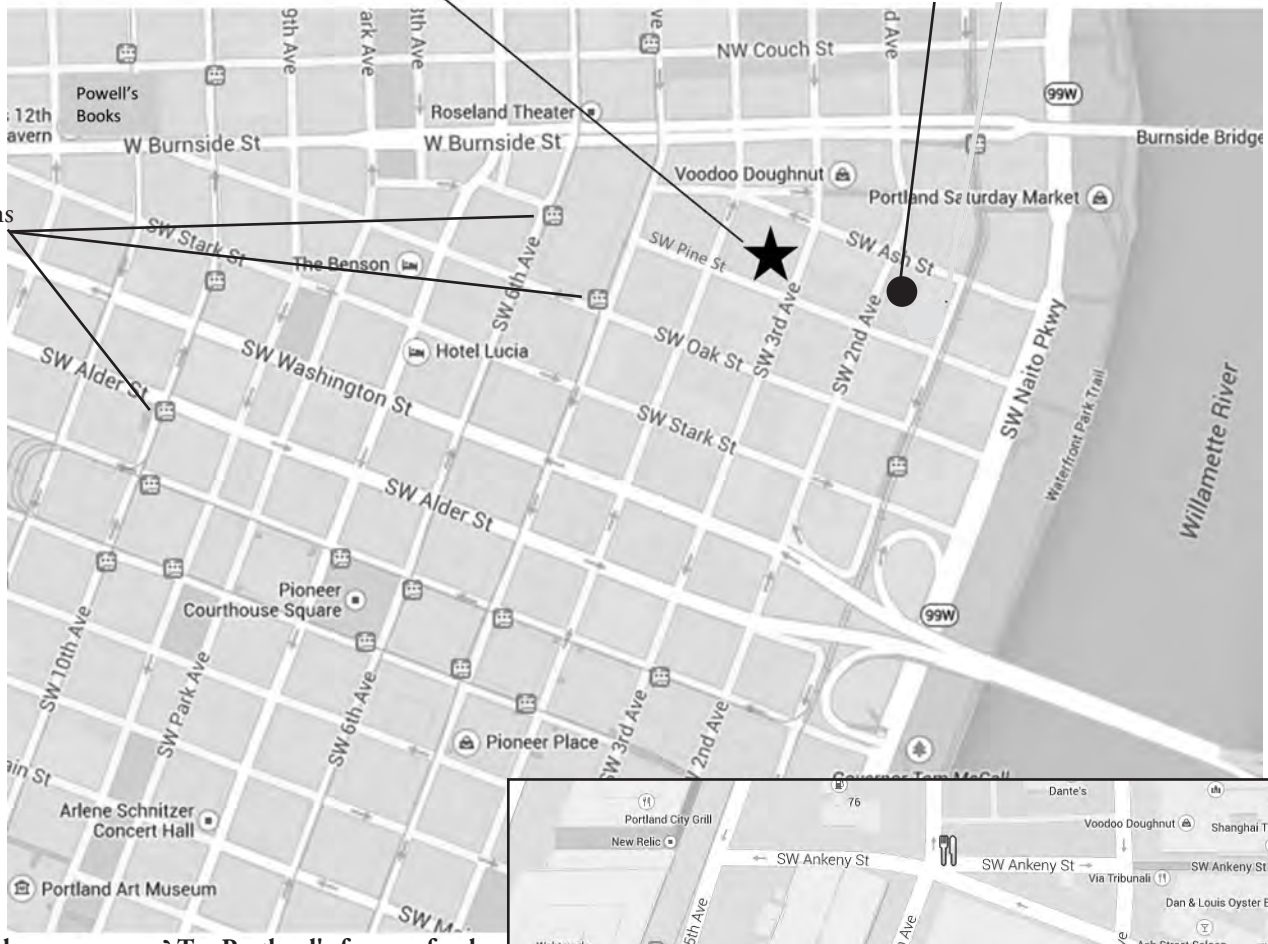
Defining a New Ecological Baseline: Pacific Northwest Fauna and Flora in the Anthropocene

February 24-27, 2015
Embassy Suites Hotel
Portland, Oregon

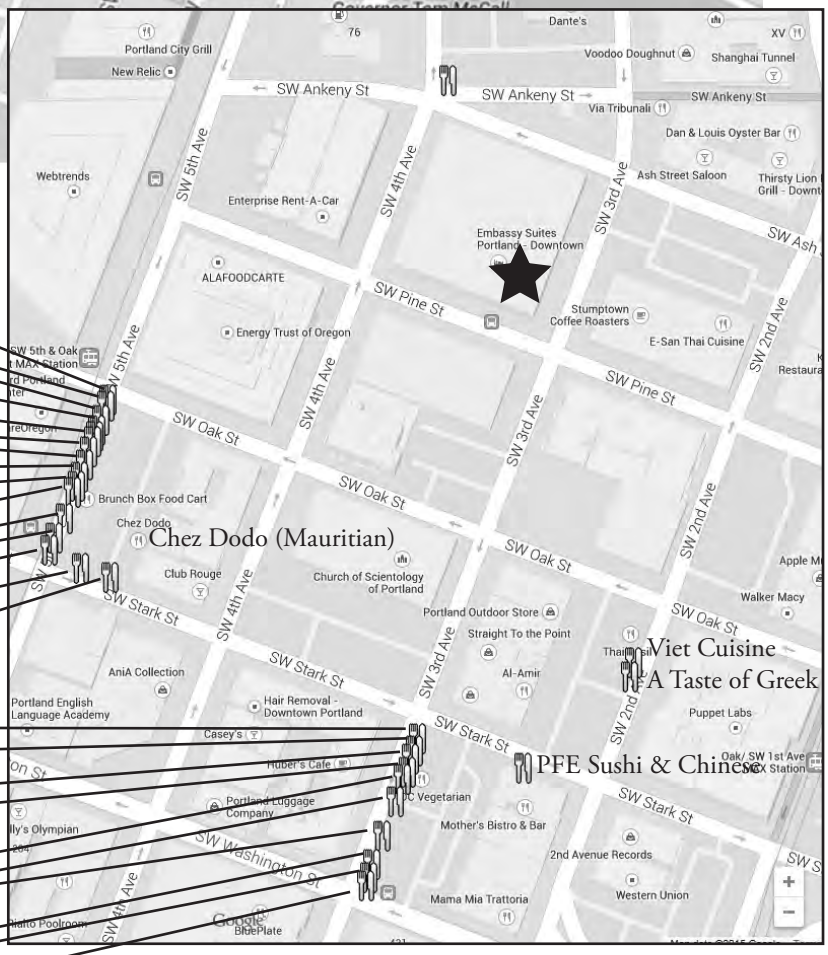
The Society for Northwestern Vertebrate Biology
&
NW Partners in Amphibian and Reptile Conservation
2015 Joint Annual Meeting

NW PARC Social at Kells Irish Restaurant and Pub 112 SW 2nd Ave. Tuesday, Feb. 24 at 7:00 pm

Embassy Suites Portland – Downtown 319 SW Pine St



These icons mark Max Light-rail stations



Lunch on your own? Try Portland's famous food carts, not far from the hotel.

- Aybla Mediterranean Grill
- Saigon (Vietnamese)
- Boolkogi Taco Korean BBQ
- La Jarochita (Mexican)
- Spoons (soup)
- Thai Sky
- Philly Cheese Steaks & Hamburgers
- Julie's Food (Vietnamese)
- Khob Khun Thai Food
- Brunch Box (burgers - also breakfast)
- Veli Thai Food
- Real Taste of India
- Bulkogi Korean BBQ
- Tabor (Czech food)
- The Swamp Shack (Cajun)
- Francisco Taqueria
- Just Thai
- Pho Le (Vietnamese & Thai)
- DC Vegetarian
- Beez Neez (sausages, incl. reindeer)
- Asia Express
- Taste of Korea
- Sonny Bowl (vegan bowls)
- Tito's Burritos
- El Masry Egyptian

Society for Northwestern Vertebrate Biology
Northwest Partners in Amphibian and Reptile Conservation
2015 Joint Annual Meeting

Defining a New Ecological Baseline: Pacific Northwest Fauna and Flora in the Anthropocene

Welcome Message

Welcome to Portland for our meeting. The City of Portland is an appropriate venue for our theme in that it has over 279 parks. Public parks and natural areas exceed 4,000 ha (10,000 acres) and include a wide range of habitats for a large diversity of Pacific Northwest species. Forest Park, the largest of the urban parks, has over 100 native bird species, 50 mammals, 8 amphibian species (with some reports of perhaps 9, take a break and look for them all!), and hundreds of arthropod species. Portland also has the world's smallest park, 0.292 square meters, Mill Ends Park, according to the Guinness Book of World Records. Irrespective of Mill Ends small diversity, based upon a probable species area curve, research in urban environments for ecological research has largely been ignored. As we move into the Anthropocene with increased urbanization and human impacts in rural areas we need to consider a new paradigm of management across this patchwork of differently altered landscapes. For this reason, we put together a program that consists of workshops and plenaries that addresses some of these issues. We hope that you enjoy the program.

SNVB and NW PARC have a long and committed history of collaborating on meetings and we are like a family. The collaborative approach to our meetings provide a greater array of participating organizations, resulting in more symposia topics explored and increased networking opportunities for all involved.

If you would like to be involved in either of these great organizations please contact us or other members of the boards. We are looking for new board members, media help, and an editor for the Murreletter. Also, your SNVB membership and NW PARC participation help to sustain the organizations, including publications (e.g., Northwestern Naturalist, NW Fauna), outreach materials, and meetings and workshops for professional development. Both organizations are committed to education, the best possible science for management, and describing the Natural History of the Pacific Northwest. SNVB has candidates for a number of board positions - please take time to vote (you should have been sent an electronic ballot, but paper ballots are available). The voting closes Feb. 26 at 6:00p.m.

Many individuals worked tirelessly to help put together this program. Without Becky Hill (VP-Oregon Region) this meeting would not have happened, she organized ALL aspects of the meeting from researching venues to the smallest details of projectors. We are very indebted to her, please give her your thanks. We think she is a superstar. Also from the SNVB group, Teal Waterstrat and Eric Lund contributed greatly to organizing the abstracts, lots of work on the program, and setting up the new Website and registration process. Other critical members of the SNVB board contributed significantly to the workshops, plenaries, sessions, volunteer organization, and fundraising. NW PARC's citizen science workshop was possible because of the dedication of several individuals on NW PARC's steering committee as well as the generous participation of citizen science experts that were willing to share their knowledge. We would also like to thank Northwest Ecological Research Institute for sponsoring their workshop and Becky Hill for being such a great liaison for SNVB and the venue.

On behalf of SNVB board and NW PARC steering committee, we would like to thank you for participating in this conference, and we hope you enjoy the breadth of talks and rich discussions that will surely follow. Please enjoy Portland and the diversity it has to offer.

Steve Wagner
SNVB President

Denim Jochimsen
Kris Kendell
NW PARC Co-chairs

Table of Contents

This pond in a city park wetland restoration area was intended to be much smaller. But the beavers downstream decided to dam it up into something bigger, and went to work on the alders and Oregon ash (below).

Meeting Planning Committee

Chair: Becky Hill

Committee Members: Tiffany Garcia, Erim Gomez, Paul Hendricks, Bob Hoffman, Denim Jochimsen, Kris Kendell, Eric Lund, Darcy Pickard, Lindsey Thurman, Steve Wagner, Kim Walters, F. Teal Waterstrat, Robert Weaver

Meeting Volunteers: Shawn Bell, Lauren Christy, Jordan Ellison, Brooks Estes, Craig Fergus, CJ Flick, Diana Forsberg, Megan Garvey, Bradford Hickswa, Robert Hoffman, Jim Holley, Leigh Anne Isaac, Denim Jochimsen, Aline Jossi, Chris Kopet, Sydney Lisignoli, Lindsay Magill, Juliana Masseloux, Paige Minton-Edison, Kyle Pritchard, Zuriel Rasmussen, David Reavill, Lori Salzer, Elena Skjerping, Veronica Vaca

Program Layout: Kathryn Ronnenberg

Cover Design: Becky Hill

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The Society for Northwestern Vertebrate Biology

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Rough-skinned Newt in the road.

Dixon Creek - an urban watershed.

Bald Eagle.

Sponsors and Contributors to the 2015 SNVB Annual Meeting

The Society for Northwestern Vertebrate Biology would like to acknowledge the generosity of the following sponsors of the 2015 annual meeting:

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Special Events

NW PARC-SNVB Welcome Social, hosted by NW PARC

Tuesday Feb. 24, 7:00 pm, Kells Irish Restaurant and Pub, 112 SW 2nd Ave.

All meeting attendees are encouraged to walk a couple blocks east on Pine Street from the Embassy Suites to Kells Irish Pub on Tuesday evening for food, drink and a chance to catch up with old friends. **All NW PARC & SNVB attendees welcome!**

SNVB Member Luncheon

Wednesday 25 Feb., noon - 1:00 pm, Arcadian Garden, Lower Level 2

Our business luncheon is your opportunity as an SNVB member to come hear what your board has been up to over the past year along with our goals going forward. We will also outline current openings on the board and other opportunities for members to get involved. Lunch will be provided to all those who indicated that they would attend when they registered for the meeting. Members will also have a chance to cast their votes for candidates nominated for expiring board positions.

Elections: Current SNVB members should have received an email in the weeks leading up to our annual meeting with a link to our online elections ballot which included candidate biographies. For those that did not vote online, paper ballots will also be available throughout the meeting and voting will close at the start of the banquet, 6:00 pm on Thursday February 26, so that we can announce our elected board members during the awards ceremony. Candidate biographies are also printed in this program.

Student Mentoring Session

Wednesday 25 Feb., 3:00 - 5:00 pm, %ÒÉÃ (ÁÕÓÅÒ Room

The mentoring session is a great opportunity for students to learn from and connect with professionals in a casual setting.

The first half of the session will include a **45 minute workshop-style lecture "Ten Steps to Better Poster Design"** on professional poster design guidelines and techniques led by Kathryn Ronnenberg. Kathryn is the copy editor for Northwestern Naturalist, and a Research Information Specialist with the US Forest Service's Aquatic Ecology and Management team in Corvallis, Oregon, where she specializes in graphic design and technical editing.

Following the workshop, participants will have the opportunity to ask questions, network, learn about future job markets and develop contacts with individuals working in a variety of areas including biology, research, natural resource management and related fields.

Wednesday Feb. 25, Queen Marie Ballroom - full bar for poster session & social

Poster Session

6:00 - 8:00 pm

More than two dozen posters will be presented during a two hour social event on Wednesday evening. Come check out all of the authors' hard work and graphic design skills and enjoy a (free!) cold beer on tap.

Slide Mix-a-Lot Social

8:00 pm until?

Clear your schedule on Wednesday evening, Feb. 25th because the Slide Mix-a-Lot social is going to be something to remember! Four esteemed members of our society will volunteer to present 10 minute 'scientific' talks using slides that they have never seen before! They will be just as surprised as you are when a slide containing a rainbow colored unicorn pops up, or a graph depicting the correlative relationship between bighorn sheep sightings and happiness. Don't worry, presenters: free beer or even a full cash bar will be within reach. The audience will vote for the best presentation and heckling is encouraged!

Photography Contest

Thursday 26 February, voting ends at 6:00 pm

Our annual photo contest will take place during the banquet and will be in digital format again this year. Volunteer judges will select up to three finalists in each category prior to the banquet and these images will be projected on the big screen leading up to dinner. Paper ballots will be available on all tables and all attendees are encouraged to vote for the winner of each category. The votes will be tallied during dinner and the winners will be announced before the conclusion of the banquet during our awards ceremony.

Special Events

Annual Banquet - Queen Marie Ballroom

Thursday 26 February, 6:00 pm (Silent Auction and bar open at 5:00 pm)

Join us at the annual banquet to socialize, eat good food and enjoy our **silent auction** while we summarize society announcements from the past year. Before dinner, **Jeremy Monroe of Freshwaters Illustrated** will inspire us with awe at the beautiful underwater world. Full details are available in the banquet section of this program. The banquet will conclude with the presentation of our annual awards including our 2015 student scholarship winner, best student oral presentations and posters and the photography contest. We will also recognize one or more SNVB members for their long-standing contributions to the society. As at the poster session and social, SNVB is hosting free beer and full cash bar is available, beginning at 5:00.

Field Trips - Friday 27 February

Please check the Announcement Board near the registration booth for important last-minute details.

Field Trip #1 – Behind the Scenes at The Oregon Zoo

Time: 10:00 - approx. 11:30 am **Trip leaders:** Dr. David Shepherdson and Zoo Staff
Cost: $18 USD, includes zoo admission **Registration deadline:** February 23, 2015

Dr. David Shepherdson (Deputy Conservation Manager) and zoo staff have built a custom guided tour for NWPARC and SNVB conference attendees! The tour will highlight the Oregon Zoo's behind the scenes conservation projects, including the western pond turtle captive rearing program and the Imperiled Butterfly Lab where Oregon silverspot and Taylor's checkerspot butterflies are raised.
Registration cost includes admission into the zoo and participants are welcome to explore after the tour is complete.

Other Notes:
Participants must be at least 10 years of age. Programs involving zoo animals are subject to change or cancellation based on animal needs. However, every effort will be made to offer alternate areas or reschedule tours.
Because these tours take place during zoo hours, animals will generally be on exhibit and not in the behind-the-scenes areas. Tour requires walking in working areas that include stairs. Not all areas of the tour may be wheelchair accessible.

Field Trip #2 – Next Adventure Beginner Kayak Lessons and Ross Island Tour

Time: 1:30 – 4:00 pm **Location:** The tour will start and end at Sellwood Waterfront Park

Experience necessary: None **Equipment needed:** All necessary equipment will be provided

Registration deadline: February 23rd, 2015 **Student to teacher ratio:** 6:1

Cost: $34 USD per person includes transportation from the hotel and all necessary equipment

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NEXT ADVENTURE
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We've all got to start somewhere. Why not on a fun and educational 2.5-hour class on the Willamette River? We'll be trying out stable, beginner-friendly recreational kayaks as we paddle to Ross Island at a leisurely pace. You will learn basic kayak skills as well as get a chance to sneak up on some unsuspecting wildlife, perhaps some great blue herons and ospreys. Ross Island acts as refuge for large numbers of wildlife so don't forget to bring your binoculars. By the end of the class you will be equipped with the knowledge to safely paddle recreational kayaks on your own adventures.

Cancellations: Field trips may be cancelled if less than 6 people register for that trip; refunds will be issued, but only in this scenario. If you register and are no longer able to attend, we will not issue a refund, however, you may transfer your trip to someone else provided that you let us know in advance.

Meeting at a Glance

Workshop descriptions begin on p. 16

Tuesday 24 February - SNVB Workshops & NW PARC Meeting

7:30 am registration opens, outside Gevurtz Room (SNVB) & inside Queen Marie Ballroom (NW PARC)

	Fireside Room	Roy Yates Room	Gevurtz Room	Queen Marie Ballroom
8:00 am - noon	**Workshop #1 - Occupancy Modeling** *Leaders: Michael Adams & Tara Chestnut*	**Workshop #2 - Training for Media Relations and Commications / Communicating in Color** *Leaders: Tiffany Woods & Kathryn Ronnenberg*		9:00 am -12:15 pm **NW PARC meeting and workshop - Citizen Science: Expanding Science and Ecological Literacy**
	Lunch on your own			*lunch provided*
1:00 - 5:00 pm	**Workshop #1 - Occupancy Modeling** continues	**Workshop #3 - Museum Collections and Specimen Vouchers** *Leaders: Brian Sidlauskas & Chris Marshall*	**Workshop #4 - Western Pond Turtle Biology, Conservation & Survey** *Leaders: Gwen Bury & Bruce Bury*	1:30 - 5:00 pm **NW PARC meeting and workshop** continue

6:00 pm **SNVB Board Meeting at Portland Prime**

7:00 pm **NW PARC and SNVB social - Kells Irish Restaurant and Pub - All are welcome!** (see p.6; map, p.1)

Wednesday 25 February - SNVB Annual Meeting

7:30 am Registration opens, outside Gevurtz Room

Queen Marie Ballroom

8:00 am Opening remarks - Steve Wagner, SNVB President

8:15 am **Plenary I:** John Marzluff - Welcome to Subirdia

9:00 am **Plenary II:** Jonathan Soll - The Metro Regional Government Natural Area Program

9:45 am *coffee break*

10:00 am **Plenary III:** Bob Sallinger - Carnage and mayhem on the urban landscape

10:45 am **Plenary IV:** Scott Becker - Human dimensions in wolf management

noon - 1:00 pm *SNVB Member Luncheon - Arcadian Garden, Lower Level Two*

	&ÉreÓÉÄÅ Room	' eÖÕÒÒÚ Room
1:00 - 2:00 pm	Ecology and Conservation of Northwest Freshwater Turtles	Urban Ecology
2:00 - 3:00 pm		Roads & Wildlife
3:00 - 4:00 pm		

%ÒÉÃ (ÁÕÓÅÒ Room

3:00 - 5:00 pm Student mentoring sessions, with **10 Steps to Better Poster Design** workshop

5:00 - 6:00 pm *Dinner (on your own)*

Queen Marie Ballroom

6:00 - 8:00 pm Poster Session - *hosted beer plus full* cash *bar available*

8:00 pm **SNVB Slide Mix-A-Lot Social**
hosted beer plus full cash bar available

Meeting at a Glance

Thursday 26 February - SNVB Annual Meeting

7:30 am	Registration opens, outside Gevurtz Room	
	&ÉreÓÉÄÅ Room **Concurrent Session I**	**' ÅÖÕÒÔÚ Room** **Concurrent Session II**
9:00 - 10:00 am	**Hands-free Sampling: Digital and Molecular (eDNA) methods for the 21st Century**	**The Anuran Takeover: Frogs in the NW**
10:00 - 10:15 am	*coffee break*	
10:15 - 11:45 am	**Hands-free Sampling,** part 2, with panel discussion	**The Anuran Takeover**, cont.
11:45 am - 1:00 pm	***Lunch (on your own)***	
1:00 - 2:15 pm	**Northwest Terrestrial Forest Fauna**	**Avian Investigations**
2:15 - 2:30 pm	*coffee break*	
2:30 - 3:30 pm	**Ichs & Herps: Form Influences on Ecology**	**Amphibian Disease**
	Queen Marie Ballroom	
5:00 - 9:00 pm	Photo Contest, Silent Auction & Raffle - *hosted beer plus full cash bar available*	
6:00 - 9:00 pm	**Banquet, Scholarships, and Awards** Banquet Speaker: Jeremy Monroe - Freshwaters Illustrated	

Friday 27 February - Field Trips

10:00 - 11:30 am	**Oregon Zoo Field Trip**
1:30 - 4:00 pm	**Willamette Kayak Field Trip**

Please check the Announcement Board near the registration booth for important last-minute details about field trips.

2011 Photo Contest Winner: Spadefoot, by Erim Gomez

Notes from plenary sessions:

Plenary Speakers

John Marzluff

John Marzluff, Ph.D., is Professor of Wildlife Science at the University of Washington. His research has been the focus of articles in the New York Times, National Geographic, Audubon, Boys Life, The Seattle Times, and National Wildlife. PBS's Nature featured his raven research in its production, "Ravens," and his crow research in the film documentary, "A Murder of Crows."

Red-breasted Sapsucker (*Sphyrapicus ruber*) drilling holes in the landscaping trees 10 feet from a busy street in front of an apartment building.

Welcome to Subirdia: A Look at Avian Ecology on Seattle's Urban Fringe.
John M. Marzluff, *School of Environmental and Forest Sciences, University of Washington, Seattle, WA 98195.*

My graduate students and I surveyed avian richness and abundance along a gradient of urbanization from Seattle, WA east to the Cascade Range foothills. Consistent with the intermediate disturbance hypothesis, we found diversity peaked in suburban settings. From 1998-2010, we focused on avian community and population dynamics at 26 study sites: 5 forested reserves, 10 single-family suburban developments, and 11 developing subdivisions (those under construction during the tenure of our research). In this "before-after-control' experiment, we color-banded (n = 3898) and annually spot-mapped territories (n = 7099) of six species. I summarize our findings noting that: 1) habitat conversion due to development caused the avian community to change as synanthropic and early successional species increased while sensitive forest species decreased; 2) annual adult survivorship correlated with these changes in abundance; 3) year-to-year movements of individuals as development proceeded were greater for forest than for early-successional species; 4) species that adapted and exploited development reproduced more successfully there than did forest-dependent species that avoided development; 5) adults of species that thrived in developments attained equal annual survival across reserved to developed landscapes, while species that avoided neighborhoods tended to survive poorly outside of reserves; 6) the humans living in our study areas frequently feed birds and provided nest boxes, actions that were positively correlated with increases in secondary cavity-nesting and seed-eating birds; 7) humans also maintained outdoor cats, and 11% of humans both fed birds and let their cats outside, actions that were negatively correlated with the abundance of birds regularly using feeders. I discuss our findings relative to conservation goals, suggesting that diverse urban avifaunas are important to human engagement and wellbeing, as biodiversity begets biophilia.

Swainson's Thrush (*Catharus ustulatus*) and Pacific Wren (*Troglodytes pacificus*)—aka "avoiders"—moved twice as far in developing landscapes (167.5 m, n = 15) than in developed (63.8 m, n = 3) or reserved (74.9, n = 17) landscapes. Movement in developing subdivisions was often precipitated by site clearing and resulted in breeders packing into nearby less-disturbed remnant forest. Breeders from species that remained stable or increased during development—Song Sparrow (*Melospiza melodia*), Spotted Towhee (*Pipilo maculatus*), Dark-eyed Junco (*Junco hyemalis*), and Bewick's Wren (*Thryomanes bewickii*), aka "exploiters"—exhibited similar movements regardless of development type (developing: 58.2 m, n = 205; developed: 48.9 m, n = 68; reserved: 81.2 m, n = 67). The relative ease by which displaced breeders can secure productive territories influences the impact of housing development on avian conservation.

Plenary Speakers

Jonathan Soll

Jonathan Soll is the Science Division Manager for the Portland, Oregon-based Metro Regional Government's Natural Area Program. He leads a team of natural resources scientists responsible for setting natural area acquisition and restoration priorities and for implementing and tracking restoration projects on Metro's portfolio of nearly 16,000 acres. Jonathan and his team are also responsible for representing Metro on conservation science issues and working with partners on projects throughout the region.

Jonathan's training includes a biology degree from Reed College and a Master's degree in Forest Ecosystem Analysis from the University of Washington, College of Forest Resources; plus 25 years in the school of hard knocks doing practical conservation biology and natural resources management. Jonathan's conservation work has focused on three main tracks: restoration ecology, especially controlling invasive species to restore high-quality habitat, conservation planning and monitoring for enhancing management effectiveness, and developing conservation priorities for large landscapes.

Before joining Metro in 2009, Jonathan worked for the Nature Conservancy for 16 years, the last 10 as Portland Area Preserves Manager and Willamette Basin Conservation Director. Prior to resettling in the Willamette Valley in 1999, he served as Central Washington Project Manager for the Washington field office of The Nature Conservancy, where he managed biodiversity inventory and analysis projects on the Hanford Nuclear Reservation and the Yakima Training Center.

Jonathan's favorite wild habitats include oak savanna, open oak-pine-fir woodland, and subalpine meadows.

The Metro Regional Government Natural Area Program: 20 Years of Land Conservation for Nature and People. Jonathan Soll, *Metro Regional Government, Portland, OR.*

The three county area surrounding Portland, Oregon is home to Metro, the country's only elected regional government. Since 1992, the greater Portland Metropolitan region has seen a remarkable level of investment in land conservation that is now paying dividends in natural habitat, livability, and our community's access to nature. Launched in 1992 with the Metro Greenspaces Plan, this effort has been supported by bond measures in 1995 and 2006 that have provided $350,000,000 to Metro and local jurisdictions to acquire land to protect water quality and wildlife habitat and provide meaningful access to nature close to home. Over 14,000 acres have been acquired to date, with more on the way. During this time, Metro has developed a sophisticated approach to resource conservation and restoration. More recently The Intertwine Alliance has grown out of the rich soil that collaborating on natural areas protection produced. The Alliance, through its partners, has produced a Regional Conservation Strategy and Biodiversity Guide that highlight the value of the wildlife habitat in near-urban areas and explains the key strategies for achieving meaningful conservation in the most-developed portion of Oregon and southwest Washington. These successes in turn created support in the community for a $50,000,000 operating levy, one of the earliest if not the first in its kind in the U.S. In the next 6 months Metro will work with partners to develop it first 'System Plan', laying out a vision for our portfolio for the next decade.

Spring - when the Pacific Chorus Frogs come out and wander around in the streets.

Plenary Speakers

Bob Sallinger

Bob Sallinger has worked for Audubon Society of Portland since 1992 and currently serves as the Society's conservation director. Bob's responsibilities include developing Audubon's local regional and national conservation priorities which focus on creating green cities and native birds across the state of Oregon. His responsibilities also include overseeing Audubon's Backyard Habitat Certification Program, citizen science programs, and its wildlife hospital which treats more than 3,000 injured wild animals each year. The Portland Audubon Society is the largest chapter of the National Audubon Society, with over 14,000 members in the Portland Metropolitan Region. In addition to his work at Audubon, Bob also serves on the Portland Parks Board, as an elected director East Multnomah County Soil and Water Conservation District, and as an adjunct law professor at Lewis and Clark Law School. Bob's passion for conservation was developed early exploring the woods of Massachusetts and later on solo hikes from Mexico to Canada on the Pacific Crest Trail and from Canada to New Mexico on the Continental Divide. Bob has a B.A. in Biology from Reed College and a J.D. with a Certificate in Environmental Law from Lewis and Clark Law School. He lives in Northeast Portland with his wife Elisabeth Neely, three children, a dog, cat, goats and chickens.

Carnage and Mayem on the Urban Landscape: Moving Toward Livable Urban Landscapes for People and Wildlife. Bob Sallinger, *Conservation Director, Audubon Society of Portland, 5151 NW Cornell Road, Portland, Oregon 97210.*

Audubon Society of Portland has been a pioneer in the field of urban wildlife conservation with efforts to protect urban wildlife populations and habitat dating back more than a century. With over 14,000 members in the Portland Metropolitan Region, Portland Audubon is today the largest chapter of the National Audubon Society in large part due to is long-term commitment to connecting people with nature close to where they live, work, and play. Today that imperative has never been more important, as a growing majority of people in the United States reside on urban landscapes and as appreciation of the ecological importance of urban wildlife populations increases. Bob will discuss some of Audubon's innovative and occasionally controversial programs to engage urban communities with wildlife conservation through education, restoration, and citizen science programs. Audubon has used a wide array of strategies to increase public stewardship, address human-wildlife conflicts, reduce wildlife hazards, and drive proactive public policies and programs to protect and restore urban wildlife populations. Sallinger will discuss Audubon programs such as its wildly successful Swift Watch, which has been so popular that it generates traffic jams in NW Portland; its Backyard Habitat Certification Program, co-managed with Columbia Land Trust, which has enrolled over 2500 urban property owners and 180 acres of urban property in an aggressive restoration efforts; and a unique, longstanding collaboration with the Feral Cat Coalition to address cat predation on native birds. Our urban landscapes are populated with a wide diversity of wildlife, but for many urban residents, wildlife remains something remote and invisible. This talk will explore how we can change that dynamic.

Two urban cats (belled for cats even), and the Northwestern Gartersnake they caught.
Photos by Kathryn Ronnenberg

Plenary Speakers

Scott Becker

Scott Becker is the wolf specialist for the Washington Department of Fish and Wildlife in Wenatchee. He received an MS degree from the University of Wyoming examining factors limiting population growth of the north Jackson (WY) moose herd. Scott has been involved with large carnivore (grizzly bear, black bear, mountain lion, and wolves) management and monitoring activities since 2000 when he began working as a Trophy Game Biologist for the Wyoming Game and Fish Department (WGFD). He switched to strictly wolf management in 2008, working for both WGFD and the U.S. Fish and Wildlife Service's Wyoming Wolf Recovery Program, where he directed wolf management and monitoring activities in a large portion of northwest Wyoming. At present, Scott directs field activities related to wolf recovery and management in Washington.

Human Dimensions in Wolf Management: A Manager's Perspective. Scott Becker, ***Washington Department of Fish and Wildlife, Wenatchee, WA 98801; scott.becker@dfw.wa.gov***

The art of managing wildlife is often more about managing people than the animal itself. Large carnivores, wolves in particular, hold a special place in the American psyche, whether positive or negative, and management based on sound science is often challenged by the strong emotions and viewpoints many hold about the species. Throughout the Northern Rocky Mountains (Idaho, Montana, Wyoming, eastern 1/3 of Oregon and Washington), 20-30% of known wolf packs are involved in ≥1 conflict in any given year, but managing those conflicts involves balancing the interests of opposing groups whose identity is closely tied to their perception of wolves on the landscape. Further complicating the issue is dual state and federal management of wolves in the Pacific Northwest. The science behind wolf management provides some insight into the driving factors behind these competing interests and points to some possible solutions facing the expanding populations in Washington and Oregon. This will likely involve integrating lessons learned elsewhere with our unique ecological and human landscapes.

Banquet Speaker

Jeremy Monroe

Director, Freshwaters Illustrated

I came to educational filmmaking, photography, and writing from a background in aquatic ecology, and through a motivation to share the vibrant aquatic worlds that have always inspired me. Through the nonprofit organization, Freshwaters Illustrated, I work to produce images and stories about freshwater ecosystems, which are among the most diverse and threatened on earth. My work is a blend of visual art, science communication, and storytelling, and thankfully, very collaborative.

By sharing the nature and wonder of aquatic ecosystems, along with the people who work to understand and preserve them, I try to demonstrate and celebrate a richer and more holistic connection we all have to water. It is that deeper connection that I hope can inspire more sympathy for aquatic life, and that might contribute to a more inclusive movement to conserve freshwater ecosystems.

www.freshwatersillustrated.org | www.facebook/com/wemayfly

NW PARC Annual Meeting & Workshop - Tuesday 24 February

Queen Marie Ballroom, 9:00 am - 5:00 pm

8:30 am	Registration opens, Queen Marie Ballroom
9:00 am	Welcome and Introductions
9:15 am	**National PARC Update** - Priya Nanjappa and Jen Williams
9:45 am	*Keynote Address:* **Diary of a Citizen Scientist: Chasing Tiger Beetles and Other New Ways of Engaging the World** - Sharman Apt Russell
10:45 am	*Coffee Break (included in registration fee)*
11:15 am	Metro Sustainability Center's Wildlife Monitoring Program: data collection standards, monitoring methods, and recruitment of citizen scientists - Katy Weil
11:45 am	Snake Search: engaging youth and partners in citizen science programs - Katie Roloson
12:15 pm	*Lunch (included in registration fee)*
1:30 pm	Strengths and weaknesses of participatory science-aligned monitoring and education in the Salmon River Estuary - Erin Baumgartner and Karen Haberman
2:00 pm	Southwest Washington Amphibian Monitoring Project (SWAMP): A citizen's perspective - Peter Ritson, Michelle Devlaeminck, Jack Dojan, and Dave Newcomb
2:30 pm	An obsession with Odonata: engaging with citizen scientists to promote dragonfly conservation, provide habitat, and study their migration in North America - Celeste Searles Mazzacano
3:00 pm	*Coffee Break (included in registration fee)*
3:30 pm	iNaturalist and the success of "Herps in Texas" - Wendy Connally
4:00 pm	eBird and eBird Northwest: proven tools for citizen science - Wendy Connally and Bill Tweit
4:30 pm	State of the Union: herpetofaunal diseases - Dede Olson
4:45 pm	Discussion and concluding remarks
5:00 pm	*Dinner (on your own)*
7:00 pm	**NW PARC and SNVB social at Kells Irish Restaurant and Pub!** **All are welcome!** See map, p. 1

NORTHWEST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

SNVB Workshop Descriptions - Tuesday 24 February

Workshop #1 – Occupancy Modeling, 8:00 am - 5:00 pm, Fireside Room

Title: ***Assessing Species Probability of Occurrence*** **Cost:** $60 USD **Maximum Enrollment:** 30

Leaders: Michael Adams (*Supervisory Research Ecologist, US Geological Survey*) and Tara Chestnut (*US Geological Survey, Oregon Water Science Center*)

It is often of interest to ask questions about the probability of occurrence for a species of wildlife. For example, how does the probability that a pond is occupied by red-legged frogs relate to the occurrence of non-native fish? Such analyses rely on survey data that result from efforts to detect the species of interest and measure site characteristics. These analyses are hampered by false negatives: the failure to detect a species at a site where it is present. Occupancy models can be used to estimate the probability that a site is occupied and other parameters related to changes in occupancy despite false negatives. They use some form of repeat observations to estimate and account for the probability that a single observation will detect a species that is present. Since their initial development in 2002, there have been several important expansions of the occupancy modeling framework including multi-season models that estimate local extinction and colonization rates, two-species models that deal with false negatives in two species simultaneously, multi-state models that allow response categories beyond just presence and absence, and integrated habitat models that deal with sites that may or may not exist in a given year (e.g., ephemeral ponds). We have also come to better understand some of the pitfalls of occupancy models.

The main goals of this half day workshop will be to:

1) Offer an introduction to the basic occupancy model and the basics of free software called PRESENCE;
2) Overview of the range of occupancy models currently available;
3) Offer handouts to help get you started with occupancy studies and some hands-on time with PRESENCE.

The target audience is beginners who have little or no experience with occupancy analyses but a basic understanding of regression analysis.

Please bring your own laptop with the latest version of PRESENCE installed (http://www.mbr-pwrc.usgs.gov/software). Otherwise you should be able to pair with someone with a laptop. Contact Michael_Adams@usgs.gov with any questions.

Workshop #2 – Training for Media Relations and Communication / Communicating in Color 8:00 am - noon, Roy Yates Room

Cost: $30 USD **Maximum Enrollment:** 25

Leaders: Tiffany Woods, **Training for Media Relations & Communication,** 8:00 -10:00 am
Kathryn Ronnenberg, **Communicating in Color**, 10:00 am - noon

In **Training for Media Relations & Communication**, participants will learn how to create awareness of research beyond the standard scientific journal format. They will also learn how to work with reporters, stay on message and succinctly explain the significance of their research in layman's terms. Using interactive exercises and open discussions, participants will develop talking points about their research. Finally, you will observe a simulated on-camera interview followed by feedback.

This segment of the workshop will be led by Tiffany Woods. Tiffany runs the news team at OSU's Extension and Experiment Station Communications Department. She also writes press releases and magazine features, shoots photos and produces videos. Previously she was a financial and general news reporter for Reuters in Chile, a freelancer in Peru for U.S. newspapers, and a magazine editor near Chicago. She is a graduate of the University of Oregon's School of Journalism and Communication.

Communicating in Color: With more and more journals publishing online, more electronic media, and decreasing costs of color printing, scientists and students are increasingly asked to create figures and maps in color for publications and presentations. Good slide design presents additional challenges. However, just throwing a lot of color at a figure isn't a good method of design. Color can actually obscure the most important features of your graph, map, or figure, if it's used poorly. So how do we learn to use color well, effectively, and accessibly to communicate the points we're trying to emphasize? How much color is enough? Which colors should we use – particularly if we want to make sure our graphics can be understood by readers or viewers who may be color blind? (Roughly 8% of men are red-green color-blind, and 0.5% of women.) Can we reinforce meaning in ways that don't depend solely on color? Are we implying an unintended meaning with the colors we choose? How can we work with, not against, a viewer's instinctive interpretation of color choices, particularly on maps? These will be some of the topics covered in the workshop, along with a basic vocabulary for understanding color and how it works in print and on-screen. Participants are invited to bring along a figure or map they would like some advice on. — Kathryn Ronnenberg works for the US Forest Service, Pacific Northwest Research Station, doing graphic design and science editing, and is the copy editor for *Northwestern Naturalist*.

SNVB Workshop Descriptions - Tuesday 24 February

Workshop #3 – Museum Collections and Specimen Vouchers

1:00 - 5:00 pm, Roy Yates Room **Cost: $30 USD Maximum Enrollment: 25**

Title: *Presses, Pins and Preservatives — why vouchers specimens matter*

Leaders: This workshop will be run by curators, faculty and instructors at OSU and will cover a broad range of taxonomic expertise: Dr. Brian Sidlauskas (*OSU Department of Fisheries and Wildlife (FW) Assistant Prof and Curator of OSU's Ichthyology Collection – https://www.facebook.com/OregonIchthyologyCollection*), Jessica Castillo (*OSU FW Dept. PhD candidate and instructor of Bird and Mammal Preservation*), and Dr. Chris Marshall (*Curator of the Oregon State Arthropod Collection – http://osac.science.oregonstate.edu/about*).

Have you ever collected and submitted a specimen voucher to a museum collection? If not, you should be! The importance of voucher specimen collection by field biologists in invaluable when you consider how many of us rely on vouchers to obtain data on distribution, introduction, adaptation and speciation. But the methods can be confusing and the field of collections is advancing quickly (e.g., eDNA and tissue collection in remote environments).

The main goals of this half-day workshop are to:

1) Overview the need for biological collections and the importance of archival knowledge;

2) Review of the diverse collection protocols for whole specimens, tissue, eDNA, etc. in the field;

3) Have a panel discussion on applications for this type of information and collection experiences in the field.

Workshop #4 – Western Pond Turtle Biology, Conservation and Survey Techniques

1:00 - 5:00 pm, Gevurtz Room **Cost:** $20 USD (students), $30 (non-students) **Max. Enrollment:** 40

Title: *Biology, Conservation and Survey Techniques of Western Pond Turtles*

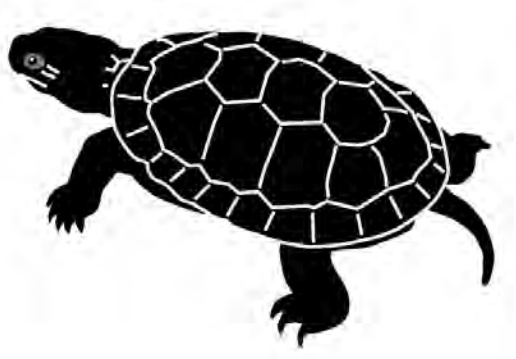
Leaders: Gwen Bury (*Dept. Integrative Biology, Oregon State University, Ph. D candidate*) and R. Bruce Bury (*U.S. Geological Survey; Emeritus Scientist*).

The Western Pond Turtle (WPT) is a species of high visibility and conservation concern. This workshop will review the life history, habitat requirements and behavior of this native turtle. We will demonstrate types of traps used, established field techniques (e.g., aging) and new methods (e.g., videos of aggressive behavior). Current threats and challenges to the species will be outlined. The workshop will conclude with a group discussion of management issues and conservation measures. This workshop is lecture, discussion and lab experience with no field study because the turtles are not active in February.The main goals of this half day workshop will be to:

Learning outcomes for this workshop include:

1) Understand the variety in WPT life history including differences in geography and life stages.
2) Students will become familiar with pros and cons of methods and approaches of population assessment.
3) Accurate assessment of status incorporates both size and age classes.
4) Management needs to include life history traits, local habitat conditions and regional challenges.

Participants will need to have a copy of the recent WPT handbook (Northwest Fauna 7) for use during the workshop. Northwest Fauna can be purchased online (http://thesnvb.org/northwest-fauna/) and they will be offered for $12 (cash only) at the workshop.



SNVB Workshop Descriptions - Wednesday 25 February

Ten Steps to Better Poster Design - workshop during Student Mentoring Session
Wednesday 25 Feb., 3:00 - 4:00 pm, %ÒÉÃ (ÁÕÓÅÒ Room

Cost: Free with registration **Maximum Enrollment:** none

Leader: Kathryn Ronnenberg (*US Forest Service, Pacific Northwest Research Station*)

Posters are inherently visual media. A well-designed poster should grab the viewer's attention and keep it, with compelling graphics, concise, understandable text, easy-to-read fonts, and an intuitive direction of information flow. Unfortunately, these paragons of poster design are few and far between at most conference poster sessions. All too often, a poster amounts to a slightly compressed, graphic-poor, version of a research paper, converted into awkward bullet points. So how can we create more effective, attractive posters? Begin with a focus on the your intended audience. Gather or create visuals of as many pieces of your information as possible, and make sure your color choices are accessible to all readers. Then tune and trim your text to cover your key points and fit your audience, and choose fonts and type sizes that are easy to read from a poster session distance. Attract attention with color and design, but don't distract attention with too much pattern or too many heavy boxes. Take and give proper credit, and review your product carefully. Then prepare to meet your public with a handout and a rehearsal of your talking points. This workshop will lead you through some of the details of how to polish your posters into a better product.

These Barn Swallows returned every year to nest on the light fixture in my carport. Their nesting success was low - the nest and eggs were often destroyed by a malicious little boy, and possibly the next-door neighbors. Out of the 16 years that I lived there, I only saw them fledge two nests-full of chicks.

Wednesday 25 February

7:30 - 9:00 am	Registration open – outside Gevurtz Room
	Plenary Session - Queen Marie Ballroom
8:00 am	Opening remarks - Steve Wagner, SNVB President
8:15 am	Plenary I: **John M. Marzluff** - Welcome to Subirdia: A Look at Avian Ecology on Seattle's Urban Fringe
9:00 am	Plenary II: **Jonathan Soll** - The Metro Regional Government Natural Area Program: 20 Years of Land Conservation for Nature and People
9:45 am	*break*
10:00 am	Plenary III: **Bob Sallinger** - Carnage and Mayhem on the Urban Landscape: Moving Toward Livable Urban Landscapes for People and Wildlife
10:45 am	Plenary IV: **Scott Becker** - Human Dimensions in Wolf Management: A Manager's Perspective
noon	*SNVB Member Luncheon - Arcadian Garden, Lower Level Two*

Wednesday 25 February

12:15 - 2:15 pm Registration open – outside Gevurtz Room

1:00 - 4:00 pm, Concurrent Paper Presentation Sessions

Abstracts begin on p. 23	&ÉreÓÉÄÅ Room	' ÅÖÕÒÒÚ Room
	Ecology and Conservation of Northwest Freshwater Turtles *Moderator: Bruce Bury*	**Urban Ecology** *Moderator: Teal Waterstrat*
1:00 pm	Overview of the Western Pond Turtle: distribution, ecology, and conservation status – Bruce Bury	Influence of small manmade barriers on sculpin (*Cottus*) species distribution and abundance in Puget Sound lowland streams – Teal Waterstrat
1:15 pm	Western Pond Turtles in the upper Willamette Valley: widely distributed, relatively abundant, fast-growing, and socially interactive? – Gwendolynn Bury	Evaluating marine nearshore connectivity: an exercise for the Bellingham Bay shoreline – Ilon Logan
1:30 pm	Riverine spatial dynamics of the Western Pond Turtle in free-flowing and regulated forks of the Trinity River, CA – Donald Ashton	Effects of an American Crow roost on a wetlands restoration – Douglas Wacker
1:45 pm	Abundance dynamics of Western Pond Turtles (*Actinemys marmorata*) on the Trinity River using basking surveys – Melissa Snover	open
2:00 pm	*coffee break*	**Roads & Wildlife**
2:15 pm	Presence of Ulcerative Shell Disease in Western Pond Turtles in western WA - etiology and treatment success – Tammy Schmidt	★Identifying landscape restrictions to gene flow in the American Pika in the I-90 corridor via circuit theory analysis – Craig Fergus
2:30 pm	Status of Red-eared Sliders in south coastal BC and potential effects on Western Painted Turtles (coast population) – Aimee Mitchell	The effect of artificial light on wildlife use of passage structures – Leslie Bliss-Ketchum
2:45 pm	Introduced turtles in Oregon: distribution, breeding, and control efforts – Susan Barnes	★The effects of road noise on the calling behavior of Pacific Chorus Frogs – Danielle V Nelson
3:00 pm	Best management practices for conserving Oregon's native turtles: an overview – Laura Guderyahn	open
3:15 pm	panel discussion	
3:30 pm		
3:45 pm		
3:00-5:00 pm	Eric Hauser Room	
	Student Mentoring Sessions & **"Ten Steps to Better Poster Design Workshop"**, 3:00 pm	
5:00 pm	*Dinner (on your own)*	
	Queen Marie Ballroom - *hosted beer and full cash bar available*	
6:00 pm	**Poster Session** - see p. 22 for Posters at a Glance	
8:00 pm	**Slide Mix-A-Lot Social** - see Special Events for description	

Thursday 26 February

7:30 - 9:00 am Registration open – outside Gevurtz Room

9:00 am - 11:45 am, Concurrent Paper Presentation Sessions

Abstracts begin on p. 23	Fireside Room	Gevurtz Room
	Hands-free Sampling: Digital and Molecular (eDNA) Methods for the 21st Century *Moderator: Christian Engelstoft*	**The Anuran Take-over: Frogs in the NW** *Moderator: Blake Hossack*
9:00 am	★Harnessing computer vision for ecological monitoring – Ben G Weinstein	Amphibian skeletochronology: opportunities and hazards – Chris Rombough
9:15 am	Using environmental sampling to estimate *Bd* distribution and occupancy in amphibian breeding habitats in Alaska –Tara Chestnut	★Underwater vocal behavior of the Northern Red-legged Frog—a pilot study – Danielle V Nelson
9:30 am	Prelimary results from five eDNA studies in southern BC – Jared Hobbs (5 min) **&** ★Mapping the distribution of the Columbia Spotted Frog in the Great Basin using environmental DNA – Matthew Smith (10 min)	Effects of water temperature on breeding phenology, growth, and metamorphosis of Foothill Yellow-legged Frogs – Clara Wheeler
9:45 am		Growth characteristics of Oregon Spotted Frogs from 3 populations in central Oregon – Austin Buskohl
10:00 am	*coffee break*	
10:15 am	Incorporating environmental DNA in monitoring programs: insights from Eastern Hellbender conservation – Stephen Spear	Evaluation of characteristics to differentiate larvae of Oregon Spotted Frog and Northern Red-legged Frog – Stephen Nyman
10:30 am	Identifying occupied Chinook and Coho salmon redds using environmental DNA analysis – David Pilliod	★Giant Frogs of Bend—Phenotypic plasticity in Oregon Spotted Frogs – Tlell Wolf
10:45 am	Designing efficient monitoring programs for amphibians using environmental DNA – Caren Goldberg	Ecological aspects of Oregon Spotted Frog eggs and larvae at ponds and meadows of the Samish River Preserve, Whatcom County, WA – Stephen Nyman
11:00 am	Discussion	Getting to the party on time: environmental cues for spring migration in Oregon Spotted Frogs – Jay Bowerman
11:15 am		Movement and habitat use of Oregon Spotted Frog in fall and early winter in Oregon – Christopher Pearl
11:30 am		Introduced reed canary grass attracts and supports a common native amphibian – Katie Holzer
11:45 am		Comparative roles of temperature and precipitation on wetland inundation and amphibian breeding in the Greater Yellowstone Ecosystems – Blake Hossack
noon	*Lunch (on your own)*	

Thursday 26 February

1:00 - 2:15 pm, Concurrent Paper Presentation Sessions

Abstracts begin on p. 23	Fireside Room	Gevurtz Room
	Northwest Terrestrial Forest Fauna *Moderator: Eric Lund*	**Avian Investigations** *Moderator: Robert Hoffman*
1:00 pm	Forest meadows: reptile biodiversity hotspots – Deanna Olson	★Pacific Mistletoe facilitates an increase in micro-habitat abundance and songbird species richness in OR White Oak stands – Kyle R Pritchard
1:15 pm	Woodland salamanders: abundances, functional roles, and use as metrics of seral status in PNW forest ecosystems – Hart Welsh	★Fish flying in the forest: the influence of salmon on songbirds – Marlene A. Wagner
1:30 pm	Near-term effects of repeated thinning with riparian buffers on headwater stream vertebrates and habitats in Oregon – Deanna Olson	The occurrence and occupancy status of the California Spotted Owl on Sierra Pacific Industries' lands in the Sierra Nevada – William Hall (for K Roberts)
1:45 pm	Indirect effects of Brown Bears (*Ursus arctos*) on small mammal populations in coastal ecosystems – Yasaman Shakeri	A benchmark survey of Oregon's birds built with eBird: the Oregon 2020 project – W Douglas Robinson
2:00 pm	Distribution and abundance of tree voles in the northern Coast Ranges of Oregon – Amy Price (Eric Forsman presenting)	open
2:15 pm	*coffee break*	

2:30 - 3:45 pm, Concurrent Paper Presentation Sessions

	Fireside Room	Gevurtz Room
	Ichs & Herps: Form Influences on Ecology *Moderator: Hart Welsh*	**Amphibian Disease** *Moderator: Steve Wagner*
2:30 pm	★Comparing jump performance and free movement of three species of northwest amphibians – Evan M Bredeweg	★Embryonic exposure to a pathogen and its influence in the development, hatching time and survival of the Pacific Chorus Frog – Jenny Urbina
2:45 pm	★Predator-mediated competition in an amphibian community – Lindsey Thurman	Ecology of the amphibian chytrid fungus *Batrachochytrium dendrobatidis* in lentic systems outside of amphibian hosts – Tara Chestnut
3:00 pm	★A morphological analysis of development in the Soft Sculpin, *Psychrolutes sigalutes* – Daniel Geldof	Enigmatic amphibian survival follows enigmatic decline and "extinction": lessons from Costa Rica to the Pacific Northwest – Steven Whitfield
3:15 pm	Functional anatomy of muscle length and jaw shape in Salish Sea sculpins – Nicholas Gidmark	open
3:30 pm	★Intraspecific agonistic and display behavior of the terrestrial Coastal Giant Salamander (*Dicamptodon tenebrosus*) – David Reavill	

Queen Marie Ballroom

5:00 pm	Silent Auction, voting for photo contest, hosted (free) beer, and full cash bar open
6:00 pm	**Banquet - Banquet Speaker: Jeremy Monroe** Silent Auction, Raffle, Scholarships, Photo Contest, and Awards - hosted beer, full cash bar

Posters at a Glance

A ★ immediately before the abstract title denotes a student speaker. Posters will be hung by number in the poster session.

1. Environmental DNA: using molecular analysis to detect Boreal Toad (*Anaxyrus boreas*) in an industrial setting in Alberta. DNA: using molecular analysis – Brandon Booker	★14. Prey odor discrimination and tongue flicking behavior by ingestively naïve and non-naïve neonate Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*) – Megan Linn
★2. Using clay models to test for avian recognition of aposematic warning coloration of Ring-necked Snakes (*Diadophis punctatus*) – Hannah Crow	★15. Microhabitat preference of Oregon Ensatina (*Ensatina eschscholtzii oregonensis*) in small populations in central Snohomish County, Washington state – Krista Little
3. Preliminary estimates of juvenile survival and dispersal in the White-headed Woodpecker – Phillip Fischer	16. Insights into avian nesting ecology: using remote cameras to quantify activities of nest predators at White-headed Woodpecker nests – Teresa Lorenz
4. Adaptive reuse of a historic farmhouse into a bat maternity colony – Cathy Flick	★17. Preliminary results examining survival, habitat use and movement of head-started Western Painted Turtles using radiotelemetry – Deanna MacTavish
5. Salamanders, global warming, and metrics of growth and biomass in Palouse Prairie wetlands – Erim Gomez	★18. Do crow vocalizations vary in different behavioral contexts? – Bri McCloskey
★6. Earthen dam provides habitat for a Black Salamander population in SW Oregon – Colin Guiley	★19. Differences in call number and type between two behavioral contexts of the American Crow (*Corvus brachyrhynchos*) – Alexis Menth
7. Prelimary results from five eDNA studies in southern BC – Jared Hobbs	20. Evaluation of an aquatic funnel trap for shallow water habitats used by Oregon Spotted Frog (*Rana pretiosa*) – Stephen Nyman
8. Using aquatic environmental DNA (eDNA) to track fish colonization following dam removal on the Elwha River, Olympic National Park, Washington – Marshal Hoy	★21. Ecology and behavior of the Colorado Checkered Whiptail lizard (*Aspidoscelis neotesselata*) in Grant County, Washington state – Troy Peterson
9. Alberta Volunteer Amphibian Monitoring Program – Kris Kendell	★22. Getting kids excited about natural history through inquiry-based science – Anne Salow
10. Herpetofauna of Alberta Biobank project – Kris Kendell	23. Red Knot (*Calidris canutus roselaari*) migration on the Pacific coast of the Americas – Lori Salzer
★11. Foraging value of temporary grasslands to barn swallows in an agriculturally dominated landscape – Olga Lansdorp	24. Field detection & assessment of ulcerative shell disease in Western Pond Turtles (*Actinemys marmorata*) in Washington – Tammi Schmitt
★12. Variation in call number and intracall variation of the American Crow (*Corvus brachyrhynchos*) between post-roost aggregations and diurnal activity centers – Alexander Lefort	25. Management plan and population analysis of Western Painted Turtles (*Chrysemys picta bellii*) at Fairview Creek Headwaters – Ashely Smithers
13. Determining species diversity and population size of bats at the Remac Mine, Pend d'Oreille Valley – Leigh Anne Isaac	★26. Preliminary results from "A spatial linkage of non-breeding habitat to breeding habitat of Oregon Spotted Frogs (*Rana pretiosa*) using a genetic parentage analysis" – Chelsea Waddell

Poster abstracts begin on page 42.

Presenting speaker's name is marked with an *, and abstracts are in alphabetical order by first author. Student presentations are denoted by ★ before the title of the talk.

Notes

Riverine Spatial Dynamics of the Western Pond Turtle in Free-flowing and Regulated Forks of the Trinity River, California. Donald T. Ashton*, *USDA Forest Service, Pacific Southwest Research Station, Arcata, CA, 95521 & US Geological Survey, Forest and Rangeland Ecosystems Science Center, Corvallis, OR, 97331; dashton@usgs.gov*; Josée S. Rousseau, *Klamath Bird Observatory, Ashland, OR;* James B. Bettaso, *US Fish & Wildlife Service, East Lansing Field Office, East Lansing, MI, 48823*; Hartwell H. Welsh, Jr., *USDA Forest Service, Pacific Southwest Research Station, Arcata, CA, 95521.*

Turtles are long-lived organisms and many species exhibit some degree of fidelity to sites used for particular life-history functions; sea turtles return to their natal nesting beaches, in confined lentic waters turtles often show allegiance to a cove or stretch of shoreline, and in rivers they may exhibit affinity to certain portion of a continuous habitat. Based on capture-recapture collected in 1990s (1991-4) and 2000s (2005-7) we describe movement patterns and site fidelity of Western Pond Turtles (*Actinemys* [*Emys*] *marmorata*) on two forks of the Trinity River, Trinity County, California, one free-flowing and the other dammed. Hypolimnetic releases to the dammed fork maintain colder summer water temperatures relative to the free-flowing fork where the water warms throughout the summer. We used dynamic segmentation in ArcGIS® 9.2 to assess the turtle locations and quantify individual movement distances from both study periods and forks. Most recapture locations were within several hundred meters of the previous capture, even for those spanning the decade. Site fidelity was high, with more than half of turtles moving <0.5 km), although long-distance movements (>2.5 km) were documented for several individuals of each sex . And while males on average moved further than females, the longest movements were by females (>5 km). Differences in movement distance between study periods or river fork was subtle and seldom statically significant. The long-term site fidelity reported here despite the anthropogenic perturbations of the riverine environment downstream of the dam suggests turtles may resist self-relocation as habitat degrades.

Introduced Turtles in Oregon: Distribution, Breeding, and Control Efforts. Susan P. Barnes*, *Oregon Department of Fish and Wildlife, 17330 SE Evelyn Street, Clackamas, OR 97015; susan.p.barnes@state.or.us.*

A variety of non-native turtles species occur in the wild in Oregon. The Red-eared Slider (*Trachemys scripta elegans*) and the Common (eastern) Snapping Turtle (*Chelydra serpentina*) are known to successfully reproduce and are considered highly invasive. Oregon's native turtle conservation partners have been working together for almost 10 years to determine how extensively these non-native turtles have spread and to learn more about their effects on native species, including Oregon's two native turtles, the Western Painted (*Chrysemys picta bellii*) and Western Pond Turtles (*Actinemys marmorata*). Partners have been collaborating on widespread education efforts as well as capture and removal efforts to reduce and control known invasive turtle populations.

The Effect of Artificial Light on Wildlife Use of Passage Structures. Leslie L. Bliss-Ketchum*, Catherine E. de Rivera, Brian C. Turner, *Department of Environmental Science & Management, Portland State University – ESM, PO Box 751, Portland, OR 97207-0751; blissket@pdx.edu;* Dolores M. Weisbaum, *Department of Geography, Portland State University – GEOG, PO Box 751, Portland, OR 97207-0751.*

Artificial light disrupts the behavior of birds, sea turtles, bats and other species; however, its effects on terrestrial animals are largely unknown. Such information is needed to inform mitigation of habitat fragmentation in the face of expanding urbanization. Wildlife crossing structures can help mitigate habitat fragmentation by roads, but some structures are proposed as dual-use (by foot/bike traffic and wildlife) and typically include artificial light. We studied the effect of ecological light pollution on animal usage of an under-road passage structure. On a weekly basis, sections of the structure were subjected to High, Low, or Zero light followed by a "Reference" period where all light treatments were off. Sand-track data were collected to determine use by the terrestrial vertebrate community during 2011 and 2012, documenting 23 species of mammals, birds, reptiles and amphibians. NMDS plots and ANOSIM analysis revealed significantly different vertebrate species assemblages using the passage between different light treatments ($p = 0.001$). We also found significant differences in usage based on activity period (nocturnal, diurnal, and crepuscular). Comparisons of the Reference period and Zero treatment found dramatic differences in the crepuscular group, suggesting that even the nearby presence of artificial light resulted in avoidance behavior.

Notes

It is clear that for the terrestrial vertebrate community, habitat connectivity is disrupted by the presence of artificial light, with a strong response by nocturnal species and the most dramatic avoidance in the crepuscular Columbia Black-tailed Deer (*Odocoileus hemionus columbianus*).

Getting to the Party on Time: Environmental Cues for Spring Migration in Oregon Spotted Frogs (*Rana pretiosa*). Jay Bowerman*, *Sunriver Nature Center, 57245 River Road, Sunriver OR 97707, frogs1@sunrivernaturecenter.org;* Christopher A. Pearl, *US Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis OR 97331, christopher_pearl@usgs.gov.*

The Oregon Spotted Frog (*Rana pretiosa*) is a highly aquatic, explosive breeding amphibian endemic to Oregon, Washington and lowland British Columbia. Throughout much of its range, this species overwinters under ice where it is largely isolated from the environmental cues of air temperature and precipitation reported to trigger spring migration in most amphibians and breeding takes place soon after ice out. Thus, getting to the breeding site on time presents an interesting challenge in this species. More than a decade of migration monitoring shows that *R. pretiosa* in Sunriver, OR, usually begin leaving a main wintering site in early March, regardless of ice cover. Early migration can occur at water temperatures <2°C, but higher temperatures have not stimulated migration earlier than the beginning of March. When heavy snow and ice cover extends into April, increasing numbers of frogs migrate before the ice is gone, but migration surges dramatically after ice-out, when light penetration rises sharply and water temperatures abruptly rise above 5°C. Initiation of migration in this population of *R. pretiosa* appears to be limited by a minimum calendar date, but additional factors influence the progression of migration later on.

★**Comparing Jump Performance and Free Movement of Three Species of Northwest Amphibians.** Evan M Bredeweg*, Tiffany Garcia, *Oregon State University, Nash Hall, Corvallis, OR 97331; evan.bredeweg@oregonstate.edu.*

Locomotion has long been a central focus of animal physiology and ecology. Studies on locomotor performance provide an approach for studying the lifestyle-specific movements of animals in controlled settings. In anuran amphibian species, jump distance has been correlated with body morphology (i.e., weight and limb length). This trait is also thought to be under strong selection as an anti-predator defense, as it is often used as a measure of performance for flight response. However, it is unclear how jumping capacity affects other movement behaviors, such as juvenile dispersal and exploration. As the need for conservation of amphibian species has increased, more attention has been focused on terrestrial movement and dispersal as an important factor for connecting populations across the landscape. Thus, linking quantitative measures of physiological jumping performance to dispersal ability and movement behavior can improve our understanding of amphibian species persistence. To assess how these factors interact, we compared jumping performance, morphology, and short-term movement behavior in juveniles of three northwestern anuran species (*Pseudacris regilla*, *Rana cascadae*, and *Anaxyrus boreas*) using maximum jump distance, photographic limb measurements, and fluorescent powder-tracking. Individual performance for these variables was tracked throughout the experiment and compared after accounting for difference in body size. We hypothesized that longer jump distances will cause decreased free-movement distance. As recent approaches to understanding dispersal behavior show the importance of intra- and inter-specific variation, future experiments such as this one can provide vital information on the movement of these animals during a cryptic life stage.

Western Pond Turtles in the Upper Willamette Valley: Widely Distributed, Relatively Abundant, Fast-growing, and Socially Interactive? Gwendolynn W Bury*, *Department of Zoology, Oregon State University, Corvallis, OR 97731; buryg@onid.orst.edu;* R Bruce Bury, *1410 NW 12th Street, Corvallis, OR 97330; burybr@peak.org.*

There is concern about the status and survival of the Western Pond Turtle (*Actinemys marmorata*) in the Willamette Valley, Oregon. In summers of 2012- 2014, we caught 65 turtles in two small ponds at Luckiamute State Recreation Area, near Albany, Oregon. Most were adults, but there were juveniles (26%). Over half the marked turtles were recaptured at least once. They have fairly rapid growth rates. A few were large-sized (e.g., one male was 193 mm carapace length and weighed 1010 g). Radiographs of 11 females revealed a moderate clutch size ($\bar{x}$= 6.0, range 5–8). We found high levels of turtle-specific algae (*Arnoldiella chelonum*) on most turtle shells. The Luckiamute ponds appear to have a healthy population of Western Pond Turtles. Turtles observed in Eugene ponds had many cases of aggressive interactions. More field studies are

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needed to better define the status and population trends of Western Pond Turtles in western Oregon. We recommend a thorough survey of suitable habitat prior to other conservation efforts.

Overview of the Western Pond Turtle: Distribution, Ecology and Conservation Status. R. Bruce Bury*, *1410 NW 12TH Street, Corvallis, OR 97331; burybr@peak.org.*

The Western Pond Turtle (*Actinemys marmorata*) is a species of concern in OR and CA, and considered endangered by the state of Washington. It was previously proposed for federal listing. Aquatic systems in the Pacific Northwest are experiencing multiple threats from pollution, draining or alteration of habitat, and invasions by predators. Native turtles appear to be declining, but we lack comprehensive inventories of their occurrence and abundance. Invasive species appear to be increasing in numbers and are now breeding at several locations. My field studies reveal recaptures of turtles marked 40–42 yrs ago. Although few individuals (<5%) reach such an age, some are 55+ yrs or older. Today, there are critical needs to: (1) document the current distribution and relative abundance of native turtle species; (2) compare key population features and habitat requirements of native and invasive turtles across different habitats; and (3) initiate studies on how these co-mingled turtle communities interact. It is time to develop regional action plans to better protect and restore turtles in the Pacific Northwest. Habitat loss and alteration remain the principal threats to the long-term survival of these turtles. Turtles receive widespread public support and are charismatic, which assists in efforts to protect them.

Growth Characteristics of Oregon Spotted Frogs from Three Populations in Central Oregon. Austin Buskohl* and Jay Bowerman, *Sunriver Nature Center, 57245 River Road, Sunriver OR 97707; austin@sunrivernaturecenter.org; frogs1@sunrivernaturecenter.org.*

The Oregon Spotted Frog (*Rana pretiosa*), recently listed as "Threatened" under the federal Endangered Species Act, has disappeared from an estimated 70% of its range. Management decisions and conservation efforts affecting this species should be based on understanding of the frogs' basic biology. We used mark and recapture data from three populations to investigate growth rates and size distributions among three populations of Oregon Spotted Frogs in Deschutes County. We found no evidence of increase in length between metamorphosis and the first winter despite observations of active feeding by metamorphs. Nearly all increase in body length takes place during the next two summers, and little or no growth was seen after age 3. Growth begins in April or early May, and ends in late September or October. Females make up an increasing proportion of frogs older than 4, although both sexes reach at least 8 years of age.

Ecology of the Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis* in Lentic Systems Outside of Amphibian Hosts. Tara Chestnut*, *US Geological Survey, Oregon Water Science Center and Oregon State University Environmental Science Program; chestnut@usgs.gov, tarachestnut@gmail.com;* Deanna H. Olson, *US Forest Service Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331;* Chauncey W. Anderson, *US Geological Survey, Oregon Water Science Center;* Deborah D. Iwanowicz, *US Geological Survey, Leetown Science Center;* Andrew R. Blaustein, *Oregon State University Environmental Science Program and Department of Integrative Biology.*

Emerging infectious disease (EID) events have increased over the last several decades worldwide, and the proportion of recent EID events caused by fungal agents far outweighs all other disease agents. More than 30 extinction events have been attributed to fungal pathogens since 2000. One such pathogen is the amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), which is implicated in worldwide amphibian population declines and possible extinctions. We investigated the ecology of *Bd* in amphibian breeding habitats in the Willamette Valley, Oregon using molecular techniques sometimes referred to as environmental DNA. To investigate biotic and abiotic variables that may relate to the occurrence of *Bd* in amphibian habitats, we conducted an exploratory analysis using machine-learning methods (boosted regression trees) to generate new hypotheses regarding the occurrence of *Bd* in the aquatic environment. Amphibian density, species richness, and *Bd* infection in amphibians sampled were not associated with *Bd* detection in the aquatic environment, suggesting that *Bd* does not require an amphibian host to persist in wetlands. *Bd* detection in amphibian breeding habitats was associated with low organic carbon (<7.3 mg/L) and high euglenoid density (>116). If *Bd* is associated with low organic carbon conditions in the aquatic environment, it may have multiple strategies for accessing vital nutrients, and may assimilate both organic and inorganic matter

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to obtain nutrients (e.g., nitrogen). Euglenoids are common flagellated autotrophic or heterotrophic protists that typically occur in wetlands with high organic material, typical of lentic amphibian breeding habitats. If *Bd* retained traits of its closest relative, a saprobic chytrid that occurs in lentic systems, it's possible that *Bd* uses euglenoids as an alternate host. These strategies would allow *Bd* to persist in a diversity of habitats when amphibians are seasonally absent, and could offer an explanation for its widespread distribution and year-round persistence in aquatic habitats. While the specific roles that organic carbon and euglenoids have in influencing *Bd* occurrence in our study area are not clear, and it's possible that these results are spurious or stochastic in nature, they suggest that elements in the environment that are not related to amphibian hosts influence the occurrence of *Bd* at a site. Future work investigating whether *Bd* uses eugleniods as a parasite, saprobe, or both would help clarify this relationship. Our study supports the hypothesis that both abiotic and biotic factors independent of amphibians influence *Bd* occurrence in aquatic settings.

Using Environmental Sampling to Estimate Amphibian Chytrid Fungus Distribution and Occupancy in Amphibian Breeding Habitats in Alaska, USA. Tara Chestnut*, *US Geological Survey, Oregon Water Science Center and Oregon State University Environmental Science Program; chestnut@usgs.gov, tarachestnut@gmail.com;* Deanna H. Olson, *US Forest Service Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331;* Larissa L. Bailey, *Colorado State University, Department of Fish, Wildlife, and Conservation Biology;* Radu Popa, *University of Southern California, Biological Sciences;* Chauncey Anderson, *US Geological Survey, Oregon Water Science Center;* Andrew R. Blaustein, *Oregon State University Environmental Science Program and Department of Integrative Biology.*

Global incidence of emerging infectious diseases has increased at exceptional rates in recent years. Molecular methods sometimes referred to as environmental DNA (eDNA), can provide a greater understanding of the distribution of pathogens when they occur in the environment, outside of host species. The fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*) was first described in the late 1990s, and is potentially important in recent global amphibian population declines. In Alaska, *Bd* was first detected in 2002 in Wood Frogs (*Lithobates sylvaticus*) from coastal areas , but sampling efforts in 2006 failed to detect *Bd* in Wood Frogs in the interior. In this study, we investigated the occurrence of *Bd* in wood frogs and their breeding habitats in Alaska, and the relationship between *Bd* occupancy of breeding sites and environmental variables including temperature and precipitation. We used quantitative PCR to estimate Bd DNA recovered from frog skin and in water from Wood Frog breeding habitats. We detected *Bd* in Wood Frogs and water filters throughout the study area; however, there were no occasions when we detected *Bd* in both sample-types from the same site. Approximately 41% of Wood Frog breeding habitats we sampled were occupied by *Bd*. When *Bd* was present at a site, there was a 95% chance of detecting it with 2 to 7 samples depending on the volume of water sampled. Sampling using molecular methods provided a greater understanding of Bd distribution in our study area than could be revealed by sampling amphibians alone. Bd was detected in at least 20% more sites by sampling breeding habitats. By accounting for imperfect detection, our high-latitude study provided a truer estimate of Bd distribution in Wood Frog breeding habitats, but more has to be done to determine the relationship between Bd occupancy of habitats and the occurrence of infection in Wood Frogs. This work shows that if the objective of a study is to determine the Bd status of a natural site, sampling the habitat rather than the animals may be the most cost-effective approach in terms of time and resources; however, inference of the disease status of an amphibian population (or potential secondary hosts or vectors) cannot be made except by sampling them directly.

★**Identifying Landscape Restrictions to Gene Flow in The American Pika (*Ochotona princeps*) in the I-90 Corridor Via Circuit Theory Analysis.** Craig Fergus*, *FergusC@cwu.edu*; Joseph Lorenz, *LorenzJ@cwu.edu*; Kristina Ernest, *ErnestK@cwu.edu*; Steve Wagner, *WagnerS@cwu.edu; Central Washington University, 400 East University Way, Ellensburg, WA 98926 .*

A healthy level of gene flow between populations is important to the long-term persistence of wildlife species. This movement can be impeded, however, by a number of natural and anthropogenic landscape barriers that slow or block dispersal. Knowing the impact of these different features could therefore be helpful in management and land-use decisions. Our study used GIS tools to compare genetic connectivity between 14 American Pika (*Ochotona princeps*) habitat patches across a 30 square mile area adjacent to Interstate 90 near Snoqualmie Pass, WA. Tissue samples were collected from 85 individuals, along with 80 distinct

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fecal samples. Samples were genotyped at nine microsatellite loci and then compared to generate Fst values between populations. The Circuitscape program was then used to calculate "distance scores" for all possible routes between each population's location. These scores were based on resistance surfaces generated by systematically varying the potential impact of roads, water bodies, elevation, slope, and vegetation density. The corresponding matrices of Fst values and distance scores were compared via the Mantel test. Each parameter was assessed first in isolation and then grouped with other parameters to create the final models. AIC was used to determine the model with the strongest correlation to the genetic data. Additionally, as the Washington State Department of Transportation (WSDOT) is in the process of adding multiple wildlife crossing structures across I-90, the analysis was re-run with simulations of the crossing structures in place. This provided an assessment of the possible improvement to connectivity provided by the structures.

★A Morphological Analysis of Development in the Soft Sculpin, *Psychrolutes sigalutes*. Daniel L Geldof*, Nicholas J Gidmark, *University of Washington, Friday Harbor Laboratories, 620 University Road, Friday Harbor, Washington 98250; dgeldof@u.washington.edu; Gidmark@uw.edu.*

The early life history of fishes is enigmatic, yet pivotal. In a relatively short timeframe, fragile, unrecognizable planktonic larvae undergo radical physical and behavioral transformations. Despite the critical nature of early life (survivorship hovers around 1%), ecological interactions, such as predator-prey dynamics, are difficult to observe and largely unknown. Morphological analyses are powerful indirect tools for understanding the dynamic demands on growing fish. Examinations of relative development speeds in morphological pathways (e.g., propulsive structures versus feeding elements) clarify the importance of their corresponding behaviors. The physical/behavioral transitions of larval development are defined by widely-documented phases (notochord flexion, skeletal transformation, larval-juvenile behavioral shift, settlement, etc.) But, at species-level, the process is more variable and nuanced. Soft Sculpin (*Psychrolutes sigalutes*) are one such example: rather than finding suitable habitat immediately following physical transformation, as most fish do, *P. sigalutes* returns to feed in the plankton at night, flitting between settlement attempts. Most growth, uniquely, takes place before settlement. Using cleared and stained specimens of developing *P. sigalutes*, we documented their protracted physical transformation, compared them with a sister taxon, *P. paradoxus*, and other previously-studied species. Rapid development of feeding, propulsive, and mechanosensory structures suggests that *P. sigalutes* quickly becomes an effective nighttime pelagic hunter. The delayed growth of protective and structural components suggests a trade-off in robustness and settlement capability for rapid predatory dominance. We speculate that developing *P. sigalutes* may be apex predators in their planktonic environment, possibly responsible for top-down forcing of earlier settlement periods in cohabitant ichthyoplankton.

Forsman, Eric - See abstract under Price, Amy

Functional Anatomy of Muscle Length and Jaw Shape in Salish Sea Sculpins. Nicholas J Gidmark*, *University of Washington, Friday Harbor Laboratories, Friday Harbor, WA 98250; Gidmark@uw.edu;* Anna D Conrades, *Truman State University, Kirksville, MO 63501;* Nina L Finley, *Whitman College, Walla Walla, WA 99362*

Salish Sea sculpins are astoundingly diverse, and anatomy, kinematics, and muscle physiology collectively determine the biomechanical implications of this diversity. An often-overlooked variable is physiological muscle length: force declines as muscle is stretched or shortened and force is optimal at an intermediate length, so jaw-closing force is dictated by jaw-closing muscle length. Previous data suggest that snail size, for example, dictates gape in a molluscivore; since gape dictates muscle length, which dictates muscle force, prey size has an overriding effect on the predator's force available for crushing, and thus performance. The relationship of mouth gape (and gape change) to muscle length (and muscle length change) describes the implications of muscle physiology for organismal performance. We studied this relationship for several species of Salish Sea sculpin from the San Juan Islands. We found that the gape:muscle-length relationship changes through ontogeny; since muscle force and suction volume scale differently with size, larger fish face a force deficit when closing the mouth around an engulfed volume of water. In Great Sculpin (*Myoxacephalus polyacanthocephalus*), we found that this deficit is counteracted by ontogenetic changes in jaw shape, resulting in lower jaw movement per muscle length-change at larger sizes. Across five species, we found that the gape:muscle-length relationship co-evolves with muscle length, so muscle length-change magnitude remains relatively constant and low across phylogeny. The simple relationship between muscle length and gape distills

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important aspects of anatomy, in vivo kinematics, and muscle physiology, providing vital insight into the functional diversity of feeding mechanisms.

Designing Efficient Monitoring Programs for Amphibians Using Environmental DNA. Caren S Goldberg*, Katherine M Strickler, *Alexander K. Fremier School of the Environment, Washington State University, Pullman, WA, 99164.*

Detection of amphibians using environmental DNA (eDNA) varies across systems and requires customized study design to achieve high detection probabilities. We have been investigating covariates of detection for 8 amphibian species in Arizona, Idaho, and Florida. At Arizona wetlands, detection probabilities were limited by diffusion and sample volume. Adjusting sampling design to include spatially distributed samples and increasing the pore size on filters from 0.45 µm to 6 µm so that sample volume could be increased improved detection probabilities for amphibians (to 0.63 – 0.77 per sample), although the increase in pore size may have reduced concurrent detection of ranavirus. At Florida wetlands, detection probabilities were limited by acidity, with detections at sites with pH > 5 at 0.75-1.0 and pH < 5 at 0-0.25. In streams in Idaho, we found that amount of Rocky Mountain Tailed Frog (*Ascaphus montanus*) eDNA did not differ between samples taken along transects from faster and slower flowing waters (p = 0.70), although for Bull Trout (*Salvelinus confluentus*) these slower-water samples had 4X more eDNA than the matched fast-water samples (p = 0.01). Based on these results and those from other studies, we are developing technical transition tools for agencies, including a field sampling protocol, guidance for choosing a laboratory to analyze samples, and a Website with videos, protocols, references, and potentially a discussion forum.

Best Management Practices for Conserving Oregon's Native Turtles: An Overview. Laura Guderyahn*, *City of Gresham Natural Resources Program, 1333 NW Eastman Parkway, Gresham, OR 97030; laura.guderyahn@greshamoregon.gov.*

Oregon's two native turtle species have experienced significant population declines and continue to be highly vulnerable to habitat loss and other anthropogenic impacts. Even restoration work that involves ground disturbance, in-water work, changes in water level and hydroperiod, planting of vegetation, and use of heavy equipment can negatively affect turtles. There has been a growing demand for known techniques for successfully avoiding and minimizing harmful effects on turtles at project sites and during project implementation. Additionally, there has even been a growing desire to incorporate turtle habitat elements into projects designed to benefit other species, such as native fish reconnection projects. To address these issues and needs, the Oregon Native Turtle Working Group recently produced "Best Management Practices for Conserving Oregon's Native Turtles". The document is a compilation of peer-reviewed, recommended best methods for creating suitable turtle habitat and for avoiding and minimizing harmful impacts to turtles and their habitats during project implementation. The Turtle BMPs help project planners and natural resource managers know how to: 1) determine if turtles are present on a project site; 2) create and enhance habitat specifically for turtles; and 3) plan, design and implement specific types of projects with turtles in mind. The BMPs also include useful information on turtle ecology, when to best conduct certain project actions, and tips for responding to certain turtle related scenarios. Regardless of the project type or situation, each can be made to be less harmful to turtles by considering the information in the Turtle BMPs document.

Hall, William - see abstract under Roberts, KN

Preliminary Results from Five eDNA Studies in Southern BC. Jared Hobbs*, *M.SC., R.P.BIO., Hemmera, 4730 Kingsway, Burnaby BC, V5H 0C6; jhobbs@hemmera.com;* Caren S Goldberg, *Washington State University, 100 Dairy Road, Pullman Washington, WA 99164, caren.goldberg@WSU.edu.* (**short-5 min**)

Environmental DNA (eDNA) methods provide an efficient alternative survey method for aquatic and semi-aquatic organisms. Field effort associated with sample collection is less intensive than that associated with traditional baited trapping (e.g., for Pacific Water Shrews, *Sorex bendirii*) and/or physical searches (e.g., for Northern Red-legged Frogs, *Rana aurora*). This method is non-invasive to the target species, reduces the risk of pathogen transfer between sites, is highly accurate for detection of species in lotic and lentic habitats, is able to detect the presence of pathogens and is cost-effective for species that are difficult to detect using traditional methods. The application of eDNA methods is receiving increasing attention in British Columbia

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(BC). In the 2014 field season, Hemmera and Washington State University collaborated to successfully implement seven eDNA projects on six species in southern BC. Target taxa included Rocky Mountain Tailed Frog (*Ascaphus montanus*), Coastal Tailed Frog (*Ascaphus truei*), Red-legged Frog, Great Basin Spadefoot (*Spea intermontanus*), Western Tiger Salamander (*Ambystoma mavortium*) and Pacific Water Shrew. The development of a primer for Pacific Water Shrew represents the first application of this method for detection of a semi-aquatic mammal in North America. These projects represent the first application of eDNA in BC in a formal environmental assessment process. Results will be used to inform conservation and management in both a regulatory and a conservation framework. During implementation, lessons were learned regarding survey timing, sampling design and qPCR assay design. Knowledge gaps are also identified and discussed.

Introduced Reed Canary Grass Attracts and Supports a Common Native Amphibian. Katie Holzer*, Sharon Lawler, *University of California, Davis, One Shields Avenue, Davis, CA 95616; kaholzer@ucdavis.edu.*

The control of introduced plants is frequently a demanding and expensive activity for habitat managers. It can be difficult to achieve sustained suppression for some well-established species, and control measures may harm native organisms. Reed Canary Grass (*Phalaris arundinacea*) is a common wetland invader that can produce near-monocultures and greatly alter wetlands. To examine the relationship between this plant and native amphibians we assessed field survey data and measured amphibian-plant relationships in constructed replicated experimental ponds. Survey data showed positive associations between Reed Canary Grass and three taxa of native amphibians in urban and suburban ponds in Portland, Oregon. Outdoor mesocosm experiments elucidated mechanisms whereby native and introduced plants influenced the preference and performance the common native Pacific Chorus Frog (*Pseudacris regilla*). Males preferred to call from Reed Canary Grass, and there was a strong trend for females to lay eggs on it compared to three other common plants offered. Tadpoles had seven times higher survival in Reed Canary Grass. Observations suggested that these patterns are likely due to the complex spatial structure and typical dimensions of this grass: it provides support for calling males, its leaves and shoots are of ideal size for oviposition, and it may provide refuge from predators. This study demonstrates that some introduced plants may be beneficial for native amphibians even if they appear to crowd a habitat. Improved understanding of the relationships between introduced plants and target species can help guide management by identifying situations where control of introduced plants may be de-prioritized.

Comparative Roles of Temperature and Precipitation on Wetland inundation and Amphibian Breeding in the Greater Yellowstone Ecosystem. Blake Hossack[1]*, *U.S. Geological Survey, Aldo Leopold Wilderness Research Institute, 790 E. Beckwith Avenue, Missoula, MT 59801; blake_hossack@usgs.gov;* Adam Sepulveda, *U.S. Geological Survey, Northern Rocky Mountain Science Center, 2327 University Way, Bozeman, MT 59715;* Andrew Ray, David Thoma, [2] *National Park Service, Greater Yellowstone Inventory and Monitory Network, 2327 University Way, Bozeman, MT 59715;* Debra Patla, *Northern Rockies Conservation Cooperative, P.O. Box 2705, Jackson, WY 83001.*

In Yellowstone and Grand Teton national parks, depressional wetlands constitute only 3% of the landscape. Despite their limited representation, 38% of Yellowstone's 1,200 plants, 70% of Wyoming's 400 birds, and all 5 native amphibians are associated with wetlands. Recent changes in temperature and precipitation are causing early drying or even a lack of inundation for these keystone habitats. Because climate forecasts unequivocally predict continued warming for this and many other regions, it is important to determine the link between climate and wetland inundation and its potential implications for species that depend upon these habitats. Based on cooperative National Park Service and US Geological Survey monitoring data collected between 2006 and 2012, the percentage of monitored wetlands that were inundated has varied between 59% (2007) and 96% (2011). We used long-term data to assess how wetland inundation and amphibian occurrence relate to climate drivers. We found that estimates of annual runoff (water flow that occurs when soils are saturated) explained nearly 65% of the variation in the percentage of wetlands inundated. Among native amphibians, the Boreal Chorus Frog (*Pseudacris maculata*) was most closely tied with annual runoff. In 2007, the hottest and driest year within our record, chorus frogs were documented breeding at only 60 wetlands. In 2011, a cool and wet year, we found chorus frogs in 110 wetlands. While our data show strong relationships between runoff, wetland inundation, and chorus frog occurrences, temperature rather than precipitation appears to be driving these patterns.

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Evaluating Marine Nearshore Connectivity: An Exercise for the Bellingham Bay Shoreline. Ilon Logan*, Jessica Redman, Jim Keany, *Environmental Science Associates, 5309 Shilshole Avenue NW, Suite 200, Seattle, WA 98107; ilogan@esassoc.com;* Vikki Jackson, *Northwest Ecological Services, Bellingham, WA 98225;* Renee LaCroix, *City of Bellingham Public Works Natural Resources, Bellingham, WA 98225.*

Bellingham Bay once consisted of expansive tidal flats enriched by multiple freshwater rivers, eelgrass beds, and mixed sand-gravel beaches. Major alterations to these marine nearshore habitats resulted from over 100 years of industrial uses and today, alongshore (waterward) and marine riparian (landward) connectivity are substantially impaired in some locations. To provide information to the Port and City of Bellingham's Waterfront District redevelopment process, we evaluated connectivity in 20 geographic units of the Bellingham Bay shoreline using a qualitative model. Each unit was assessed, for both the marine and terrestrial environments, based on habitat patch size and alteration, permeability within the unit, and permeability to the adjacent unit. Several elements were evaluated including sediment transport, organic material import and export, and organism mobility. The analysis indicates a strong relationship between development and relative connectivity. Overall, units containing developed features scored lower than units that were less developed and contained natural beaches and estuaries, and free of tidal restrictions. The dominant feature affecting connectivity along both the marine and terrestrial axes is the BNSF railway line, whereas industrial ports, marinas, docks and piers inhibit or limit the transport of sediment and organisms alongshore. The assessment reflects the role of human activity on nearshore connectivity and the relationship to potential restoration actions. Restoring patches of habitat may provide a set of "stepping stones" through the central waterfront, thereby improving habitat connectivity within a matrix of nearshore development.

The Status of Introduced Red-eared Sliders in Southern Coastal British Columbia and Potential Effects on Endangered Western Painted Turtles (Coast Population). Aimee M Mitchell*, Rebecca A. Seifert, *Athene Ecological and Coastal Painted Turtle Project, Vancouver, BC. V5N 1A5; athene.aimee@gmail.com and wptrecovery@gmail.com;* Christopher MA Currie, *Carex Ecological Consulting, Vancouver, BC, V5R 1X6; ccurrie.carex@gmail.com*.

The Red-eared Slider (*Trachemys scripta elegans*) is the world's most widely introduced freshwater turtle, and is listed by the IUCN as one of the world's 100 worst invasive species. In many areas where they have been introduced, sliders have been shown to represent a threat to native turtles through competition and disease transfer. Despite these concerns, little research has taken place on Red-eared Slider populations in the South Coast of British Columbia, or potential effects on the endangered Western Painted Turtle (*Chrysemys picta bellii*). We report on the size of slider populations relative to native turtles in 40 locations across South Coastal British Columbia observed from 2009 through to present. We also examine the previously unknown reproductive potential of Red-eared Sliders in the area, including the first documented successful hatchlings in 2015. Our results and review of trends in other areas suggest that this invasive species may be emerging from a lag phase in invasion. In addition, there is evidence that incidents of successful hatching are likely to increase with projected changes in climate (warming) already displayed through the temperature monitoring of nesting habitat of local native turtles. Populations that were previously supported by pet releases alone are now proven to be reproducing successfully, and represent a substantial threat to the recovery of the coastal population of endangered native turtles.

★**The Effects of Road Noise on the Calling Behavior of Pacific Chorus Frogs.** Danielle V. Nelson*, *Department of Forest Ecosystems and Society, Oregon State University, Richardson Hall 321, Corvallis, OR 97331; danielle.nelson@oregonstate.edu;* Holger Klinck, *(1) Bioacoustics Research Program, Cornell Lab of Ornithology, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY 14850; (2) Cooperative Institute for Marine Resources Studies, Oregon State University and NOAA Pacific Marine Environmental Laboratory, Hatfield Marine Science Center, 2030 SE Marine Science Drive, Newport, OR 97365;* Tiffany S. Garcia, *Department of Fisheries and Wildlife, Oregon State University, Nash Hall 104, Corvallis, OR 97331.*

Fitness consequences of anthropogenic noise on organisms that have chorus-dependent breeding requirements, such as frogs, are not well understood. While frogs were thought to have innate and fixed call structure, species-specific vocal plasticity has been observed in populations experiencing high-noise conditions. Adjustment to call structure, however, can have negative fitness implications in terms of energy expenditure and female choice. The Pacific Chorus Frog (*Pseudacris regilla*), a common vocal species broadly

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distributed throughout the Pacific Northwest, often breeds in waters affected by road noise. We compared Pacific Chorus Frog call structure from breeding populations at 11 high- and low-traffic sites in the Willamette Valley, Oregon. We used passive acoustic monitoring and directional recordings to determine mean dominant frequency, amplitude, and call rate of breeding populations, individual frogs, and to quantify ambient road-noise levels. Preliminary results suggest that while it is unclear if individuals differ in call structure across noisy and quiet sites, high road-noise levels decrease the effective communication distance of both the chorus and the individual. This research enhances our understanding of acoustic habitat in the Willamette Valley and the impacts of anthropogenic noise on a native amphibian species.

★**Underwater Vocal Behavior of the Red-legged Frog (*Rana aurora*) – A Pilot Study.** Danielle V. Nelson*, *Department of Forest Ecosystems and Society, Oregon State University, Richardson Hall 321, Corvallis, OR 97331; danielle.nelson@oregonstate.edu;* Holger Klinck, *(1) Bioacoustics Research Program, Cornell Lab of Ornithology, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY 14850; (2) Cooperative Institute for Marine Resources Studies, Oregon State University and NOAA Pacific Marine Environmental Laboratory, Hatfield Marine Science Center, 2030 SE Marine Science Drive, Newport, OR 97365;* Tiffany S. Garcia, *Department of Fisheries and Wildlife, Oregon State University, Nash Hall 104, Corvallis, OR 97331.*

Males of most species of anurans use acoustic communication to attract females during the breeding season for mating. For the majority of these species, this communication is done in air. However, several species, including the Northern Red-legged Frog (*Rana aurora*), produce calls underwater. Because of this, the species is difficult to survey visually and acoustically with commonly used monitoring techniques. Furthermore, its vocal repertoire and behavior are not well known. The goal of this pilot study was to determine if passive acoustic monitoring can be used to record red-legged frogs underwater, with the objective of collecting data to describe their calls and calling activity in more detail. A 2-channel recorder (WildlifeAcoustics SM2+) was equipped with both a hydrophone and a microphone to capture underwater and in-air communication signals of anurans at Finley National Wildlife Refuge near Corvallis, Oregon. Preliminary data analysis suggests that red-legged frog choruses lasted for up to ten hours at a time and were continuous from sunset to sunrise. Individual frogs called in bouts of three to five calls at a time. This study extends understanding of the breeding behavior of this species of frog and allows for future work on the acoustic characteristics of underwater frog calls.

Evaluation of Characteristics to Differentiate Larvae of Oregon Spotted Frog (*Rana pretiosa*) and Northern Red-legged Frog (*Rana aurora*). Stephen Nyman*, *Whatcom County Amphibian Monitoring Project and HDR, Inc., 1111 North Forest Street, Bellingham, WA 98225; stephen.nyman@hdrinc.com.*

Quick and accurate identification of similar species is a necessity for field studies where conditions and study design do not allow for extended holding times, invasive procedures, or collection of voucher series. Identification of larvae of related species of amphibians may be particularly challenging, complicated by changes in appearance associated with ontogenetic development. Larvae of Oregon Spotted Frog (OSF) (*Rana pretiosa*) and Northern Red-legged Frog (NRLF) (*R. aurora*) often occur together at sites in western Washington and are described in some accounts as difficult or impossible to differentiate reliably. Over the course of a study of OSF larval ecology at the Samish River Preserve, Whatcom County, Washington, I observed and photographed large numbers of larvae of the two species, with reference to the Gosner (1960) stage of development. I compared these observations to my observations and photographs of larval NRLF from other sites in western Washington and information on the two species in existing, published sources. I will summarize characteristics that were effective in differentiating larvae of the two species and discuss inconsistences between my observations and published accounts. Possible explanations for inconsistencies include failure of some published accounts to consider changes in appearance during development, the legacy of prior systematics of the spotted frog complex, and undocumented regional differences. However, my evaluation of published accounts was limited by paucity of accompanying photo-documentation. I encourage other researchers to document larvae and to make digital images available using online natural history image databases such as CalPhotos and Encyclopedia of Life.

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Ecological Aspects of Oregon Spotted Frog (*Rana pretiosa*) eggs and larvae at ponds and meadows of the Samish River Preserve, Whatcom County, Washington. Stephen Nyman*, *Whatcom County Amphibian Monitoring Project and HDR, Inc., 1111 North Forest Street, Bellingham, WA 98225; stephen.nyman@hdrinc.com.*

Oregon Spotted Frog (OSF) (*Rana pretiosa*) is a rare and vulnerable species of the Pacific Northwest and is associated with emergent wetlands ("meadows") in which shallow areas are used for breeding. I present here the first year results of a study of OSF at the Samish River Preserve, Whatcom County, Washington. The focus of the research is comparison of OSF life history at the five sites where egg masses have been recorded, which include the shallow margins of two deep, excavated ponds and three shallow meadows dominated by dense Reed Canary Grass (*Phalaris arundinacea*). Surveys and subsequent monitoring documented more than twice as many OSF egg masses at the meadows than at the ponds. Repeated sampling with aquatic funnel traps demonstrated that OSF larvae dispersed from egg mass locations to suitable larval habitat at each site; however, some larvae were later found in isolated pockets of water, particularly at Southeast Meadow, where no substantial openings with deeper water occurred. Comparison of body sizes and developmental stages of OSF larvae from the five sites provided evidence that larvae grew more rapidly at the ponds than at the meadows and that metamorphosis began first at the ponds. Differences among meadow sites were also apparent, with the smallest larvae at Southeast Meadow. Although the ponds may have afforded conditions suited for more rapid growth and development, the ponds supported predatory insects that did not occur in the meadows. I discuss implications of these results for the direction of future research and management of OSF habitat.

Forest Meadows: Reptile Biodiversity Hotspots. Deanna H. Olson*, *Pacific Northwest Research Station, US Forest Service, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us;* Nathan Breece, *Fish and Wildlife Program, Natural Resources Department, Grand Ronde Tribe, Grand Ronde, OR 97347*.

Forest meadows enrich biodiversity of forest landscapes. In many cases, forest encroachment or invasive species are rapidly altering these communities in the Pacific Northwest. An improved understanding of the species associated with meadows would aid our understanding of their ecosystem services, and might aid management decisions. We hypothesized that forest meadows would be reptile biodiversity hotspots, in part due to the greater solar radiation at ground level, upon which reptiles may rely for their activities. Furthermore, we predicted that meadows on southward-facing slopes, compared to northward aspects, would have greater reptile richness and abundance. From 2012 to 2014, we surveyed for reptiles monthly using corrugated metal cover boards at three sites in the Oregon Coast Range, each with four treatment units: northward forest meadow; northward forest; southward forest meadow; southward forest. One additional site was monitored with two treatment units: northward and southward meadows. Only 1 of 319 total reptile captures was found in forest units, and 261 of 318 (82%) captures were in southward-facing meadows. Over 80% of four species (gartersnakes [*Thamnophis* spp.], Northern Rubber Boas [*Charina bottae*], Northern Alligator Lizards [*Elgaria coerulea*], Western Skinks [*Plestiodon skiltonianus*]) captures occurred on southward forest meadows; Gopher Snakes (*Pituophis catenifer*) occurred more equally among meadow aspects. Our results support forest meadows as reptile biodiversity hotspots.

Near-Term Effects of Repeated-Thinning with Riparian Buffers on Headwater Stream Vertebrates and Habitats in Oregon. Deanna H. Olson*, *Pacific Northwest Research Station, US Forest Service, 3200 SW Jefferson Way, Corvallis, OR 97331; dedeolson@fs.fed.us;* Julia I. Burton, *Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, OR 97331.*

We examined the effects of a second-thinning harvest with alternative riparian buffer management approaches on headwater stream habitats and associated vertebrates in western Oregon, USA. Our analyses showed that stream reaches were generally distinguished primarily by average width and depth, along with the percentage of the dry reach length, and secondarily, by the volume of down wood. In the first year post-harvest, we observed no effects of buffer treatment on stream habitat attributes after moderate levels of thinning. One of two "thin-through" riparian treatments showed stronger trends for enlarged stream channels, likely due to harvest disturbances. The effects of buffer treatments on salamanders varied among species and with habitat structure. Densities of *Plethodon dunni* and *Rhyacotriton* species increased post-harvest in the moderate-density thinning with no-entry buffers in wider streams with more pools and narrower streams with more down wood, respectively. However, *Rhyacotriton* densities decreased along streams with the narrowest

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buffer, 6 m, and *P. dunni* and *Dicamptodon tenebrosus* densities decreased in thin-through buffers. Our study supports the use of a 15-m or wider buffer to retain sensitive headwater stream amphibians.

Movement and Habitat Use of Oregon Spotted Frogs (*Rana pretiosa*) in Fall and Early Winter in Oregon, USA. Christopher A. Pearl*, Brome McCreary, Michael J. Adams. *USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, Oregon 97331. christopher_pearl@usgs.gov.*

Oregon Spotted Frog (*Rana pretiosa*) populations are concentrated along the Cascade Range in Oregon. Most information on *R. pretiosa* wintering comes from lower elevations where winters are more moderate. We used radio-telemetry to study movement and habitat use by adult *R. pretiosa* in three wetland complexes in Oregon. Frogs were consistently aquatic at 2 complexes, where they most often were found in relatively shallow vegetated microhabitats. At the other complex, frogs started in similar habitat but appeared to move into more terrestrial retreats associated with an old lava flow. Frogs in one lake site made extensive use of springs around its periphery. Movement rates declined later in fall and into early winter. Frogs in flowing ditch habitats settled in wintering sites that were further from first locations (up to 1.1 km) than frogs in non-ditch sites (<250 m). This study adds to information on the range of habitats and behaviors associated with overwintering in *R. pretiosa*.

Identifying Occupied Chinook and Coho Salmon Redds Using Environmental DNA Analysis. David S Pilliod, Matthew B Laramie, *US Geological Survey Forest and Rangeland Ecosystem Science Center, Boise, ID 83706; dpilliod@usgs.gov;* Burke Strobel, *Portland Water Bureau, Portland, OR 97204.*

Annual salmon redd counts are conducted visually throughout the Columbia Basin to monitor salmon reproduction, yet counts can be misleading when practice redds or gravel scours are counted as oviposition sites and when multiple species are using the same breeding habitat. We developed a technique to use environmental DNA (eDNA) to distinguish between redds made by Chinook (*Oncorhynchus tshawytscha*) and Coho (*Oncorhynchus kisutch*) salmon and to distinguish occupied from unoccupied gravel scours that have the appearance of redds. We collected 15 mL triplicate water samples from the gravel interspaces of known redds (where their identity and origin was not in doubt), apparent redds of unknown origin, random gravel locations, and from within the water column at multiple locations in the Sandy River basin, a tributary to the Columbia River in Clackamas and Multnomah Counties, Oregon. We extracted all DNA in the sample and quantified the amount of Chinook and Coho DNA in each sample using qPCR. Preliminary results suggest that water drawn from redds occupied by the eggs of a particular species had significantly more DNA for that species than water collected from nearby gravel or the surrounding water column. Our preliminary results also suggest that eDNA methods can distinguish between Chinook and Coho if the origin of the redd is unknown. These preliminary findings further demonstrate the potential uses of eDNA methods for monitoring aquatic species and complementing existing monitoring methods for Pacific salmon.

Distribution and Abundance of Tree Voles in the Northern Coast Ranges of Oregon. Amy L Price, *Siuslaw Watershed Council, PO Box 422, Mapleton, OR 97453; crew@siuslaw.org;* Jason S Mowdy, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, 97331;* Eric D Forsman*, *US Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97331;* James K Swingle, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, 97331.*

We sampled 86 randomly selected survey plots to evaluate the distribution and abundance of Red Tree Voles (*Arborimus longicaudus*) on the Tillamook and Clatsop State Forests in the northern Coast Ranges of Oregon in 2011–2013. We conducted surveys by visually searching for tree vole nests while walking along 500 m of transect in each plot. Trees with potential nest structures were climbed to determine if the structures were tree vole nests. We found tree vole nests in only 4 random plots, all of which were located near the coast, at the western edge of the Tillamook State Forest. Of 33 tree vole nests located, 20 (61%) were in old forests (≥80-y-old), and 13 (39%) were in 1 young forest plot in a stand that was 65-y-old. We concluded that tree voles were absent from most of Tillamook and Clatsop State Forests, probably due to the fact that most of the area was either logged or burned in the early 1900s, and subsequently intensively managed on short rotations. We also suggest that remnant stands of old forest on Bureau of Land Management and state lands are acting as source populations from which tree voles populate adjacent young forests. Cuttings

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found in nests provide evidence that most of the voles were feeding on needles of Western Hemlock (*Tsuga heterophylla*) or Sitka Spruce (*Picea sitchensis*).

★Pacific Mistletoe Facilitates an Increase in Microhabitat Abundance and Songbird Species Richness in Oregon White Oak Stands. Kyle R Pritchard*, *Department of Forest Ecosystems and Society, Oregon State University, 321 Richardson Hall, Corvallis, OR 97331; Kyle.Pritchard@oregonstate.edu;* David C Shaw, *Department of Forest Engineering, Resources and Management, College of Forestry, Oregon State University, 280 Peavy Hall, Corvallis, OR 97331;* Joan C Hagar, *USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331.*

The Pacific Northwest has suffered dramatic declines in the amount and quality of oak-dominated forests and savannahs in the last 200 years. Restoring oak systems often involves selectively thinning stands of oaks in order to mimic pre-settlement conditions. In choosing which trees to cut, land managers often remove trees with obvious signs of infection. One such infection is the parasitic mistletoe *Phoradendron villosum*. However, by removing mistletoe-laden trees from the landscape, managers may be doing a disservice to oak-associated wildlife. Although there is evidence that mistletoe species are important components of ecosystems globally, the role of Pacific Mistletoe in an oak-dominated ecosystem is almost completely undocumented. In order to determine the importance of Pacific Mistletoe for breeding birds, we conducted timed observations of bird use of Oregon White Oaks (*Quercus garryana*) with varying levels of mistletoe infection at several sites in the Willamette Valley. In addition, we quantified the amount of 'microhabitat' features within trees caused by mistletoe infection. Our results suggest that an increase in mistletoe load is associated with: 1) an increase in structural heterogeneity within the crown of the tree; and 2) an increase in avian species richness and abundance. By focusing on retaining trees with high volumes of mistletoe in the crown, land managers may be able to increase the habitat quality of oak-associated bird communities.

★Intraspecific Agonistic and Display Behavior of the Terrestrial Coastal Giant Salamander (*Dicamptodon tenebrosus*). David Reavill*, Steve Wagner, Robert Weaver, Central Washington University, 400 East University Way, Ellensburg WA 98926; reavilld@cwu.edu

Intraspecific interactions are an important factor in shaping the population structure of terrestrial salamanders. Both physical interactions and scent-marking are vital components to the establishment of territories and influence dispersion of individuals. However, little is known about the terrestrial interactions of many salamander species. In this study, I observed the first accounts of agonistic and display behavior of terrestrial individuals of the Coastal Giant Salamander (*Dicamptodon tenebrosus*) in 40 staged laboratory encounters. Territory holders exhibited aggressive behaviors such as biting and lunging more frequently than intruders. Biting also happened fairly frequently, with bites being observed in nearly all interactions. Behavioral patterns showed similarities to those seen in plethodontid salamanders, and certain behaviors seemed to serve the same functions, such as aggression, agonistic displays, and passive displays. No evidence for marking behavior was observed, such as vent-rubbing, which is commonly seen in plethodontid salamanders. Similarly, behaviors facilitating enhanced chemoreception were either not present or not apparent, as there was no evidence for nose-tapping which, is commonly interpreted as a chemoreceptive behavior. The aggressive nature of these salamanders likely contributes to the dispersion of adults seen in the field.

The Occurrence and Occupancy Status of the California Spotted Owl on Sierra Pacific Industries' Lands in the Sierra Nevada of California. Kevin N Roberts, *Sierra Pacific Industries, 3950 Carson Rd., Camino, CA 95709; KRoberts@spi-ind.com;* William E Hall*, *Parametrix, Inc., 700 NE Multnomah St., Portland, OR, 97219; whall@parametrix.com;* Amanda J. Shufelberger, *Sierra Pacific Industries, P.O. Box 1450, Cedar Ridge, CA 95924; AShufelberger@spi-ind.com;* Matthew A. Reno, *Sierra Pacific Industries, P.O. Box 247, Standard, CA 95373; MReno@spi-ind.com;* Michelle M. Schroeder, *Sierra Pacific Industries, 2849 Northgate Dr., Chico CA 95973; MSchroeder@spi-ind.com*

Since the 1970s, the California Spotted Owl (*Strix occidentalis occidentalis* [CSO]) has been documented on lands currently owned by Sierra Pacific Industries (SPI) in the Sierra Nevada of California. In 2012, SPI began an occupancy study on a portion of the CSO population known to occur on its managed timber lands consisting of 5 distinct ca. 4,000-ha watersheds from the southern end of the Cascade Range to just north of Yosemite National Park, on which 57 historical CSO sites were recorded. Up to three night-time surveys

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were conducted at each site. From 2012-2014, the yearly occupancy of the known CSO sites within the study areas ranged from 72% to 86%. As each CSO site is considered "occupied" until 3 years of absence, a 97% occupancy status has been calculated for the 2012-2014 period. During this 3-year period, 84% of the occupied sites have had "pair" status confirmed, and of those 51% have attempted to nest at least once. Also, the total number of known CSO sites within the study areas increased from 57 to 62 sites. Crude densities for the 3-year period are calculated to be 0.104 CSO-occupied territories/km^2 and 0.192 individual adult owls/km^2. We found that while CSO populations being studied on adjacent USFS lands continue to decrease in occupancy and crude densities, the populations being monitored on SPI lands show increases in the number of known sites, high occupancy rates, and high crude densities.

A Benchmark Survey of Oregon's Birds Built with eBird: the Oregon 2020 Project. W Douglas Robinson*, Tyler A Hallman, Jenna R Curtis, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331; douglas.robinson@oregonstate.edu.*

We live in a pivotal time in history. We are changing the land, the sea and the climate. Birds respond to such changes. We are the first generation of humans to realize we are partly responsible for climate change, to know that we are massively altering the habitat of Earth's biodiversity, and to have the technological capability to map, measure, instantly share, and electronically archive our observations of nature. The Oregon 2020 project recognizes our unique position in history and involves citizen scientists (birders) to create a benchmark survey of Oregon's birds so that future generations can repeat our surveys and understand, with 20/20 hindsight, exactly how birds have responded to environmental change. Our project uses a combination of education, encouragement, and collaborative field excursions to generate bird count data. All observations are entered into the public eBird database and instantly shared. Surveys are done in normal birding hotspots, but most importantly in a randomized selection of one-square mile areas across the state. The sampling design is easy to understand, easily viewed with our smartphone app, and interfaces with eBird. The project end date is estimated to be in year 2020, at which time we project several million bird observations from the nearly 3000 sample areas will be available for analysis. Our project website, oregon2020.com, keeps participants informed of project updates and progress.

Amphibian Skeletochronology: Opportunities and Hazards. Chris Rombough*, *Rombough Biological, PO Box 365, Aurora, OR 97002; rambo2718@yahoo.com;* Jay Bowerman, *Sunriver Nature Center, 57245 River Road, Sunriver OR 97707.*

Skeletochronology, a technique for determining age from stained sections of long bones, can be a useful and efficient means of aging amphibians. However, the technique is fraught with difficulties that range from methods to analysis. Here, I use new data from several species of Oregon frogs to explain skeletochronology, how to use the technique, which amphibians can or cannot be reliably aged, and clues for judging the reliability of the process.

Prevalence of Ulcerative Shell Disease (USD) In Western Pond Turtles (*Actinemys marmorata*) in Washington – Investigation into the Etiology and Treatment Success. Tammy A Schmidt*, Stefanie M Bergh, Katherine H Haman, Eric W Holman, Kristin G Mansfield, *Washington Department of Fish and Wildlife, Olympia, WA 98501; tammy.schmidt@dfw.wa.gov*; Darin Collins, *Woodland Park Zoo, Seattle, WA 98103;* Tim Storms, *Oregon Zoo, Portland, OR 97221;* Adolf K Maas, *ZooVet Consulting, Bothell, WA 98011;* Bethany Groves, John Huckabee, *Progressive Animal Welfare Society, Lynwood, WA 98046;* Marley Iredale, Gretchen Kaufman, *Washington State University, Pullman, WA 99164.*

The Western Pond Turtle (WPT) (*Actinemys marmorata*) is a state endangered species and one of only two native freshwater turtle species to Western Washington. Two recovery sites are located in South Puget Sound and four are located in the Columbia Gorge. The Washington Department of Fish and Wildlife (WDFW) WPT recovery plan calls for undertaking scientific investigation that will facilitate and enhance recovery efforts. WDFW's recovery effort for this species came about as a response to a respiratory disease outbreak in the early 1990s that killed an estimated one-third of the Columbia Gorge turtles. As a result, captive rearing programs were instituted in 1991 for the Columbia Gorge and in 1994 for South Puget Sound. Captive rearing consists of head-starting hatchlings at regional zoos for their first 10 months to accelerate growth in order to avoid predation by Bullfrogs (*Lithobates catesbeianus*). Ulcerative Shell Disease (USD) was identified

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in Western Pond Turtles in two populations in 2009. Intense capture efforts, begun in 2012, confirmed USD was present in all populations in Washington. A field assessment procedure developed and implemented at all six sites in 2013 found USD affecting all age classifications of captive-reared turtles but most prevalent in breeding adults. Only one wild turtle has been identified with the infection as of spring 2014. WDFW elevated the response to USD beginning in 2013 and has collected blood, shell biopsies, and radiographs for analyses. A treatment program was developed in 2012. Response to treatment was positive, and the methods were refined to maximize healing and shorten the duration of time needed in captivity to a minimum of 2 months. Turtles released after treatment are monitored annually for disease recurrence and productivity in the South Puget Sound populations. Additional investigational research into the etiology of USD will occur in 2015, and more effort will be placed on treating afflicted turtles due to encouraging results seen thus far.

Indirect Effects of Brown Bears (Ursus arctos) on Small Mammal Populations in Coastal Ecosystems. Yasaman Shakeri*, Taal Levi, *Oregon State University, Department of Fisheries and Wildlife, 104 Nash Hall Oregon State University Corvallis, OR 97331; shakeriy@onid.oregonstate.edu.*

Brown Bear (*Ursus arctos*) populations have been extirpated from much of their former range in the United States. These large-bodied omnivores can reach extraordinarily high densities in salmon-bearing ecosystems, but little is understood about how such large bear densities affect ecosystems and what services have been lost due to their extirpation. For example, Brown Bears consume thousands of fruit per day, depositing the seeds in large piles throughout the forest. These seed piles may be important resources for small mammals that hoard seeds for winter. We are using camera traps and small mammal trapping to studying the effectiveness of Brown Bears as seed dispersers and the importance of seed-filled bear scats to small mammals. We used a combination of motion-detecting trail cameras and radio frequency identification (RFID) readers trained on seed-filled bear scats to record small mammal feeding activity on scats. In summer of 2014, we established four trapping grids for small mammals. We identified and sexed all small mammals captured, and then inserted a passive integrated transponder (PIT) tag under the skin. Two grids serve as an experimental area and two girds serve as controls. Experimental grids were supplemented with seed-filled bear scats. We identified three species of rodents visiting seed-filled bear scats hundreds of times over the four month study period. RFID reader data showed three PIT tagged individuals feeding at seed-filled bear scats over 200 times in four days.

★Mapping the Distribution of the Columbia Spotted Frog in the Great Basin Using Environmental DNA. Matthew M Smith*, Caren S. Goldberg, *School of the Environment, Washington State University, Pullman, WA, 99164.*

The Great Basin population of the Columbia Spotted Frog (*Rana luteiventris*) is a candidate for listing under the Endangered Species Act. We will use environmental DNA (eDNA) and field surveys to identify occupied sites in the Oregon and Nevada range of this species, guided by predicted distribution maps developed by USGS (Pilliod and Arkle). Along with detecting occupied sites for this target species, we will also test for the presence of Ranavirus (*Ranavirus* spp.) and Smallmouth Bass (*Micropterus dolomieu*). Ranavirus causes die-offs in amphibian populations during the tadpole stage but may also affect adults. Smallmouth Bass are an introduced species that may exclude Columbia Spotted Frogs from invaded waters. Through this project, we will gain understanding of the fine-scale distribution of this species and potentially detect previously unknown populations. Additionally, we will analyze variation in eDNA replicates and eDNA detections in comparison with field detections and potential environmental covariates (pH, temperature, UV exposure) and use these results to develop an efficient and reliable eDNA monitoring method for this species.

Abundance Dynamics of Western Pond Turtles (*Actinemys marmorata*) on the Trinity River Using Basking Surveys. Melissa L. Snover*, Michael J. Adams, USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331; msnover@usgs.gov

The Trinity River, Trinity County, California is a regulated river currently receiving extensive restoration efforts. Releases into the river from the Lewiston Dam are relatively constant at 9°C throughout the year, making summer water temperatures artificially low for rivers in this region. Previous studies of Western Pond Turtles (*Actinemys marmorata*) have found slower growth rates, later age at maturity, smaller adult sizes and lower annual fecundity in Trinity River turtles compared to other populations in the region. We developed a long-term monitoring strategy for the Trinity River Western Pond Turtle population from the Lewiston

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Dam to the confluence with the North Fork Trinity River. We used kayaks to observe the river banks, record numbers and locations of basking turtles, habitat characteristics and environmental conditions, with three surveys each season. Total basking turtles observed for each survey were 88, 114, and 112 in 2013 and 85, 116 and 111 in 2014. 75% of river segments were consistently classified as occupied or unoccupied between years based on naïve occupancy observations. We applied binomial mixture models to estimate abundance corrected for imperfect detection. Preliminary analyses suggest that the most parsimonious model of habitat covariates included density of basking structures and water depth, supporting previous observations that turtles prefer deep pools, and that basking structures are likely critical given the cold water temperatures. The consistency of our results between years suggests that basking surveys are a viable means of evaluating changes in population size and distribution.

Incorporating Environmental DNA in Monitoring Programs: Insights from Eastern Hellbender Conservation. Stephen Spear*, *The Orianne Society, Athens, GA 30605; sspear@oriannesociety.org;* Michael Freake, *Lee University, Cleveland, TN 37311;* John Groves, *North Carolina Zoological Park, Asheboro, NC 27205;* Thomas Floyd, *Georgia Department of Natural Resources, Social Circle, GA 30025;* Christopher Jenkins, *The Orianne Society, Athens, GA 30605;* Lisette Waits, *University of Idaho, Moscow, ID 83844*

Environmental DNA (eDNA) provides a non-invasive method to detect species presence and has the potential to provide information on population size and other demographic parameters. As a result, there has been great interest in incorporating this technique into inventory and monitoring programs for threatened aquatic species. In the past several years, we have used eDNA to complement survey effort for Eastern Hellbenders (*Cryptobranchus alleganiensis alleganiensis*). Hellbenders are among the most threatened of salamanders, and are currently being considered as a candidate for ESA listing. Accurate data regarding presence and population status is thus critical. Many populations do not appear to be reproducing successfully despite continued presence of long-lived older adults, and thus presence-only may be insufficient for population monitoring. We used a quantitative PCR protocol to amplify hellbender eDNA from river samples to not only test for species presence, but also to test the possibility of the technique to predict population size, reproductive status, and validate models of species distribution. We filtered water samples at over 200 sites across Tennessee, North Carolina, and Georgia from 2011-13. Hellbenders have high detectability with eDNA. However, there is not a clear relationship between eDNA estimates and survey numbers that may largely reflect the variability in snorkel survey estimates. Hellbender eDNA is greatly elevated during the breeding season, but may primarily represent males in breeding condition regardless of successful recruitment. Finally, eDNA appears to be well suited as a validation technique for species distribution models, and highlights spatial patterns of decline.

★**Predator-mediated Competition in an Amphibian Community.** Lindsey L Thurman*, Tiffany S Garcia, *Department of Fisheries & Wildlife, Oregon State University, Corvallis, OR 97331; lindsey.thurman@oregonstate.edu.*

Explanations for coexistence are often framed with respect to interspecific competition. However, predator-prey relationships can also play a significant role in structuring communities via predator-mediated competition. This results in a behavioral exchange wherein prey attempt to minimize predation risk and predators try to maximize predation efficiency. To minimize predation risk, one strategy is for prey to seek refuge, but refuge use can be costly and indirectly affect the outcome of competitive interactions. To understand how optimal foraging and prey behavior affect amphibian community dynamics, I exposed three anuran competitors (*Rana cascadae*, *Pseudacris regilla*, and *Anaxyrus boreas*) to a co-occurring amphibian predator, the Long-toed Salamander (*Ambystoma macrodactylum*), in a fully factorial experimental design with 7 competition treatments (intra- and inter-specific) and 2 predator treatments (present vs. absent). *Ambystoma macrodactylum* exhibited size-specific prey selectivity, in which the smallest prey, *P. regilla*, was preferentially consumed. As a result, *P. regilla* increased refuge use in the presence of the predator, but the relative amount of refuge use was dependent upon competitor composition. As densities of *P. regilla* decreased due to predation, the predator switched prey preference to the denser competitor and refuge use subsequently decreased. This prey-switching behavior was most apparent in the *Pseudacris-Anaxyrus* competition treatment. Interestingly, *Rana cascadae* experienced the lowest relative predation pressure, but the highest proportion of refuge use, suggesting competition may be a more significant driver of behavior than predation for this species. Exposure to predation provided a clearer interpretation of competitive dynamics among the larval anurans and revealed a species-specific sensitivity to competition and predation.

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★**Embryonic Exposure to a Pathogen and Its Influence on the Development, Hatching Time, and Survival of Hatchlings of the Pacific Chorus Frog (*Pseudacris regilla*).** Jenny Urbina*, *Environmental Sciences, Oregon State University, Corvallis, OR 97330; urbinagj@onid.orst.edu;* Tiffany Garcia, *Fisheries and Wildlife, Oregon State University, Corvallis, OR 97330;* Andrew R. Blaustein, *Integrative Biology, Oregon State University, Corvallis, OR 97330.*

Emerging infectious diseases are one of the multiple factors contributing to the current biodiversity crisis. Amphibian populations in particular are declining globally in part due to chytridiomycosis, an emerging infectious disease, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*). This fungus primarily affects keratinized structures in tadpoles and metamorphs. However, *Bd* produces digestive enzymes that can affect early developmental stages. We currently lack information regarding *Bd* impacts on early amphibian life-history stages as well as research on potential latent effects of *Bd* exposure on development. We examined the effects of *Bd* exposure using two different Bd strains and exposure time on the eggs of the Pacific Chorus Frog (*Pseudacris regilla*) in a factorial design. We evaluated whether *Bd* exposure affects the development of embryos and the time of hatching by following the development, hatching rate, and survival. We found that both *Bd* strains and exposure time had effects on embryo development. Embryos exposed to *Bd* did not develop entirely in comparison to controls. We found a high number of undeveloped embryos in late-exposure treatments. Embryos exposed to *Bd* began to hatch earlier than controls and this response was similar in both exposure times. Due to a low number of developed embryos, the number of hatchlings from *Bd*-exposed treatments was lower than controls. Survivorship of hatchlings was similar among treatments. Our results suggest that *Bd* can affect the development and timing of hatching of *P. regilla* as well as the number of hatchlings when exposed to *Bd* strains.

Effects of an American Crow Roost on a Wetlands Restoration. Douglas W. Wacker*; Daniel A. Lombardo; Alyssa S. Branca; Kelli N. Wachter, *University Of Washington Bothell, School of Science, Technology, Engineering, and Mathematics (Biology Division), Box 358538, 18115 Campus Way NE, Bothell, WA 98011; dwacker@uw.edu.*

Over the last half century, American Crow (*Corvus brachyrhynchos*) populations have become more common in urban and suburban areas in the United States. Their roosts, which can contain thousands of birds, are sometimes established on restored green spaces in these areas. Crows established one such roost in Bothell, WA on a ~58 acre wetlands area, restored from cattle pasture in the late 1990s by the University of Washington Bothell and city, state, and federal partners. This roost contains 10-16,000 crows in the fall, winter, and early spring and 1-4000 in the summer. In this study, we assessed the ecological effects of this roost on soil chemistry and bioindicator biodiversity. Nitrate levels were significantly higher, and pH significantly lower on roost areas of the North Creek Wetlands, consistent with a large input of uric acid-rich crow waste. Plant abundance and species richness were also lower under the roost, but Red Alder (*Alnus rubra*) and Salmonberry (*Rubus spectabilis*) were more prevalent in roost versus non-roost plots, potentially suggesting the increasing dominance of these plant species in this disturbed environment. One goal of this restoration was to create a space where indigenous Pacific Northwest flora and fauna could flourish, so the negative effects of this native synanthrope create a philosophical dilemma, increasingly typical of the Anthropocene.

★**Fish Flying in the Forest: the Influence of Salmon on Songbirds.** *Marlene A. Wagner*, John D. Reynolds, *Earth2Ocean Research Group, Simon Fraser University, 8888 University Drive, Burnaby, B.C. V5A 1S6 and Hakai Institute, Heriot Bay, B.C. V0P 1HO; mawagner@sfu.ca.*

Pacific Salmon (*Oncorhynchus* spp.) provide a complex cross-ecosystem link between the ocean, freshwater, and terrestrial systems. When marine-derived nutrients from spawning salmon are transferred to riparian forests through various food-web pathways, they increase invertebrate abundance and enhance plant structure, thereby subsidizing resources that are important to birds. We quantified the influence of the annual salmon spawning event on the spatial aggregation of songbird communities across a wide range of salmon-spawning biomass on 14 discrete streams along the remote northern coast of British Columbia. Point-count data spanning two years were combined with environmental covariates in riparian forests to create a priori models based on individual bird species and ecological guilds (insectivores, frugivores, generalists) that were ranked using an information-theoretic approach. Results suggest that bird density increases with salmon biomass and that watershed size and vegetation composition are also important predictors. This work further elucidates the

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holistic ecological importance of salmon to terrestrial ecosystems and provides new information to inform ecosystem-based management.

Influence of Small Manmade Barriers on Sculpin (*Cottus* spp.) Distribution and Abundance in Puget Sound Lowland Streams. Frithiof T Waterstrat*, Roger A Tabor, *USFWS, Washington Field Office, 510 Desmond Drive Southeast, Lacey, WA 98503; Teal_Waterstrat@fws.gov;* Daniel W Lantz, Hans B Berge, *King County Department of Natural Resources and Parks, 201 South Jackson Street, Seattle, WA 98104.*

The distribution of fishes is often influenced by manmade and natural barriers. Barriers alter fish abundance and species composition, which may indirectly affect other components of the aquatic community. The importance of barriers to anadromous salmonids has been studied extensively; however, the effects of barriers on small, nongame species have received relatively little attention. Sculpin (Cottidae) are often the most abundant fish present in Pacific Northwest streams and can have important effects on aquatic ecosystems through competition for habitat, resources, and as predators or prey of other organisms. We examined the effects of small manmade barriers on five species of native sculpin: Coastrange (*Cottus aleuticus*) and Prickly (*C. asper*) which typically inhabit the lowest stream reaches; and Riffle (*C. gulosus*), Torrent (*C. rhotheus*), and Shorthead Sculpin (*C. confusus*) which typically inhabit more upstream reaches. We compared fish populations upstream and downstream of barriers in 16 Puget Sound lowland streams. All streams had populations of Coastrange and Prickly Sculpin in reaches downstream of the barrier. In 7 of the 16 streams studied, other sculpin species were also present. Our findings demonstrate that barriers can eliminate or substantially reduce the abundance of Coastrange and Prickly Sculpin. Coastrange Sculpin (*Cottus aleuticus*) typically were the most abundant fish below the barriers and the more upland species were rare. Coastrange and Prickly Sculpin that were found above the barriers were significantly larger than those below the barriers. Overall, small barriers appear to have an important effect on sculpin distribution, size, and species composition. Further studies to identify exact physiological or behavior thresholds that barriers create to exclude lowland sculpin are needed.

★**Harnessing Computer Vision for Ecological Monitoring.** Ben G Weinstein*, *653 Life Science - Stony Brook University, New York 11793; benweinstein2010@gmail.com.*

Human observation is expensive and limits the breadth of data collection. Emerging tools from computer science allow ecologists to harness remotely-placed video cameras and automated analysis to expand data collection in time and space. Field cameras are used in a wide array of applications, from underwater fish counters to studies of pollination ecology. One drawback of field-based video recordings is extensive review time. Computer vision, a field of computer science, can mitigate this cost and enhance data collection by extracting biological information from images with minimal time investment. I developed a new computer vision tool called MotionMeerkat which users can download and use for their own ecological studies. This tool has been tested on videos of birds, fish, and mammals in a variety of ecological backgrounds. A user inputs a video and the software returns images of the animal based on changes in pixel values and intensity. In each of the test cases, MotionMeerkat was highly successful in finding motion events and often reduced the number of frames needed to capture animal events by over 90%. False positives were most common in highly windy terrestrial backgrounds or very turbid aquatic backgrounds. This tool is part of a broader opportunity to utilize cutting edge computer science applications for ecological monitoring.

Woodland Salamanders: Relative Abundances, Functional Roles, and Use as Metrics of Seral Status in Pacific Northwest Forest Ecosystems. Hartwell H Welsh, Jr.*, Garth R Hodgson, *USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory 1700 Bayview Drive, Arcata, CA 95521; hwelsh@fs.fed.us and ghodgson@fs.fed.us .*

Woodland salamanders are prolific in healthy native forests where high abundances and predation on decomposer arthropods affect nutrient and carbon pathways at the litter/soil interface. Their extreme niche conservatism and low vagility make them uniquely suited as metrics of seral status. Mill Creek is a 103-km^2 commercially logged redwood watershed where primary forest is being restored. We tested salamanders as metrics of seral recovery using surface counts and body condition across early seral, mature, and primary forest stands. Using ANCOVA with a PCA-derived composite landscape covariate, we distinguished effects of coastal proximity and advancing succession. Both effects increased California Slender Salamanders (*Batrachoseps attenuatus*); advancing succession alone increased Ensatina (*Ensatina eschscholtzii*) numbers;

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however, their body condition (BC) means and variances were lower in older stands. Del Norte Salamander (*Plethodon elongatus*) BCs were higher inland but lower in late seral. Modeling of counts and BCs along successional gradients suggested that greater structural complexity supported larger populations in two of three species, with greater competition within and among species, suggesting greater fitness related to advanced succession. Late-successional Northwest forests support less-tractable species like spotted owls and Marbled Murrelets that are more costly and difficult to monitor compared to woodland salamanders.

Effects of Water Temperature on Breeding Phenology, Growth, and Metamorphosis of Foothill Yellow-legged Frogs (*Rana boylii*): a Case Study of the Regulated Mainstem and Unregulated Tributaries of California's Trinity River. Clara A Wheeler*, Hartwell H Welsh, Jr., *USDA Pacific Southwest Research Station, Arcata, CA 95521; cawheeler@fs.fed.us;* James B Bettaso, *US Fish and Wildlife Service, East Lansing, MI 48823;* Donald T Ashton, *US Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, OR 97330.*

During a period of severe drought, as recently experienced in California, conflicts over water appropriations for agricultural or hydroelectric use and the protection of fish and wildlife are unavoidable. As water supplies become depleted, management decisions regarding the fate of the water stored in reservoirs will become increasingly challenging and future proposals to restore rivers to their natural conditions by dam removal (actions that can benefit entire ecosystems) will likely to be "dead in the water." Yet, in modified environments, management decisions that benefit particular species may be unfavorable to others. For example, cold water released from a reservoir benefits salmonids, creating thermal conditions similar to tributaries historically used for reproduction prior to dam construction. However, depressed summer water temperatures may be disadvantageous to co-existing species such as the Foothill Yellow-legged Frog (*Rana boylii*), which uses warm edgewater stream habitats for breeding sites. We found that breeding activity, hatching, and metamorphosis occurred later, and metamorphs were smaller and leaner along the regulated and colder mainstem relative to six unregulated tributaries of the Trinity River, in northwestern California. The mechanism(s) underlying the results was not established, but potential explanations include direct effect of water temperature on frog development and growth, and indirect effect on feeding rates and food availability (quality and quantity). Depressed summer water temperatures appear to play a vital role in inhibited tadpole growth on the regulated mainstem and may be a causative factor in the decline of this population. Understanding thermal requirements of salmonids, anurans, and other species and integrating this information into environmental flow assessments and management decisions is a critical step towards mitigating the effects of stream regulation on the biota.

Enigmatic Amphibian Survival Follows Enigmatic Decline and "Extinction": Lessons from Costa Rica to the Pacific Northwest. Steven M. Whitfield*, *Gonzaga University, Biology Department, 502 E Boone Ave, Spokane, WA 99258, whitfields@gonzaga.edu;* Gilbert Alvarado, Juan Abarca, Hector Zumbado, Ibrahim Zuniga, Adrian Pinto, *Universidad de Costa Rica, San Pedro, Costa Rica;* Valerie McKenzie, *University of Colorado – Boulder, Dept. of Ecology & Evolutionary Biology, Boulder, CO 80309;* Jacob Kerby, *University of South Dakota, Biology Department, 414 E Clark St, Vermillion SD 57069.*

Approximately 41% of the world's amphibian species are threatened with extinction, and species in tropical regions are disproportionately threatened with extinction. Anthropogenic factors associated with apparent extinctions and mass mortality events have been contentious for decades, and have largely diverged on interpretations of whether a single anthropogenic stressor (emergence of the amphibian chytrid fungus, Batrachochytrium dendrobatidis "Bd") or multiple anthropogenic stressors (interactions among Bd and climate, Bd and contaminants, Bd and other emerging infectious diseases) have driven population declines and/or extinctions. Here, we summarize evidence that amphibian species from Central America that are widely perceived to be globally extinct are instead persistent in small, fragile "relict populations" that comprise the last known living individuals of their species. We show that while the extinction of these species is presumably driven by the emergence Bd, all relict populations co-exist with infections by Bd, and we evaluate evidence for the disparate adaptive strategies of tolerance or resistance to infection by Bd among species. We explore evidence that resistance or tolerance to Bd is driven by cutaneous microbial symbionts as a primary line of immune defense, and interpret these results in the context of potential probiotic supplementation programs for amphibian populations vulnerable to Bd emergence elsewhere. Finally, we demonstrate that while controversy lingers over a single-stressor versus multiple-stressor causality of amphibian declines, we show that restoration of threatened amphibian will require a detailed understanding of the multiple-stressor environment in which relict amphibian populations now survive.

★Giant Frogs in Bend: Phenotypic Plasticity in Oregon Spotted Frogs (*Rana pretiosa*). Tlell L Wolf*, *Bend Science Station, 1027 NW Trenton Avenue, Bend, OR 97701; tlellwolf@gmail.com;* Jay Bowerman, *Sunriver Nature Center, Sunriver, OR 97707.*

In 2012, Oregon Spotted Frogs (*Rana pretiosa*) were discovered in a small constructed pond in Bend, Oregon. These frogs were exceptionally large, some exceeding the size range for known populations within the Deschutes River basin. Search for a founding population revealed an extensive marsh directly across the Deschutes River from the pond. Spotted frogs in the marsh were much smaller. Mark/recapture efforts showed that a few frogs moved between these two sites, suggesting that both sites draw from a single gene pool. Over the past two years, recaptures of marked juvenile and yearling frogs showed that frogs living in the pond grew nearly twice as fast as contemporaries in the marsh. Significantly warmer water combined with more abundant and richer food sources in the pond appear to explain why frogs in the pond grow faster and reach much larger size at maturity. These results highlight a surprising level of phenotypic plasticity for size in Oregon Spotted Frogs.

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Backyard deer can be fun to watch, or a nuisance, or both. But urban life has its dangers for deer, too. The doe at left limped around on a partially healed compound fracture for a season, then disappeared. The young buck above was the second deer struck and killed at this not-particularly-busy street intersection located just where a heavily used deer trail crossed. Photos by K Ronnenberg.

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A ★ immediately before the abstract title denotes a student speaker. Posters will be hung by number in the poster session.

1. Environmental DNA: Using Molecular Analysis to Detect Boreal Toad (Anaxyrus boreas) in an Industrial Setting in Alberta. Brandon K Booker, Cynthia A Paszkowski, David W Coltman, Corey S Davis, *Department of Biological Sciences, CW 405, Biological Sciences Building, University of Alberta, Edmonton, AB, T6G 2E9; bbooker@ualberta.ca, cindy.paszkowski@ualberta.ca, dcoltman@ualberta.ca, cordavis@ualberta.ca;* Kris Kendell, *101 9 Chippewa Road, Sherwood Park, AB, T8A 6J7; kris.kendell@ab-conservation.com;* Doug Manzer, *Alberta Conservation Association; Box 1139, Crowsnest Pass, AB, T0K 0E0; doug.manzer@ab-conservation.com*

Monitoring species by detection is the first stage to creating biodiversity indices for species distributions. Traditional amphibian monitoring using physical detection can be biased because of the secretive nature of many amphibians. This presents a need for innovative approaches to amphibian monitoring that are more sensitive and comprehensive. In aquatic habitats, sloughing cellular debris creates an accumulation of nucleic acids. Amplifying, sequencing, and comparing short genetic fragments from the environment (environmental DNA or eDNA) may provide information on what organisms occupy a habitat. We conducted amphibian surveys in nine waterbodies at the Shell Carmon Creek project near Peace River, Alberta. Using three water-sampling techniques, we collected 186 water samples from five confirmed Boreal Toad (*Anaxyrus boreas*) breeding sites and one site where we detected an individual Boreal Toad. One mitochondrial locus will be amplified from water samples, sequenced, and aligned to known Boreal Toad sequences to establish presence or absence at each site. Results will be compared to the physical detection data to determine the reliability of the eDNA method for detecting the Boreal Toad. The Shell Carmon Creek work will contribute to the development of a standardized eDNA protocol that can be applied to other species of amphibians in Alberta.

★2. Using Clay Models to Test for Avian Recognition of Aposematic Warning Coloration of Ring-Necked Snakes (*Diadophis punctatus*). Hanna Crow, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg WA 98926; weaverro@cwu.edu.*

Aposematic coloration is a common theme among animals, both vertebrate and invertebrate. The bright and contrasting colors warn possible predators of distasteful and even poisonous compounds. The recognition of such warning signals is known among mammals, fishes, and reptiles (both avian and non-avian). For our study, we examined the efficacy of such warning coloration in a small, cryptic species of snake, the Ring-necked Snake (*Diadophis punctatus*). Ring-necked Snakes are a trans-continental species that average less than 70 cm total length. In the western United States, they are associated with oak-pine woodland, and along riparian zones in semi-arid habitats. When discovered, Ring-necked Snakes reveal vibrant yellow or orange bellies, and also curl the red ventral surface of the tail upward. For our experiment we used 6 types of clay models. The first were green with alternating patterns of dots (no dots, single, or double row). The other type of model was bright orange with this same pattern. Models (n = 246) were placed in appropriate habitat where several species of birds may see them. After 4-6 days, models were gathered and scored for bite marks. The percentages of green models with bite marks were: no dots, 34.6%; single row, 27.1%; and double row, 32.3%. The percentages of orange models with bite marks were: no dot, 2.3%; single row, 0.8%; and double row, 3%. Our data show a greater percentage of bite marks on green models compared to orange models. This supports the hypothesis that birds recognize and avoid aposematic coloration in Ring-necked Snakes.

3. Using Aquatic Environmental DNA (eDNA) to Track Fish Recolonization Following Dam Removal on the Elwha River, Olympic National Park, Washington. Jeffrey Duda, Marshal Hoy, Dorothy Chase, Carl Ostberg, *U.S. Geological Survey, Western Fisheries Research Center, 6505 NE 65th Street, Seattle, Washington 98115;* Samuel Brenkman, *Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.*

Removal of two dams on Washington's Elwha River is the largest project of its kind, with a key goal being the recolonization of anadromous fish to upstream spawning and rearing habitats in the Olympic National Park wilderness. However, tracking the extent of recolonization is challenging, as current techniques applicable in the frontcountry are untenable in the roadless backcountry. We developed and validated a collection of species-specific molecular markers for use in PCR amplification of aquatic environmental DNA (eDNA). The protocol involves collecting and filtering replicate 1-L water samples in situ and then extracting DNA

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from each filter in the lab. The extracted eDNA is then interrogated for the presence of target species using mitochondrial DNA probes in a qPCR analysis. We targeted 11 fish species, sampled before and after dam removal, most recently across 56 river kilometers at 10 frontcountry and 14 backcountry sites from the mainstem (n=14) and tributaries (n=10). After being limited to 8 river kilometers downstream of the Elwha Dam for a century, salmon have been visually observed upstream of both dam locations. Chinook Salmon (*Oncorhynchus tshawytscha*) had the first opportunity to migrate past the recently removed Glines Canyon dam (September, 2014); we detected the presence of Chinook Salmon eDNA considerably farther upstream than detections made with visual and snorkeling surveys. The development of species-specific molecular markers holds promise for examining patterns of target species presence/non-detection for the purpose of tracking the rate and extent of recolonization of migratory fish species in the Elwha River.

4. Preliminary Estimates of Juvenile Survival and Dispersal in the White-Headed Woodpecker. Philip C. Fischer, *Retired civil engineer, Selah, WA; pcfischer@gmail.com;* Teresa J. Lorenz, *College of Natural Resources, University of Idaho, Moscow, ID 83844.*

The White-headed Woodpecker (*Picoides albolarvatus*) is a sensitive species and important cavity excavator in dry pine forests of the northwest. While their nesting ecology has received a lot of attention, information is lacking on the fate of young after nest fledging. Past research studies with color-banded adults have speculated that first-year survival is low and dispersal distances are small. Here, we used radio-telemetry to track juvenile survival and dispersal in White-headed Woodpeckers (n = 13) in the first four months post-fledging. Survival was high, and Kaplan-Meier survival from radio-tagged chicks ($\bar{x}$ = 0.89; 95% CI: 0.43-0.98) did not differ from adult survival (n = 34) for the same time period (χ^2 = 0.0009, P = 0.9765). Only one juvenile died during the monitoring period, and this mortality occurred after independence from parents. Dispersal distances were greater than expected based on past telemetry studies with related woodpecker species. Average dispersal distance at four months was 16.5 km (±13.2 km) and included one dispersal event of 45.6 km, which is greater than mean and maximum dispersal for Black-backed (*P. arcticus*), Red-cockaded (*P. borealis*), and Red-bellied (*Melanerpes carolinus*) woodpeckers tracked in past studies. Our findings suggest that White-headed Woodpecker juvenile survival and dispersal distances may be higher than generally assumed, and management plans for this species should be revised to account for these factors. Meanwhile, additional studies of longer duration and with larger sample sizes are needed to confirm whether our estimates are reflective of annual survival and dispersal in other years and populations.

5. Adaptive Reuse of a Historic Farmhouse into a Bat Maternity Colony. Catherine J Flick, *US Forest Service, Columbia River Gorge National Scenic Area, Hood River, OR 97031; flick@gorge.net.*

The poster describes the adaptive reuse of the McClure farmhouse by a big-eared bat maternity colony and the simple, low-cost repairs completed on the structure. The historic farmhouse is on government property and was stabilized in 2014 to provide a safe, dependable maternity roost for approximately 100 Townsend's Big-eared Bats (*Corynorhinus townsendii*). Funding afforded minimal building maintenance: repair a leaking roof; reduce forced entries by humans; paint graffiti to restore respectability to the farmhouse's exterior. In-house technical expertise and labor kept the project costs within budget. Coordination with and approval by the archaeologist and landscape architect were critical to the project's implementation. Funding was provided by the Interagency Special Status/Sensitive Species Program, US Forest Service/Bureau of Land Management.

6. Salamanders, Global Warming, and Metrics of Growth and Biomass in Palouse Prairie Wetlands. Erim Gomez, Rodney Sayler; *School of the Environment, Washington State University, PO Box 646410, Pullman, WA 99164-6410; erimgomez@gmail.com; rdsayler@wsu.edu.*

Shallow, seasonally-flooded wetlands (vernal ponds) are productive for many amphibian species partly because they are devoid of predatory fish. However, increasing temperatures and altered precipitation patterns that accompany global climate change may threaten these ecosystems and their aquatic biological communities if wetlands dry prematurely before amphibians can undergo metamorphosis and begin their terrestrial adult life stage. We studied growth dynamics of Long-toed Salamanders (*Ambystoma macrodactylum*) in a series of Palouse Prairie wetlands to evaluate the hypothesis that growth was influenced by wetland periodicity and that salamanders would be forced to emerge at a smaller body size in seasonally-flooded

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wetlands compared to more permanent wetlands. We used advanced algorithmic modeling techniques to compare sizes of salamander larvae among 16 wetlands across time, elevation, and spatial landscapes in Palouse Prairie and found that size distributions were: 1) smaller in vernal ponds that dried up more quickly; 2) larger in more permanent wetlands regardless of wetland area; but 3) varied significantly among wetlands of similar area, flooding periodicity, and geographic location. We conclude that each wetland constitutes its own somewhat unique ecosystem, which complicates studying the metrics of growth and biomass across landscapes. However, algorithmic modeling allows diverse wetlands to be objectively grouped and compared for relevant ecological features on an a posteriori basis. If seasonal flooding dynamics of vernal ponds are altered by climate change, it may reduce productivity of this segment of the aquatic landscape for amphibians in Palouse Prairie and elsewhere in the Pacific Northwest.

★7. Earthen Dam Provides Habitat for Black Salamander Population in SW Oregon. Colin S Guiley. *Southern Oregon University, Ashland, OR 97520; guileyc@sou.edu.*

Black Salamanders (*Aneides flavipunctatus*) reach the northernmost limit of their range in southwestern Jackson County or southeastern Josephine County, Oregon. Little is known about Black Salamanders in southern Oregon, partially due to spotty distribution and seeming rarity in the area. Of the sites where Black Salamanders are known to occur in Oregon, the easternmost is located near Ashland, Oregon at Emigrant Lake. In fall 2014, I began a study on a large population found living in a man-made structure (embankment dam) at this site using time-constrained searches to compare numbers on the dam face to their numbers in the surrounding undisturbed habitat, and to investigate general activity patterns. Many more salamanders (9 per person-hour) have been found on the dam face than in the seemingly suitable habitat adjacent to the dam (0). This disparity, although partially explainable by possible greater ease of locating the salamanders on the dam, suggests intensive use of this man-made structure by Black Salamanders.

8. Preliminary Results from Five eDNA Studies in Southern BC. Jared Hobbs, *M.Sc., R.P.Bio., Hemmera, 4730 Kingsway, Burnaby BC, V5H 0C6; jhobbs@hemmera.com;* Caren S Goldberg, *Washington State University, 100 Dairy Road, Pullman Washington, WA 99164, caren.goldberg@WSU.edu.*

Environmental DNA (eDNA) methods provide an efficient alternative survey method for aquatic and semi-aquatic organisms. Field effort associated with sample collection is less intensive than that associated with traditional baited trapping (e.g., for Pacific Water Shrews (*Sorex bendirii*)) and/or physical searches (e.g. for Northern Red-legged Frogs (*Rana aurora*)). This method is non-invasive to the target species, reduces the risk of pathogen transfer between sites, is highly accurate for detection of species in lotic and lentic habitats, is able to detect the presence of pathogens, and is cost-effective for species that are difficult to detect using traditional methods. The application of eDNA methods is receiving increasing attention in British Columbia (BC). In the 2014 field season, Hemmera and Washington State University collaborated to successfully implement seven eDNA projects on six species in southern BC. Target taxa included Rocky Mountain Tailed Frog (*Ascaphus montanus*), Coastal Tailed Frog (*Ascaphus truei*), Red-legged Frog, Great Basin Spadefoot (*Spea intermontanus*), Tiger Salamander (*Ambystoma mavortium*) and Pacific Water Shrew. The development of a primer for Pacific Water Shrew represents the first application of this method for detection of a semi-aquatic mammal in North America. These projects represent the first application of eDNA in BC in a formal environmental assessment process. Results will be used to inform conservation and management in both a regulatory and a conservation framework. During implementation lessons were learned regarding survey timing, sampling design and qPCR assay design. Knowledge gaps are also identified and discussed.

9. Alberta Volunteer Amphibian Monitoring Program. Kris Kendell, *Alberta Conservation Association, Sherwood Park, AB, T8A 6J7; kris.kendell@ab-conservation.com.*

Alberta Conservation Association (ACA) delivers the Alberta Volunteer Amphibian Monitoring Program (AVAMP) in partnership with Alberta Environment and Sustainable Resource Development. AVAMP is a long-term community survey of amphibians established in 1992 under the auspices of the Declining Amphibian Population Task Force (DAPTF) in response to information showing that many populations of amphibians throughout the world have declined. Such declines have been documented in Alberta (e.g., Northern Leopard Frog [*Lithobates pipiens*]). AVAMP participants contribute to the advancement of amphibian and reptile conservation through submission of voluntary data on their own time, without direct

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supervision from ACA. AVAMP is an effective and economical means to collect basic data (i.e., species, date, location and surveyor) that can be used by researchers, government, educators, and consulting companies. These data provide general distribution information for herpetofauna populations in the province and, along with other data, assist in updating the general status of amphibians and reptiles in Alberta. All data collected through the project are entered into the Fish and Wildlife Management Information System (FWMIS) database. FWMIS provides a central repository where government staff, industry, and the public can store and access fisheries and wildlife data. AVAMP data are an important contribution to this knowledge base.

10. Herpetofauna of Alberta Biobank Project. Kris Kendell, *Alberta Conservation Association, Sherwood Park, AB, T8A 6J7; kris.kendell@ab-conservation.com;* Brian Eaton, *Alberta Innovates - Technology Futures, Vegreville, AB, T9C 1T4; brian.eaton@albertainnovates.ca;* Anthony Russell, *University of Calgary, Calgary, AB, T2N 1N4; arussell@ucalgary.ca*, Mark Steinhilber, Ian Kriston, *Royal Alberta Museum, Edmonton, AB, T5N 0M6; mark.steinhilber@gov.ab.ca, ian.kriston@gov.ab.ca.*

The Herpetofauna of Alberta BioBank (HABB) is a collaborative project developed by the Alberta Amphibian and Reptile Specialist Group (AARSG) and the Royal Alberta Museum (RAM). AARSG, chaired by the Alberta Conservation Association (ACA), is a network of scientists and naturalists dedicated to the study and conservation of amphibians and reptiles in Alberta. One role of the AARSG is to initiate new projects that will be beneficial to all who are interested in amphibians and reptiles in this province. The HABB project is the first of these initiatives. AARSG, through the HABB project, coordinates the collection, curation, and supply of amphibian and reptile tissue for genetic, disease, and contaminant research, and other applications. The objective is to ultimately develop a tissue bank that covers the entirety of the province, on a grid-like basis. Currently the testing of the collection protocol and curation process is underway, based upon the acquisition of anuran larvae. Tissues are being collected and preserved following a standardized protocol and are then shipped to the RAM in Edmonton for verification of identification, curation, storage, and disbursement. Based upon the current testing procedure, protocols will later be developed for the collection and handling of tissue from other anuran life stages, larval and adult salamanders, and reptile species. The BioBank will be managed by the RAM and disbursement of tissue will be at its discretion.

★11. Foraging Value of Temporary Grasslands to Barn Swallows in an Agriculturally Dominated Landscape. Olga Lansdorp, *Simon Fraser University, Burnaby BC V5A 1S6; olansdor@sfu.ca;* Nancy Mahony, *Wildlife Research Division, Science and Technology Branch, Environment Canada, Edmonton, AB T6G 2E9; nancy.mahony@ec.gc.ca;* Tony Williams, *Simon Fraser University, Burnaby BC V5A 1S6; tdwillia@sfu.ca.*

Barn Swallows (*Hirundo rustica*), like many aerial insectivores, have experienced population declines across North America including our study area in southwestern British Columbia. The agricultural landscape in the Fraser River delta is highly anthropogenically modified and under constant development pressure but is situated along the Pacific Flyway and provides overwintering, migratory stop-over, and breeding habitat to many birds. Since Barn Swallows predominantly breed in agricultural areas, within the context of a shrinking agricultural land base we want to understand the ecological implications of different types of farmland management. In the Metro Vancouver area the Grassland Set-Aside Program, administered by the non-profit organization Delta Farmland and Wildlife Trust, annually enrolls approximately 200 hectares of farmland to function as patches of grassland. Set-aside grasslands are planted with a forage/clover seed mix and largely left untouched for up to six years. We studied the ability of these temporary grasslands to provide feeding habitat to breeding Barn Swallows in southwestern British Columbia. We sampled and analyzed the insect community and compared numbers of feeding Barn Swallows over set-aside grassland and conventionally managed agricultural fields in 2013 and 2014. Temporary grasslands have more Araneae (P-value = 0.007), Diptera (P-value = 0.007) and Neuroptera (P-value = 0.048), while more Homoptera were found in conventionally managed agricultural fields. Araneae, Collembola, Heteroptera, Mites and Neuroptera were found only over grassland fields. In addition to a more robust insect community, temporary grassland fields supported more feeding Barn Swallows than conventionally managed fields.

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12. Determining Species Diversity and Population Size of Bats At the Remac Mine, Pend d'Oreille Valley. Cori Lausen, *Wildlife Conservation Society Canada Kaslo, BC V0G 1M0;* Leigh Anne Isaac, *VAST Resource Solutions Inc. Cranbrook, BC V1C 4J1.*

In Canada, the greatest species diversity of bats occurs in British Columbia (BC). Little is known about bat ecology in the province, particularly in winter. Bats play a critical environmental role and now face unprecedented threats due to White-Nose Syndrome (WNS). There is an urgent needto locate hibernacula so that potential mitigation can be strategized and overwintering habitat secured. We focused on a mine in southeastern BC. Preliminary investigations suggest it may be the most populous and diverse hibernaculum in the province. Our goal was to quantify the number of bats and species using this hibernaculum. Bats were acoustically monitored at mine entrances to determine species identification and patterns of activity. Free-flying bats were captured using mistnets strung across accessible mine portals from September 2012 – November 2014, with emphasis on late fall and winter. Bats were banded to allow individual identification upon recapture. We captured four species in winter: California Myotis (*Myotis californicus)*, Silver-haired Bat (*Lasionycteris noctivagans*), Townsend's Big-eared Bat (*Corynorhinus townsendii*) and Big Brown Bat (*Eptesicus fuscus*). The first 3 species were most commonly captured. In fall and winter, unusual acoustic patterns attributed to Silver-haired Bats suggest a 'mating song'; the presence of females, and males with stored sperm for all 3 common species supports the hypothesis that mating is occurring here. We have banded >200 bats and continue to catch many unbanded individuals, suggesting that this hibernaculum is large relative to other western hibernacula. Recaptures confirm roost fidelity within and between years, and have provided the first evidence of year-round residency of Silver-haired Bats at a mine.

★13. Variation in Call Number and Intracall Variation of the American Crow (Corvus brachyrhynchos) between Post-roost Aggregations and Diurnal Activity Centers. Alexander Lefort, Alexis Menth, Bri Mccloskey, Hoai-An Phuoc Le, Rachel Dejneka, Douglas W Wacker, *University of Washington Bothell, Bothell, WA 98011; Aalefort@uw.edu.*

American Crows (*Corvus brachyrhynchos*) are intelligent, communal animals and show a large vocabulary of calls. In this study, we examined how crows communicate between post-roost aggregations – where crows gather as they leave their roost in the morning, and diurnal activity centers – where groups of crows forage during the day. This is a test of the information center hypothesis, as crows may use post-roost aggregations to relay information about foraging locations. We recorded audio and video on post-roost aggregations and diurnal activity centers, and analyzed the total number of crow calls using an audio analysis program, Raven Pro 1.5. Crows made more calls in post-roost aggregations than on diurnal activity centers, suggesting that they may be using post-roost aggregations as information centers. Crow numbers did not vary between the post-roost aggregations and the diurnal activity centers. We also observed a large amount of intracall variation, or variation within several call types. This variation may allow for additional information to be conveyed. These findings add to a body of pre-existing literature that suggests that crows use complex vocalizations in a context-dependent manner.

★14. Prey Odor Discrimination and Tongue Flicking Behavior by Ingestively Naïve and Non-naïve Neonate Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*). Megan Linn, Daniel D Beck, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg WA, 98926; weaverro@cwu.edu.*

Many species of rattlesnakes have diets that vary ontogenetically. The Northern Pacific Rattlesnake (*Crotalus oreganus oreganus*) is a species thought to show shifts in prey preference, from ectothermic to endothermic vertebrate prey. To test this, we presented 2 classes (ingestively naïve and non-naïve) of neonate Northern Pacific Rattlesnakes with chemical stimuli from ectothermic (lizard), and endothermic (mouse) prey. We presented odors on cotton swabs and recorded tongue flicks for 1 minute, as well as recording tongue flicking behaviors with digital video. Twenty captive-born and 5 wild-caught neonates were tested against odors gathered from laboratory mice (*Mus musculus*), and Western Fence lizards (*Sceloporus occidentalis*). We analyzed trials (n = 62) for tongue-flicking behavior, the length, duration and number of tongue flicks, and whether there was a correlation between unique tongue-flick behavior and odor. We observed responses in 69.7 % of all trials. Some observed unique tongue flicks to odors included: movement of the tongue upward and downward, sideways right or left, straight outwards, bent upward or downward. Our data

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suggest a correlation between tongue-flick rate and prey odors. Neonate rattlesnakes showed a preference for mouse (46.8 % of trials) odors, and less so for lizard odor (4.8%) or the control (17.7%) of deionized water. Preliminary analysis shows the type of tongue movement is also correlated to odor type. It appears both captive-born (naïve), and wild-caught (non-naïve) snakes show no difference in preferred prey, and preferred endothermic (mouse) over ectothermic (lizard) prey types.

★15. Microhabitat Preference of Oregon Ensatina (*Ensatina eschscholtzii oregonensis*) in Small Populations in Central Snohomish County, Washington State. Krista M. Little, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926; littlek@cwu.edu.*

The Oregon Ensatina (*Ensatina eschcholtzii oregonensis*) is one of the more abundant and commonly observed salamanders in central Snohomish County, Washington state. This species is often found among leaf litter and down woody along riparian corridors in mixed coniferous and deciduous forests. The purpose of my study was to conduct a preliminary investigation of microhabitat preference of E. e. oregonensis that I observed in 2 different forested areas at a site near Lake Stevens, Washington. The sampled microhabitats were divided into 4 categories: fallen bark from trees, rotten logs, artificial cover and other (under moss, leaf litter, rocks). Observed specimens from each category were recorded over the span of several days in mid-summer through late fall. Of the 29 total specimens observed, the highest frequency of specimens was found under alder bark (*Alnus* spp.) that had been sloughed off by woodpeckers (66%). The second highest frequency of specimens was found under rotten logs (24%), while few (7%) were found under artificial cover, and 3% of salamanders observed were found under moss. Based upon my observations, it seems E. e. oregonensis show a preference towards fallen alder bark. Under much of the fallen bark I observed an abundance of possible arthropod prey, more so than in other microhabitats. Future research direction will focus on obtaining a larger sample size, as well as examining additional microhabitat parameters (insect type and abundance, soil pH, and moisture) that may be driving the occurrence and any possible preferences by salamanders.

16. Insights into Avian Nesting Ecology: Using Remote Cameras to Quantify Activities of Nest Predators at White-Headed Woodpecker Nests. Teresa J Lorenz, *College of Natural Resources, University of Idaho, Moscow, ID 83844; lore5748@vandals.uidaho.edu;* Philip C. Fischer, *Retired civil engineer, Selah, WA; pcfischer@gmail.com.*

While avian nest survival has been the focus of a large number of research studies, the ability to identify nest predators and quantify predator activities has occurred mostly recently with the advent of video surveillance at nests. Additionally, most studies of nest survival have linked nest survival only to vegetation features, even though the act of nest predation is usually attributed to animals. Here, we used Passive Infrared trail cameras to monitor visitors to active White-headed Woodpecker (*Picoides albolarvatus*) nests (n = 16), and compared nest predator abundance at successful and unsuccessful nests. Among 170,321 images captured by our trail cameras, we documented 2097 visits by 28 species (other than the adult parents) to the nest area or cavity. We found that visits to nests by presumed predators were common, and 60% of successful nests were visited and inspected by chipmunks, squirrels, and corvids while active. We failed to positively document nest predation, highlighting the shortcomings of trail-cameras for nest monitoring research. Lastly, densities of rodents at nests did not differ for successful or unsuccessful nests ($t = 1.56$, $df = 14$, $P = 0.1400$), and were not correlated with cover at nests by shrubs ($r = 0.22$, $P = 0.4129$) or coarse woody debris ($r = 0.01$, $P = 0.9707$). Our findings are important for understanding nest survival in cavity-nesting birds, and they suggest that the actual decisions by potential predators to consume nest contents may be complex and poorly correlated with their visitation rates, presence, or abundance.

★17. Preliminary Results Examining Survival, Habitat Use and Movement of Head-started Western Painted Turtles Using Radiotelemetry. Deanna J Mactavish, *Simon Fraser University, 8888 University Drive, Burnaby BC V5A1S6 and the British Columbia Ministry of Forests, Lands and Natural Resources, 2nd Floor, 10470-152nd Street Surrey, BC V3R0Y3; mactavish.deanna@gmail.com;* Aimee M Mitchell, A*thene Ecological, 103-1516 East 1st Ave, Vancouver BC V5N1A5;* Andrea J Geilens, *Wildlife Preservation Canada, 26911 33A Ave, Aldergrove BC V4W3G7;* Vicki L Marlatt, *Simon Fraser University, 8888 University Drive, Burnaby BC V5A1S6.*

The Western Painted Turtle (*Chrysemys picta bellii*) is the only remaining native freshwater turtle in the

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province of British Columbia, Canada. Coastal populations are federally endangered and many historically occupied sites no longer support viable populations. In an attempt to augment populations, yearling turtles from a newly implemented head-starting program were released at four wetland sites within the Lower Mainland and Fraser Valley in the summer of 2014. As part of this first year of a two-year pilot study, micro transmitters were attached to all juveniles to assess survival, movement patterns, and habitat usage. All juveniles were tracked twice a day, every five days at each site for approximately three months. Based on movement data, 96% (21 out of 22 released) of juveniles survived at these four sites 30 days post-release. By 60 and 80 days, detection and movement data indicated a minimum of 75% and 19% of juveniles were still alive (active), respectively. However, this decline was primarily due to lack of transmitter detection, and it cannot be discerned at this time whether the decline is due to transmitter failure, battery loss, natural mortality or predation. Preliminary analysis on habitat usage during the summer and fall indicates juveniles significantly use shoreline habitat with moderate to high submergent vegetation. Data collection from this study is ongoing and will help optimize post-release survival rates of turtles reared in head-starting programs at future release sites through an increased understanding of juvenile habitat usage.

★18. Do Crow Vocalizations Vary in Different Behavioral Contexts? Bri Mccloskey, Rachel Dejneka, Hoai-An Phuoc Le, Alexander Lefort, Alexis Menth, Douglas W Wacker, *University Of Washington Bothell, Bothell, WA 98011; brimcclo@uw.edu*

Vocal communication among birds has been studied across many species. American Crows (*Corvus brachyrhynchos*) may employ "information centers" to collect information about foraging sites, yet how the information is gathered, actively or passively, is not well understood. To explore the information center hypothesis, we collected audio and video recordings of American Crows in the field over a three-month period, in 8 different locations across two distinct behavior contexts: post-roost aggregations (potential information centers) and diurnal activity centers (foraging sites). Recordings were analyzed using Raven Pro 1.5, a sound analysis program, and the types of calls used in each location type were compared. There was no significant difference in the average number of call types used in post-roost aggregations versus diurnal activity centers, but there were significant differences in use of the alert, assembly, and rattle calls, all calls that were previously categorized in literature. We also saw significant differences in calls not previously named or categorized, which we named the short caw and extended caw. All of these calls were shown to be used more at post-roost aggregations than diurnal activity centers. These data are consistent with the hypothesis that American Crows may use post-roost aggregations as information centers.

★19. Differences in Call Number and Type between Two Behavioral Contexts of the American Crow (*Corvus brachyrhynchos*). Alexis Menth , Bri Mccloskey, Alexander Lefort, Hoai-An Phuoc Le, Rachel Dejneka, Douglas W Wacker, *University of Washington Bothell, School of Science, Technology, Engineering, and Mathematics, Box 358538 18115 Campus Way NE Bothell, WA 98011-8246; mentha@u.washington.edu*

The American Crow (*Corvus brachyrhynchos*) is a highly intelligent bird that uses complex vocalizations as a means of social communication within different contexts. We compared how these birds communicated in two distinct behavioral contexts, pre-roost aggregations and diurnal activity centers. Pre-roost aggregations are large groups that crows form prior to flying to their roost at night, while diurnal activity centers consist of foraging groups. Here, we located four sites for each behavioral context and collected a total of ten video and audio recordings of American Crows near Bothell, WA USA. The videos were used as a control for counts obtained in the field and the audio recordings were analyzed for number of calls and number of types of calls using Raven Pro 1.5. Crows made more total calls and more types of calls in pre-roost aggregations than diurnal activity centers. These findings remained significant after controlling for the number of crows present within each context. It may be possible that pre-roost aggregations are used as information centers where crows communicate about the locations of good foraging areas discovered while at diurnal activity centers.

20. Evaluation of an Aquatic Funnel Trap for Shallow Water Habitats Used by Oregon Spotted Frog (*Rana pretiosa*). Stephen Nyman, *Whatcom County Amphibian Monitoring Project and HDR, Inc., 1111 North Forest Street, Bellingham, WA 98225; stephen.nyman@hdrinc.com.*

In order to study Oregon Spotted Frog (OSF) (*Rana pretiosa*) larval ecology, I required techniques to sample shallow, densely vegetated habitats where dip-netting was ineffective and use of conventional aquatic

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funnel traps was precluded. I designed plastic bottle traps from 3.78-liter water bottles with a funnel at each end for use in water as shallow as 7.5 cm, compared to a minimum effective depth of about 11.5 cm for commercially available, rectangular, nylon-net traps, and a footprint less than half as large, allowing use in dense vegetation. Although direct comparison of trap effectiveness was limited by differences in where the two trap types were used (i.e., bottle traps primarily in shallow water only), both trap types captured larval OSF and larvae of three other amphibian species, paedomorphic Northwestern Salamanders (*Ambystoma gracile*), adult and juvenile OSF, Three-spined Sticklebacks (*Gasterosteus aculeatus*), and a similar array of aquatic invertebrates. Most deployed bottle traps (84% of the total) captured at least one amphibian. At one site where the two trap types were used with similar frequency (30 trap days for bottles and 24 for regular traps), the mean number of larval OSF was 11.6/bottle and 11.8/regular trap. Mortality of larvae in bottle traps rarely occurred and was almost entirely associated with coincident capture of a predator. Only slightly higher water temperatures within bottles sometimes occurred. The results suggest that these traps should be added to the "tool box" for amphibian site inventories, monitoring, life-history studies, and other investigations where conditions warrant.

★21. Ecology and Behavior of the Colorado Checkered Whiptail Lizard (*Aspidoscelis neotesselata*) in Grant County, Washington State. R Troy Peterson, Robert E Weaver, *Department of Biological Sciences, Central Washington University, Ellensburg, WA 98926, petersonro@cwu.edu; weaverro@cwu.edu;* James M Walker, *Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701, jmwalker@uark.edu.*

The purpose of our study was to begin a long-term investigation on the ecology and behavior of an introduced population of Colorado Checkered Whiptail Lizard, (*Aspidoscelis neotesselata*) near Lind Coulee in Grant County, Washington state. We collected lizards by hand during June to August 2014, while post-capture laboratory analysis of stomach contents and egg size in mature individuals took place from July to December. We took photographs and video footage of the behaviors of the lizards, as well as recorded GPS positions, body, soil and air temperatures for each lizard observed. Field observations revealed lizards were primarily active mid-day from 1000 to 1300 hr, at a mean soil temperature of 40.4°C. Individual lizards had a mean body temperature of 39.6°C. The mean egg length in mature individuals was 14 mm, and the average clutch size was 3.75 (mean clutch mass = 3.25 g). It was found that 94% of captured individuals had prey items in their stomachs. Our analysis showed this population's diet consists primarily of Coleoptera (26%), Hymenoptera (21%) and Lepidoptera (14%), as well unidentifiable organic material (19%). Other prey items, such as invertebrate orders Aranea, Odonata, and Orthoptera, comprised up to 20% of the population's diet. On-site observations determined that the introduced population is expanding outward along the banks of Lind Coulee. This expansion was verified through the presence of burrows with tail drags, as well as observed individuals, south of the original site of introduction.

★22. Getting Kids Excited about Natural History through Inquiry-Based Science. Anne Salow, Elena Skjerping, David Reavill, Daniel Jager, Veronica Vaca, Omar Martinez, Robert Weaver, Wayne Quirk, Steve Wagner, *Department of Biological Sciences, Central Washington University, Ellensburg WA 98926; Salowa@cwu.edu;* Ruth Linsky, Grant Clifton, Sara Purdue, *Primate Behavior and Ecology Program, Central Washington University, Ellensburg WA 98926;* Jazmin Aguilar, Kelly Quirk, Tracy Plouse, *Mosaic2 Gear Up, Central Washington University, Ellensburg WA 98926.*

Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP) is a national program supported by the U.S. Department of Education. The program aims to create a sustainable culture of college awareness and preparedness, particularly among low-income and first-generation 6th graders through college freshmen. The focus of GEAR UP at Central Washington University is to provide hands-on, inquiry, and field-based science activities. Undergraduate and graduate college students led by scientific professionals at the university teach lessons based in various scientific disciplines including surveying for Pygmy Short-horned Lizards (Phrynosoma douglasii), and making insect collections, to conducting research on the adaptations to elevation. One of the highlights of Central's Mosaic2 GEAR UP is Camp Northwest Nature, a one-week camp in June. At the camp, students experience activities that show them what scientists and researchers do on a day-to-day basis. In addition to camp, MOSAIC2 travels to middle and high schools across the state throughout the school year. Lessons are developed based on the curriculum needs of the teacher and are focused on community-based natural history projects to excite students about science, learn about the biodiversity of their region, and prepare them for college.

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23. Red Knot (*Calidris canutus roselaari*) Migration on the Pacific Coast of the Americas. Joseph B. Buchanan, *Cascadia Research, Olympia, WA 98501 & Washington Department of Fish & Wildlife, Olympia, WA 98506; Joseph.Buchanan@dfw.wa.gov;* Lori J Salzer, *Washington Department of Fish & Wildlife, Olympia, WA 98506 Lori.Salzer@dfw.wa.gov.*

The Pacific Flyway population of Red Knots (*Calidris canutus roselaari*) uses key stopover sites in coastal Washington during spring migration. This subspecies was proposed for federal listing, but the U.S. Fish & Wildlife Service lacked sufficient information to adequately inform a listing decision. Little is known about the ecology and status of the Pacific Flyway population, while the eastern subspecies, Calidris canutus rufa has been well-studied. From 2006 - 2013, we investigated aspects of Red Knot migration in coastal Washington. Ground and boat-based surveys were conducted in Grays Harbor and Willapa Bay. We developed survey protocols for re-observations of marked birds. In 2009 and 2010 we conducted surveys throughout spring migration. Migration peak was in early May, with a high count of about 7,000 birds. Preliminary results estimate a Pacific Flyway population of 20,000 birds. In 2011, we marked 162 Red Knots at Grays Harbor, Washington. Over 25% of the Red Knots marked have been re-observed; including 20 birds in Mexico. All-years re-observation data shows connectivity between Washington and sites in Northwestern Mexico and other areas. In Washington, we re-observed Red Knots marked by other researchers at breeding sites in Alaska, Wrangel Island, Russia and at wintering areas in Baja, California.

24. Field Detection and Assessment of Ulcerative Shell Disease in Western Pond Turtles (*Actinemys marmorata*) in Washington. Tammy A Schmidt, *Washington Department of Fish and Wildlife, Lakewood, WA 98498; Adolf K Maas, Zoo Vet Consulting, Bothell, WA 98041.*

Environmentally induced abnormal conditions and disease are rising concerns for wildlife managers across the United States. Common in captive turtles, Ulcerative Shell Disease (USD) usually results from husbandry practices. In the wild, the disease can manifest from any number of adverse conditions from environmental to behavioral to biological, such as pollutants, lack of adequate basking, or illness/injury. It may take years before an outward appearance of the disease is detected. USD can progress to septicemia, paralysis, and death if left untreated. Regardless of the etiology, USD has the potential to devastate turtle populations and significantly slow recovery effort. USD was detected in Washington's endangered Western Pond Turtle (*Actinemys marmorata*) recovery populations in 2009 and is of paramount concern; therefore, we developed this assessment tool to document USD and aid in management decisions. This assessment tool is a standardized scoring system that can be used to compare USD prevalence between sites, through time, and across age classes.

25. Management Plan and Population Analysis of Western Painted Turtles (*Chrysemys picta bellii*) at Fairview Creek Headwaters. Ashley Smithers, *Portland State University, Portland OR; 97201; asmithers@pdx.edu.*

Fairview Creek Headwaters in Gresham, Oregon holds the eastern-most urban population of Western Painted Turtles (*Chrysemys picta bellii*) in the Willamette Valley. Understanding threats and current status of the urban population of turtles is of great interest to the City of Gresham. Data were collected from 2007-2014 on the population including: weight, sex, size, recapture, age, and nesting location. A habitat assessment was done looking for available nesting and basking habitat available at the site. Data collected and analysed in this project will be incorporated into a management plan for the turtle population and the site.

★26. Preliminary Results from "A Spatial Linkage of Non-breeding Habitat to Breeding Habitat of Oregon Spotted Frogs (*Rana pretiosa*) Using a Genetic Parentage Analysis. Chelsea D Waddell, *The Evergreen State College, Master of Environmental Studies, Olympia, WA 98516; WaddellC@evergreen.edu;* Marc P Hayes, *Washington Department of Fish and Wildlife, Habitat Program, Olympia, WA 98501; Marc.Hayes@dfw.wa.gov.*

The at-risk Oregon Spotted Frog (OSF, *Rana pretiosa*) has disappeared from much of its geographic range. It is endangered in Washington state, and is considered threatened under the US Endangered Species Act. Much research has been devoted to improving management of OSF breeding habitat. Despite these important efforts, adult non-breeding habitat use in western Washington remains poorly known, and a significant gap in

our understanding of this species. In western Washington, many OSF populations are small, and embedded in a rapidly urbanizing matrix. Given these habitat limitations, determining the total footprint of habitat each OSF population uses is critical to their conservation. This study investigates the spatial relationship between breeding and non-breeding habitat use patterns of adult OSFs by using genetic sampling for one such small population. This effort will take advantage of that fact that egg masses laid in 2014 at the target study site, West Rocky Prairie, have already been genetically sampled. In particular, this effort involves sampling adult OSFs genetically in their non-breeding active-season habitat, and linking those adults to breeding locations based on the parentage of egg masses. This work also contributes to characterizing this population genetically, to identify potential issues that only genetic data can reveal. As management of OSF must address all habitats that may contribute to its vulnerability, this study will not only be important to the management of the OSF population at West Rocky Prairie, but will provide a basis of what to expect for non-breeding active-season habitat in other OSF populations.

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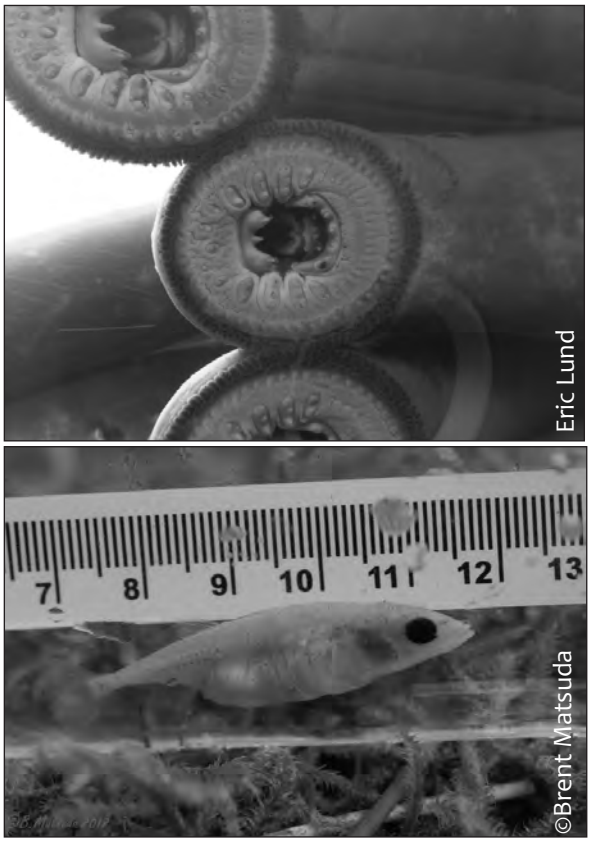
Urban ducks in Victoria, BC, after the SNVB meeting in 2007.

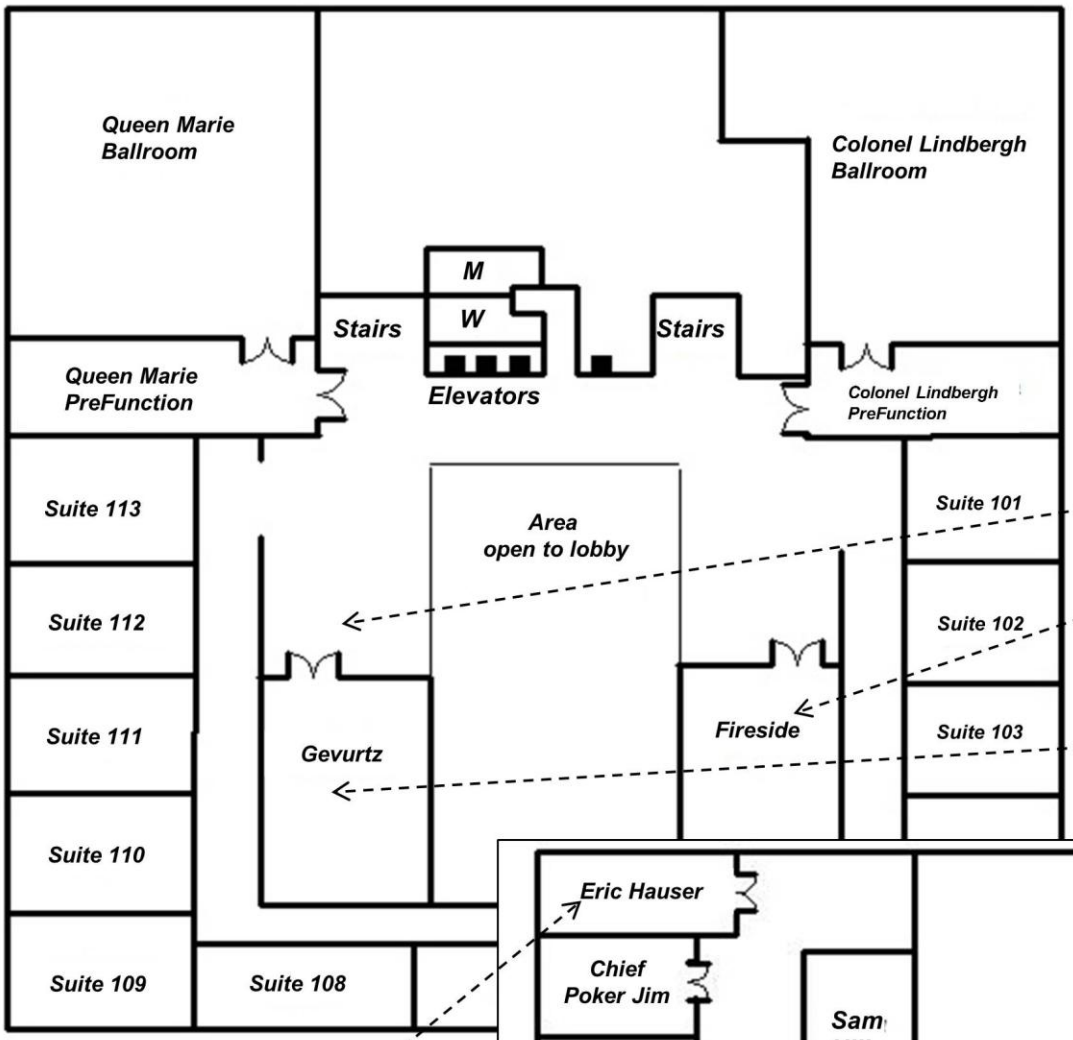


Top: Pacific Lamprey on a fish ladder window, Bonneville Dam, Columbia River. Bottom: A white form of the Three-spined Stickleback.

Notes Comments Contacts

Embassy Suites – Downtown Portland, OR

Mezzanine Level

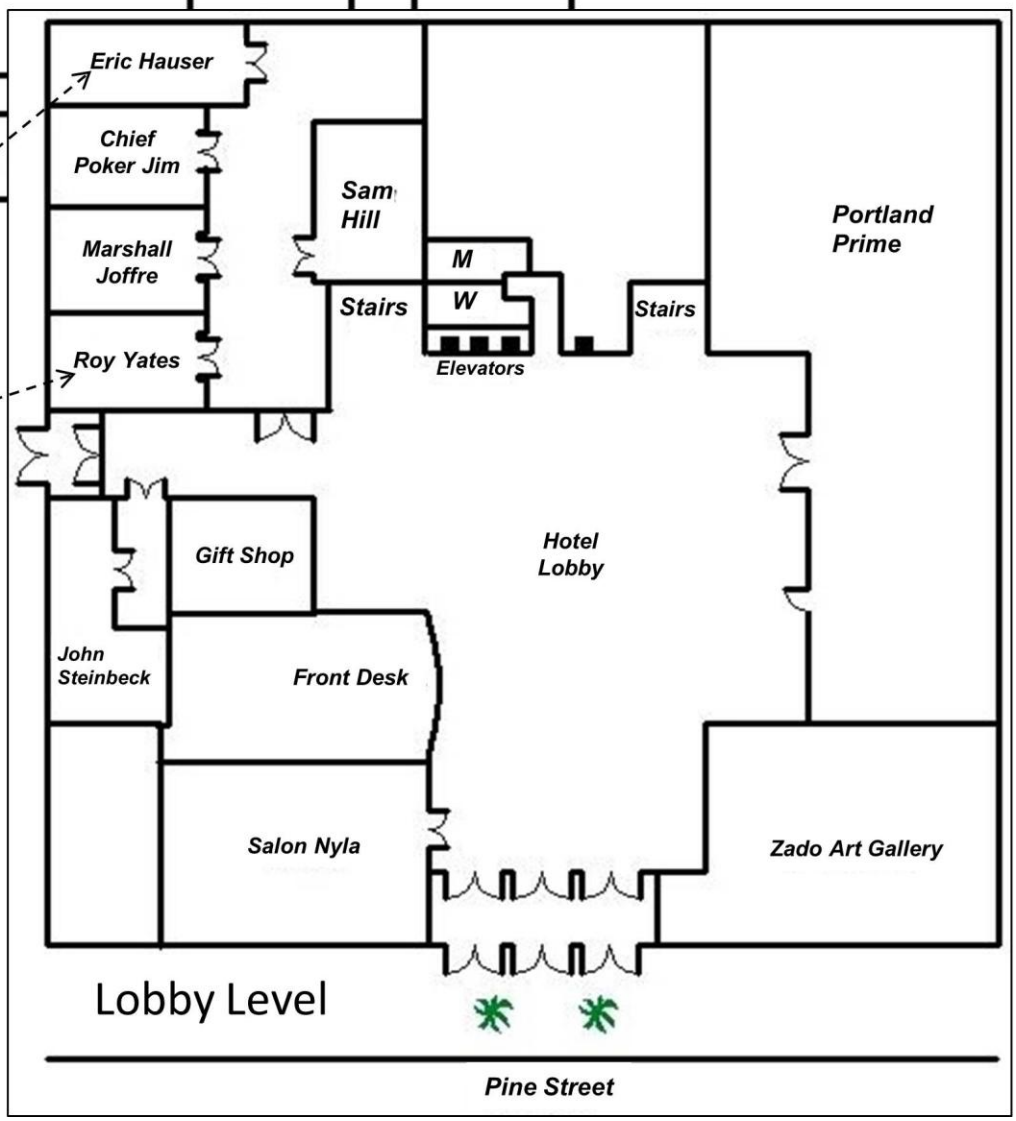


SNVB Registration (*outside Gevurtz Room*)

Fireside Room:
Occupancy Modeling Workshop #1, Concurrent Sessions

Gevurtz Room:
Pond Turtle Workshop #4, Concurrent Sessions

Lobby Level



Eric Hauser Room:
Student Mentoring and Poster Design Session

Roy Yates Room:
Media Relations and Communications Workshop #2, Museum Collections Workshop #3

Arcadia Garden
(on lower level 2):
SNVB Member Luncheon

NW PARC Sponsored Social
Kells Irish Pub
112 SW 2nd Ave
Tuesday, Feb. 24th @ 7:00 PM
All NW PARC and SNVB attendees are welcome