spatial autocorrelation and interference between traps, it is necessary to find the optimal distance apart that traps should be placed. If traps are too close together, many traps will only be representative of one sample. Furthermore, it is possible that traps close together can affect each other in various ways, either by reducing the number of insects in an area making insect density lower, or

by attracting more insects due to higher density of trap bait. In order to find the spacing necessary for traps to be far enough apart to avoid these effects, traps were placed at various distances away from each other and the number of insects caught in each trap was used to create a semivariogram. The semivariograms showed no consistent trend and thus the data were inconclusive.

Relating Pellet Counts to Snowshoe Hare Density in Lynx-occupied Areas of Washington. Paul Jensen*, *Washington State University, 1775 NE Stadium Way, Pullman, WA 99164; paulj@wsu.edu;* Daniel Thornton, *Washington State University; daniel.thornton@wsu.edu.*

Snowshoe hare (*Lepus americanus*) are the primary prey of the Canada lynx (*Lynx canadensis*), a state-endangered and federally threatened carnivore. Lynx persistence is likely tied closely to snowshoe hare density and distribution. However, we have limited knowledge of snowshoe hare density in lynx occupied areas and lack an assessment of the accuracy of different methods for estimating hare density. Although pellet counts as a method of estimating hare density has been applied many times throughout its range, for accurate calibration, localized conversions are necessary to account for differences in deposition and decomposition. We live trapped and used spatially-explicit capture-recapture (SECR) models to estimate snowshoe hare density and then related those densities to pellet counts at seven 10-ha sites in northcentral Washington. Live trapping was conducted over six consecutive days at each site and was followed by pellet counts from plots that were uncleared in previous years. We found reasonably high hare densities within lynx occupied habitat, and a strong correlation between our estimated hare density and pellet counts for our uncleared pellet plots. Based on our regression equations, some areas of the Kettle range, which do not currently support a resident lynx population, likely reach hare densities capable of supporting lynx. Our regression equation may be useful to further evaluate habitat use by snowshoe hare and to inform boreal forest managers with intent to preserve important hare habitat in support of lynx conservation.

Monitoring Habitat Connectivity on Washington State Route 26. Katrina Keleher*, *Washington State Department of Transportation, 310 Maple Park SE, Olympia, WA 98504; katrina.keleher@wsdot.wa.gov;* Kelly McAllister, *Washington State Department of Transportation; kelly.mcallister@wsdot.wa.gov.*

There is a section of SR26 that is among the top 10% of worst deer-vehicle collision areas in the State. Serving as a popular driving route to Washington State University from western Washington, this highway is frequented by students and their families. Simultaneously, it lies in the path of a seasonal Mule Deer migration. Several livestock crossing culverts pass under this section of highway at regular intervals, prompting the question of whether or not these structures could function to provide deer with a safer way to cross the highway. To address this question and to better understand the role the livestock structures play in assisting with safe crossings, we have set up ten trail cameras on either side of five structures to find out what animals are using them. After two years of monitoring, we have determined that these structures are simultaneously serving wildlife, including deer, along with the cows they were designed for. However, it is clear that the structures could easily be made more attractive to deer, in particular. To achieve maximum low cost effectiveness of this existing infrastructure, for reducing collisions and conserving wildlife, WSDOT will need to work out compromises with local

landowners and enlist the help of maintenance staff to keep tumbleweed and other nuisances from reducing the attractiveness of these highway structures. In addition, continued monitoring is vital to fully understanding this low-cost approach to reducing collisions through the increased use of structures by deer and other wildlife.

Cougar and Bobcat Population Estimation and Occupancy Modeling in the Lower Elwha Klallam Tribe's Historic Use Area. Cameron Macias*, *University of Idaho, College of Natural Resources, 975 W 6th St, Moscow, ID 83844; maci2896@vandals.uidaho.edu;* Jennifer Adams, *University of Idaho, College of Natural Resources; adamsj@uidaho.edu;* Lisette Waits, *University of Idaho, College of Natural Resources; lwaits@uidaho.edu;* Kim Sager-Fradkin, *Lower Elwha Klallam Tribe Natural Resources, 760 Stratton Road, Port Angeles, WA 98363; kim.sager@elwha.org.*

As a sovereign nation, the Lower Elwha Klallam Tribe sets annual harvest regulations that differ from those of Washington State. No data, however, have been collected on predator populations in the Tribe's historic use area and we lack information for setting annual tribal harvest regulations. To address this data gap, we used a combination of non-invasive genetic sampling, GPS radio collars, and a camera grid survey to estimate population size, genetic diversity, and occupancy of cougar (*Puma concolor*) and bobcat (*Lynx rufus*) populations on the north Olympic Peninsula of Washington State. First, we used specialized scat-detection dogs to locate and collect cougar and bobcat scat samples across the landscape. We divided our 606 km^2 study area into 32- 4x4 km sampling cells and the scat-detection teams surveyed one cell per day. Of the 207 scat samples collected during the 2018 survey, we had an 85% success rate for genetic species identification and identified 154 bobcat and 18 cougar samples. Individual identification analyses are ongoing. Second, we equipped 3 adult (1 male and 2 female) and 1 sub-adult cougar with GPS radio-collars in 2018 to observe movement and dispersal. Third, we deployed a 64-camera grid survey using the same 32-cell grid system. Each grid cell contained two cameras separated by >1 km. We will continue these three surveys through 2020. This research will provide baseline data on cougar and bobcat populations in the Tribe's historic use area and help us to develop non-invasive and cost-effective methodologies for long-term monitoring and management.

Characteristics of a High Elevation Western Pond Turtle Population. Max McClarnon*, *Biology Program, Southern Oregon University, Ashland, OR 97520*; *mcclarnom@sou.edu;* Ricky Clark, *Biology Program, Southern Oregon University*; Amanda Huffman, *Biology Program, Southern Oregon University*; Michael Parker, *Biology Program, Southern Oregon University*.

The Willow-Witt Ranch is located at approximately 1425 m (4,650 ft) elevation in the southern Oregon Cascades. A small (0.6 hectare) irrigation pond on the property is inhabited by a population of western pond turtles (*Actinemys marmorata*), and is one of the highest elevation populations in the region. Over two field seasons (2017-18) we surveyed this population to estimate population size, structure, and spatial distribution. To capture turtles, we used baited collapsible funnel traps set around the margin of the pond in areas with different vegetation densities. We took standard body size and weight measurements, estimated age and sex, and individually marked each turtle by filing notches in outer margins of carapace scutes. We captured and marked 51 individuals and used repeat mark-recapture methods and estimated population size to be 75 (41-202 95% CI). Size distribution ranged from 39-161mm carapace

length (CL) and ages were estimated to range from 1 to >20 yr. A relatively large proportion (31%) of small (≤ 69 mm CL), young (≤ 4 yr) turtles suggests that there has been successful recent reproduction and recruitment into this population. Comparing size at age data with other populations in SW Oregon shows that turtles within this high-elevation population have slower growth and attain smaller overall body sizes than most populations. We found that turtles were segregated by habitat and body size, with the smallest size classes (< 80 mm CL) captured predominantly in the densest vegetation and larger turtles (> 100 mm CL) most abundant in open water.

Evaluating the Current Extent of Van Dyke's Salamander (*Plethodon vandykei*) Distribution Based on Historic Localities: A Collaborative Effort. Aimee P McIntyre*, *Washington Department of Fish and Wildlife, 1111 Washington Street Southeast, Olympia, WA 98501; aimee.mcintyre@dfw.wa.gov;* Reed Ojala-Barbour, *Washington Department of Fish and Wildlife; reed.ojala-barbour@dfw.wa.gov;* Julie A Tyson, *Washington Department of Fish and Wildlife; julie.tyson@dfw.wa.gov;* Timothy Quinn, *Washington Department of Fish and Wildlife; timothy.quinn@dfw.wa.gov;* Marc P Hayes, *Washington Department of Fish and Wildlife; marc.hayes@dfw.wa.gov;* Alex D Foster, *Pacific Northwest Research Station, US Forest Service, 3625 93rd Avenue Southwest, Olympia, WA 98512; alexfoster@fs.fed.us;* Andrew J Kroll, *Weyerhaeuser, 220 Occidental Avenue South, Seattle, WA 98104; AJ.Kroll@weyerhaeuser.com.*

The Van Dyke's Salamander (*Plethodon vandykei*) is endemic to western Washington and is a state candidate for listing. The species is known from three disjunct geographic regions: the Cascade Mountains, Willapa Hills, and Olympic Peninsula. Lungless terrestrial salamanders respire cutaneously and require moist skin for gas exchange. The Van Dyke's Salamander is the most closely associated with water of any Pacific Northwest congener. Historically, the species was considered an old-growth obligate. However, more recently it has been associated with geomorphic and hydrologic microhabitats, such as stream channel morphology and substrate, which are not necessarily related to forest age. These considerations, in conjunction with its relatively low temperature requirements, have resulted in uncertainty surrounding its resiliency to the impacts of forest management and climate change. We designed a study to evaluate species persistence at known sites. First, in 2018 we compiled a comprehensive database of the locations of historic occurrences. Next, we identified partners throughout the species geographic distribution, including private timber landowners, state agencies, national forests and national parks. We plan to visit historically occupied sites in 2019 and 2020, document presence, and collect stand age, habitat and other covariate information. We will evaluate whether changes in occupancy are associated with stand age, forest management history, or other factors. We will inform species distribution and factors that affect detectability through modelling efforts. We will also collect tissue for genetic analysis for an evaluation of intra-specific diversity. This suite of analyses will inform conservation efforts and future studies on the species.

Wetland Meadow Habitats in the Cascade Range: Potential Refugia for Herpetofaunal Communities Accelerating Post Fire Ecosystem Recovery. Anna Neill*, *Oregon State University Herpetology Club, 2820 SW Campus Way, Corvallis, OR, 97330;welshan@oregonstate.edu;* Chris Cousins, *Oregon State University Herpetology Club; cousinsc@oregonstate.edu*; Mark Leppin, *Oregon State University Herpetology Club*; *leppinm@oregonstate.edu*; Matt Radin, *Oregon State University Herpetology Club;*

radinm@oregonstate.edu; Deanna H. Olson, *U.S. Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us.*

Wildfire disturbances are increasing in frequency in the Pacific Northwest. Fire refugia for vertebrates, both aquatic and terrestrial, are understudied. Wetlands with associated meadow habitats may act as resilient wildfire refugia for herpetofauna, which could be important components of local food webs, helping to reestablish ecological connections during post-fire recovery. We examined amphibian occurrence in wetland-meadow complexes embedded within known recent wildfire areas in comparison to areas without wildfire, to examine potential resilience of wetland refugia and their fauna to fire events. To study this, in 2018, the Oregon State Herpetology Club in conjunction with the U.S. Forest service surveyed wetland-meadow complexes for amphibians using a combination of timed visual surveys and dip-net sampling in the Sisters Ranger District, Deschutes National Forest, Oregon. Nine study sites were chosen based on occurrence of meadow habitats adjacent to wetlands and fire history, inclusive of sites within the Milli, Pole Creek, B&B Complex, and Airport fires, 2003 to 2017. Sites also varied in some habitat features, having permanent or ephemeral water sources. Large quantities of amphibian larvae and metamorphs were found at several of the seasonally wet sites, regardless of fire history, suggesting that these habitat types are important breeding habitat and animals there are potentially resilient to fire disturbance. In particular, some sites appeared to be particularly important for either amybstomatids or anurans, or both. Our experience allows for a refinement of sampling protocols for future surveys and establishes a baseline understanding of species diversity in the area.

Locating Oregon Spotted Frog Over-Wintering Sites at the Parsnip Lakes, OR. Michael S. Parker*, *Biology Program, Southern Oregon University, 1250 Siskiyou Blvd., Ashland, OR 97520*; *parker@sou.edu*; David Hering, *Crater Lake National Park, Crater Lake, OR 97604*; *david_hering@nps.gov.*

Egg mass surveys at the Parsnip Lakes show that > 90% of total Oregon spotted frog (OSF) reproduction over the past 16 years has taken place within a single pond. The pond is experiencing dramatic habitat loss due to absence of beavers and deterioration of the beaver dam, resulting in declining water depth and succession of hydrophytic vegetation. Historically, the beaver dam, bank dens, and lodge provided important over-wintering habitat for the OSF population. Current over-wintering sites are unknown, but we hypothesized that the inflow spring, which does not freeze during the winter, may now represent the best remaining habitat at the site. To determine distribution before and during movement into over-wintering sites, we used funnel traps to capture frogs in late October-early November. Frogs were PIT-tagged and released at the site of capture. Subsequent recaptures allowed determination of movement patterns and distances, and mobile PIT tag antennae were used to relocate frogs within their overwintering sites. Over 15 trap-nights (> 10,000 total trap hours), we captured 9 adult OSF (7 males; 2 females). In spite of this very small sample size, multiple observations support the hypothesis that the inflow spring is the primary over-wintering site: (1) all frogs captured were within or near the spring inflow; (2) directional traps captured frogs moving upstream from the pond into the spring channel; (3) recaptured frogs had moved 18-32 m upstream within the spring channel; and (4) pit-tagged frogs were relocated within the spring channel in January and February. Identifying over-wintering sites is critical to habitat conservation and restoration planning.

Selection of Rest Structures and Microsites by Fishers in the Cascade Range of southern Oregon. Catherine M. Raley*, *USDA Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98512; craley@fs.fed.us*; Keith B. Aubry, *USDA Forest Service, Pacific Northwest Research Station; kaubry@fs.fed.us*.

To better inform forest management activities designed to improve resting habitat for Fisher (*Pekania pennanti*), we documented use of rest structures (e.g., live trees, snags, logs) and microsites (e.g., mistletoe brooms, platform branches, cavities) throughout the year by 12 female and 7 male fishers, and sampled the availability of rest structures and microsites on the west slope of the Cascade Range in southern Oregon from 1995 to 2001. Fishers primarily used live trees (65%), snags (14%), and logs (16%) for resting. Logistic regression models investigating selection of rest structures revealed that the presence of a suitable rest microsite best distinguished used from available structures: mistletoe broom or cavity in live trees, cavity in snags, and hollow end in logs. Only the snag and log models included covariates associated with tree size, likely reflecting the need for enclosed rest microsites to be large enough to contain an adult fisher. We also used logistic regression to model the ecological characteristics of available live trees, snags, and logs that contained suitable rest microsites. Whether a tree was a hemlock (*Tsuga* spp.) had the greatest effect on the presence of suitable mistletoe broom microsites, whereas moderate stages of decay and large diameter were the most important characteristics of snags with cavities and logs with hollow ends. To maximize benefits to fishers, we recommend that management for resting habitat be focused on retaining relatively large live trees, snags, and logs that already contain suitable rest microsites, rather than simply retaining the largest available structures.

Winter Bat Activity at Maternity Sites in Western Washington. Leah Rensel*, *University of British Columbia Okanagan, 1177 Research Road, Kelowna, BC V1V 1V7*; *leahrensel@att.net.*

The White Nose Syndrome (WNS) fungal pathogen, *Pseudogymnoascus destructans* (PD), infects and kills bats during the winter. There is very little information available about winter bat activity in the Pacific Northwest so the potential impact of WNS is unknown. WNS was confirmed in Washington bats in 2016. Therefore, understanding bat winter activity is vital to the conservation of bats in Washington. Site fidelity of bats to their summer maternity roosts is well documented, but maternity sites may also be used periodically by bats during the mild western Washington winter. We assessed whether three WNS vulnerable species of bats—Big Brown bat (*Eptesicus fuscus*), Little Brown bat (*Myotis lucifugus*) and Yuma bat (*Myotis yumanensis*)—use their maternity sites or summer roosts during winter. We placed passive acoustic detectors at three sites in Skagit and Snohomish Counties with evidence of summer bat activity and monitored them continuously from September 2017 until March 2018. We identified calls by species when possible. Yuma bats and Big Brown bats were active at their individual summertime maternity colony sites, but not Little Brown bats. Other wintertime activity of Silver-haired, Hoary and California bats were also recorded. These results suggest that, unlike their eastern relatives, Big Brown and Yuma bats in western Washington are periodically active during winter and that they may return to their summer maternity sites during this time.

Physical Characteristics of Northern Pacific Rattlesnake Hibernacula in the Methow Valley, WA. John J. Rohrer*, *Okanogan-Wenatchee National Forest, U.S. Forest Service,*

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Northern pacific rattlesnakes (*Crotalus oreganus*) survive the long, cold winters in the northern latitudes of their range by retreating to subsurface sites that provide protection from freezing temperatures. They congregate at suitable winter hibernacula, often in large numbers, and most use the same site for their entire life. Suitable hibernacula appear to be rare in the northern latitude landscape, and thus may be important sites to protect in order to maintain rattlesnake populations. We investigated the relationship between solar insolation, soil type, and winter hibernacula of northern pacific rattlesnakes in the Methow Valley of north-central Washington. We used visual ground searches and radio-telemetry tracking to locate 32 winter hibernacula from 2000 to 2018. A global information system that utilized slope, aspect, elevation, latitude, and surrounding topography was used to generate insolation values on selected dates. Each of the hibernacula located were in talus or rock outcrop soil types. Interstitial spaces in the talus and fissures in the rock outcrops provided subsurface access to areas below the frostline. Winter insolation values varied greatly. Twenty-seven of the 32 hibernacula sites had winter insolation values that were the highest available in the surrounding area. At the northern extent of their range, northern pacific rattlesnakes find suitable winter hibernacula in rocky soil types that have high winter insolation. These findings could assist land managers in determining areas to protect to help maintain healthy rattlesnake populations.

Can Pika Haypiles in Disturbed Habitats Facilitate Other Generalist and Specialist Species? Jordan Ryckman*, *Department of Biological Sciences, Central Washington University, 400 East University Way, Ellensburg, WA 98926-7537; Jordan.Ryckman@cwu.edu;* Kristina Ernest, *Department of Biological Sciences, Central Washington University; Kristina.Ernest@cwu.edu.*

Wildlife crossing structures are an effective way to improve wildlife connectivity across roads. Typically, their effectiveness is assessed by looking at particular focal species, often large mammals. Within the Interstate-90 (I-90) Snoqualmie Pass East Project, low-mobility species are also being targeted, and the America Pika (*Ochotona princeps*) was designated as one of the focal species. Pikas live in talus slopes at higher elevation but also inhabit rock embankment along I-90. During summer and fall, they collect vegetation to store in haypiles as their winter food supply. We asked whether pikas might attract other species to habitats along roads near crossing structures, thus serving to facilitate community composition. In fall 2017, we located 6 haypiles alongside I-90 and in other anthropogenic rock habitats. We placed a wildlife camera facing each one and covered the field of view with plywood or plastic sheeting to keep snow from obstructing the view. Cameras were left over winter and retrieved after snowmelt in spring 2018. We captured 678 images of 8 species (including pikas) from the six locations. As expected, the majority (94%) of captures was of pikas. We also captured evidence of kleptoparasitism, where other species were foraging in the haypile and taking vegetation. Determining which species visited these haypiles, and their behavior, provided a snapshot into the ways pikas may affect the community around them. We concluded that pikas can be a resource for other species, a potential additional benefit of designing wildlife crossing structures with habitat features to improve pika connectivity.

Engaging the Public to Promote Bat Conservation in Washington. Lori Salzer*, *Washington Department of Fish & Wildlife, 1111 Washington Street SE Olympia, WA 98501; Lori.Salzer@dfw.wa.gov;* Abigail Tobin, *Washington Department of Fish & Wildlife*; Rachel Blomker, *Washington Department of Fish & Wildlife;* Joe Buchanan, *Washington Department of Fish & Wildlife*; Treg Christopher, *Washington Department of Fish & Wildlife.*

In March 2016, white-nose syndrome (WNS) was documented in Washington for the first time. This disease has devastated bat populations in the eastern United States and many western bat species are likely vulnerable and may be similarly affected. Other states have used data from over-wintering sites to assess bat populations and the impact of WNS. In Washington, over-wintering strategies for most bat species are not understood and the locations of their hibernacula are poorly known. More information is available on maternity sites in Washington, but comprehensive surveys and long-term monitoring have not been conducted. The challenge to assess impacts of WNS without baseline information for summer and winter roosts, clarified that gathering multi-species, statewide bat roost information was an immediate priority. Because many of our bats use human-made structures for roosting, we focused efforts to educate and engage the public as a means to gather information on bats. An outreach plan included use of social media, community outreach activities and our web portal to report information on groups of bats and sick or dead bats. Social media (Facebook and Instagram), reached 166,807 accounts. The public provided over 562 reports; 164 of those were groups of bats, which lead to documentation of 49 new maternity colonies. From this effort we have learned that there is an abundance of public knowledge available to us about bats. We will continue to broaden our outreach strategies to better inform our knowledge of bat roosts in Washington.

Evaluating a Novel Method to Estimate Deer Densities in Forested Habitats. Lisa A. Shipley*, *School of the Environment, Washington State University, Pullman, WA 99164; shipley@wsu.edu*; Meghan Camp, *School of the Environment, Washington State University; meghan.camp@wsu.edu*; Daniel Thornton, *School of the Environment, Washington State University; daniel.thornton@wsu.edu.*

Changes in forest management over the last century, such as fuels reductions through thinning and prescribed burning, has the potential to influence populations and distributions of both mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*) in forested landscapes. However, because deer are difficult to survey in forests using traditional methods, biologists currently lack a method to reliably estimate densities within these landscapes. Furthermore, we have a poor understanding of the spatial and temporal segregation of mule deer and white-tailed deer. Our project aims to address these problems by applying a novel method that uses camera traps to estimate species-specific densities within the Colville National Forest in northeastern Washington. During October 2017, we deployed cameras to test the feasibility of our larger study. To separately estimate densities of mule deer and white-tailed deer we estimated distances to recorded animals by comparing their distances to those of researchers in reference videos. We fit point transect models, adapted to camera trap data, using program Distance. The density estimates were 11.98 / km^2 for mule deer and 15.77 / km^2 for white-tailed deer. The 95% CI around the density estimates overlapped for mule deer (5.41 – 44.80/km^2) and white-tailed deer (11.20 – 39.29/km^2), indicating that densities were not significantly different in the sampled region. Our next step is to sample deer across a larger area

and variety of habitat types within the Colville National Forest and compare our new camera-based method of density estimates with density estimated by traditional techniques.

Do Fuel Treatment Applications in Forests Change Habitat Selection Factors for Fishers (*Pekania pennanti)*? Tessa R. Smith*, *Department of Wildland Resources, Utah State University, Logan, UT 84322; Tessa.Rene.Smith@gmail.com;* Eric M. Gese, *USDA-National Wildlife Research Center, Department of Wildland Resources, Utah State University Logan, UT 84322; Eric.Gese@usu.edu;* Pat A. Terletzky, *Department of Wildland Resources, Utah State University; Pat.Terletzky@usu.edu;* Craig M. Thompson, *Conservation Biology Institute,136 SW Washington Ave, Suite 202, Corvallis, OR 97333; Craig.Thomspson@consbio.org;* Dave Clayton, *USDA, Rogue River-Siskiyou National Forest, Medford, OR 9750; dclayton@fs.fed.us.*

Throughout the western United States, fuel reduction projects have increasingly become the management tool of choice for mitigating the rising costs and consequences of stand-replacing wildfires across the western United States. However, the removal of key structures and change in overall forest conditions may impact how habitat-obligate species, such as the fisher (*Pekania pennanti*), selects particular features for various behavioral states. Our research on a small fisher population near Ashland, Oregon, investigated which habitat elements a fisher uses on a home range scale in a pre/post treatment context. We captured and affixed GPS radio-collars to 10 fishers from 2010-2017 in the Ashland watershed unit where mechanical thinning methods and prescribed burns were being applied. Using a resource selection probability function, we then developed models to identify the habitat variables crucial to fisher space use before and after fuel reduction activities occurred. Chosen factors for data analysis included three important vegetation components relevant to previous literature results on fisher habitat selection: change in canopy cover, tree basal area, and remaining trees per hectare. We also integrated topographical and abiotic variables in the models to assess comparisons between our study and previous research findings. Although our analysis is still in progress, we anticipate our results may give insight to forest managers and wildlife biologists on how to implement fuels modification management that will conserve crucial habitat elements for fishers while safeguarding natural resources from potentially devastating wildfire effects.

A Comparison of Fundamental Nutritional Niches of White-tailed Deer (*Odocoileus virginianus*) and Mule Deer (*Odocoileus hemionus*). Anna Staudenmaier*, *School of the Environment, Washington State University, Pullman, WA 99164*; anna.staudenmaier@wsu.edu; Lisa A. Shipley, *School of the Environment, Washington State University*; *shipley@wsu.edu*; Daniel Thornton, *School of the Environment, Washington State University; daniel.thornton@wsu.edu*.

Although similar taxonomically and ecologically, ranges of mule and white-tailed deer are segregated across much of North America, except for a broad north-south zone roughly along the Rocky Mountains. Although free-ranging deer have been extensively studied in areas of both allopatry and sympatry, little is known about differences in their fundamental nutritional niches that might shape this distribution. However, field studies suggest that mule deer might be better able to tolerate plant fiber and plant secondary metabolites than white-tailed deer. Therefore, we directly compared the ability of mule and white-tailed deer to digest plant fiber and nutrients and to detoxify α-pinene, a monoterpene found in conifers and evergreen shrubs using in vivo digestion and feeding trials with 5-6 captive deer of each species. When fed a pelleted diet with 29% neutral detergent fiber, mule deer tended to have a higher dry matter, energy, and fiber

digestibility than did white-tailed deer, but a similar protein digestibility. However, both deer species had the same daily dry matter intake of pellets, and their intake declined linearly at the same rate as the percent of α-pinene increased from 0-4% over 11 days. For both species, intake of α-pinene increased to an asymptote of 0.62 g/kg body mass/day (SD = 0.24). These experiments suggest that the nutritional niches of mule and white-tailed deer are very similar, which might result in competition for food resources where sympatric. Our future experiments will compare the deers' tolerance for higher fiber forages and forages with condensed tannins.

Creating Habitat for the Northern Sagebrush Lizard at Umatilla National Wildlife Refuge. Sheri Whitfield*, *United States Fish & Wildlife Service, 64 Maple Street, Burbank, WA 99323*; *sheri_whitfield@fws.gov*; Heidi Newsome, *United States Fish & Wildlife Service, 64 Maple Street, Burbank, WA 99323*; *heidi_newsome@fws.gov.*

The Northern sagebrush lizard (*Sceloporus graciosus graciosus*) occurs in an area of the Umatilla National Wildlife Refuge (NWR) along a roadway where there is risk of mortality from vehicles. In proximity of the road, are tracts of Wyoming Sagebrush (*Artemisia tridentata*) and Antelope Bitterbrush (*Purshia tridentata*). The shrub component is largely comprised of a Cheatgrass (*Bromus tectorum* L.) understory. Lizards rely on open spaces for efficient movement while foraging or avoiding predators, are frequently less common in cheatgrass-dominated sites than in more intact shrub-bunchgrass communities. We used a meri crusher to crush vegetation over 3 years to increase open-ground and increase connectivity for the sagebrush lizard. We monitored each of the habitat types to determine lizard habitat use. Lizard surveys occurred weekly in 2017 and 2018 during the lizard active season April to September. Expected survey time is approximately 2 hours and on warm, sunny days (70-80 degrees Fahrenheit) with light winds (0-7 M.P.H.). Visual encounter surveys conducted in each habitat type (e.g., polygon, cut-in, corridor). The observer traveled along a line of fixed width of habitat and recorded all lizards visually observed. The interior of each of the polygons contain areas of open space without availability to shrub cover. Within the polygons, lizards tended to use edge areas near concealing vegetation. Monitoring sagebrush lizards has shown the lizards favored areas with open bare ground and scattered shrubs for shade and shelter. Shrubs and other vegetation within the perimeter of the polygons seemed to provide cover that lizards used. Observations during visual surveys indicated a relationship of lizard encounters in shrub areas with open ground in contrast to cheatgrass dominated areas. Habitat use by lizards occurred in polygon six and each of the five cut-ins. Lizards moved away from the roadway when habitat was created with reduced cheatgrass and increased open ground. This innovative project is the first attempt by actively managing sagebrush-steppe habitat for benefit to sagebrush lizard populations.

Conservation Status, Research Needs, and Management Recommendations for the Olympic Mudminnow (*Novumbra hubbsi*), Washington State's Only Endemic Fish. Oliva Williams*, *US Fish and Wildlife Service, Washington Fish and Wildlife Conservation Office, 510 Desmond Drive SE, Lacey WA 98503; Olivia_Williams@fws.gov;* Roger A. Tabor, *US Fish and Wildlife Service, Washington Fish and Wildlife Conservation Office; Roger_Tabor@fws.gov;* Patrick Dehaan, *US Fish and Wildlife Service, Washington Fish and Wildlife Conservation Office; Patrick_Dehaan@fws.gov*; Lauren Kuehne, *University of Washington, Fisheries Building, Room 318A, 1122 NE Boat St, Seattle, WA 98105; lkuehne@uw.edu;* Julian Olden, *University of Washington, Fisheries Building; olden@u.washington.edu;* Julie A. Tyson, *Washington Department of Fish and Wildlife, 600*

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The Olympic Mudminnow (*Novumbra hubbsi*) is Washington State's only endemic fish with a native range primarily in the Chehalis Basin, South Puget Sound, and watersheds of the Olympic Peninsula's outer coast to Ozette Lake. The preference of Olympic mudminnow for ponds, wetlands, and off-channel sloughs and oxbows means that they frequently co-occur with amphibian assemblages, and face similar threats to habitat loss or alteration. Lack of research attention and resources has also led to large knowledge gaps related to their ecology and conservation status. To help advance a research agenda for Olympic mudminnow, in December 2018 the University of Washington and U.S. Fish and Wildlife Service hosted a symposium to share current research and conservation knowledge, and to gain input from the conservation community to develop priority questions for future research.
At this meeting we share the outcomes of the 2018 Olympic Mudminnow Symposium with wildlife biologists outside traditional fisheries management forums. We also illustrate the complex and rich vertebrate assemblage in floodplain and off-channel lentic habitats of the Chehalis Basin by compiling data from multiple sources of amphibian, fishes, and lentic habitat inventories. Lastly, this poster will put special emphasis on the common threats, co-management, and differences between the needs of Olympic Mudminnow and native lentic breeding amphibians, including the federally listed Oregon spotted frog (*Rana pretiosa).*

Setting the Stage for Connectivity Assessments: Small Mammals in Forest Habitats as Potential Users of Wildlife Crossing Structures. Anjanette Wilson*, *1804 N Walnut St. Apt 4 Ellensburg, WA 98926; wilsonanj@cwu.edu;* Kristina Ernest, *Department of Biological Sciences, Central Washington University,400 E. University Way, Ellensburg, WA 98926; ernestk@cwu.edu.*

Highways create a major barrier to connectivity for wildlife populations. Interstate-90 in Washington State cuts through forest habitats along the eastern Cascades, where Washington State Department of Transportation (WSDOT) is now constructing multiple wildlife crossing structures to improve connectivity. As part of the pre-construction monitoring, we documented the species inhabiting the forest adjacent to planned crossing structures, and examined the temporal and spatial variation in species composition and relative abundance of small mammals. This study focuses on the Price-Noble Connectivity Emphasis Area, where a wildlife overcrossing, three undercrossings, and multiple culverts are being built as the highway expands. Small mammals were live-trapped on 50 m x 50 m grids with Sherman, Tomahawk, and pitfall traps for two consecutive nights during the summer in 2013, 2014, 2015, 2017, and 2018. We compared captures per trap-night among species, across sites and years. The most abundant species were Deer Mice (*Peromyscus maniculatus*) and Forest Deer Mice (*P. keeni*). The presence of other species was more variable among sites and showed lower relative abundance. We saw the lowest relative abundance of species in 2013 and the highest in 2017. Based on the data, we predict that Deer Mice (*P. maniculatus* and *P. keeni*), and chipmunks will be the first to use new crossing structures. Other species that are less abundant or have greater habitat specialization may require more time to use the crossing structures. This analysis provides baseline data for future studies evaluating the success of these wildlife crossing structures in improving connectivity.

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