19th Annual
Research Advances in Fisheries, Wildlife, and Ecology Symposium
Hybrid Edition
April 14-15th, 2022
LaSells Stewart Center and on Zoom
Oregon State University
Corvallis, Oregon, USA
Research Advances in Fisheries, Wildlife and Ecology (RAFWE) showcases research, extension, and community outreach activities conducted within or in association with the Department of Fisheries, Wildlife, and Conservation Sciences, related departments at Oregon State University, other universities, and state and federal agencies. We encourage attendees and presenters to interact throughout the day.

We thank you for your patience as we transition to a hybrid venue given the special circumstances, and we are excited to try out this new format with all of you! We hope that the changes we made this year and last will lay a framework to better incorporate our student researchers based outside of Corvallis for future RAFWEs.

Activities include a workshop, oral presentations, poster session, and keynote address. Our keynote speaker is Dr. Elizabeth Hennessy. Generous donors have also provided a variety of goods and services for a silent and live auction.

For additional information, check out the RAFWE website below:


Don’t forget to use #RAFWE for all of your social media posts!
# Schedule

## Thursday, April 14th

### Workshop

<table>
<thead>
<tr>
<th>Time</th>
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| 3:00–5:00 | Data visualization with R: tips & tricks to publish & communicate your science  
*Location: Zoom* |

## Friday, April 15th

### Oral Presentations *(Construction and Engineering Hall)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1: Charismatic Species</th>
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| 9:00   | New nests for new recruits: trees provide comparable nesting substrate for two primarily cliff nesting eagles in Spain  
*Ryan Baumbusch* |
| 9:30   | A population in peril: sage-grouse nest ecology in a degraded landscape in Modoc County California, USA  
*Chelsea Sink* |
| 9:45   | Foraging ecology of coastal wolves in Katmai National Park & Preserve *(virtual)*  
*Ellen Dymit* |
| 10:00  | Assessing how morphology of female desert bighorn sheep varies with climate in the Mojave Desert of California *(virtual)*  
*Jose Alberto Torres* |

### Break 10:30 – 10:45

### Session 2: Well-Studied Systems

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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| 10:45  | Estimating occupancy and pair status of northern spotted owls using passive acoustic monitoring  
*Cara Appel* |
| 11:00  | Demographic recovery of a reef fish population over 30 years of spawning aggregation site protection  
*Claire Rosemond* |
| 11:15  | Anchors away! Understanding historical Anchorworm parasitism of introduced warmwater fishes in the Willamette Basin, Oregon  
*Elena Eberhardt* |
| 11:30  | Predicting decomposition rates along the mainstem and riparian zones of Lookout Creek *(virtual)*  
*Meagan White* |
| 11:45  | How do knowledgeable stakeholders feel about Oregon marine reserves? *(virtual)*  
*Brian Erickson* |

### Lunch 12:00 – 1:00

### Trivia 12:15 – 1:00 *(Construction and Engineering Hall)*
<table>
<thead>
<tr>
<th>1:00–1:45</th>
<th><strong>Session 3: Species Interactions</strong></th>
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| 1:00      | Hunting tiny vampires: modeling the distribution of a salmonid ectoparasite in Willamette Valley reservoirs  
*Kelsi Antonelli* |
| 1:15      | Coralline algae and species richness  
*Dylan Heppell* |
| 1:30      | The potential effects of invasive red imported fire ants on monarch butterfly reproductive success *(virtual)*  
*Remy Sutherland* |

**Break 1:45-2:00**

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<thead>
<tr>
<th>2:00–2:45</th>
<th><strong>Session 4: Changing Landscapes</strong></th>
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| 2:00      | Grouse groceries in the Sagebrush Steppe: impacts of juniper removal on herbaceous vegetation and invertebrate diversity  
*Kim Haab* |
| 2:15      | Effects of fuel reduction treatments on surface fire behavior in juniper woodland ecosystems  
*Claire Williams* |
| 2:30      | Targeted grazing of teasel *(Dipsacus fullonum)* with sheep in riparian conservation habitats *(virtual)*  
*Jordan Anderson* |

**Break 2:45 – 3:00**

**Keynote Address (Construction and Engineering Hall)**

| 3:00–4:00 | Dr. Elizabeth Hennessy  
*Restoring evolution in the Galapagos Islands: conservationist selection, wildlife politics, and the value of history* |

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<tr>
<th>4:00–5:00</th>
<th><strong>Poster Session (Agriculture Production Room)</strong></th>
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<tbody>
<tr>
<td>5:00–6:00</td>
<td><strong>Live and Silent Auctions (C&amp;E Hallway)</strong></td>
</tr>
</tbody>
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Please use the Zoom link below to attend RAFWE virtually:  
https://oregonstate.zoom.us/j/93484119454?pwd=NlhHRZIRkhrdUFYL20wWEpCZiZMQT09  
Password: RAFWE22

Please provide constructive feedback to our presenters!  
We ask all attendees to provide constructive feedback on presentations using the following Google form. Your comments will be distributed to the presenters after the event is concluded.  

View virtual posters at the following link:  
https://oregonstate.box.com/s/sy8zn53euytcarsek600olzq41jj57ix
The LaSells Stewart Center
Virtual Attendance Information

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Password: RAFWE22

We are glad to have you join us for RAFWE from wherever you may be!

All sessions, including the Oral Presentations and the Keynote Address, will use the same Zoom link, above. Moderators will be on hand to relay questions from virtual attendees to the presenters during live Q&A sessions.

View virtual posters at the following link:

https://oregonstate.box.com/s/sy8zn53euytcarsek600olzq41jj57ix

If you are accessing Zoom using an H.323/SIP room system, use the following general information in addition to specific the meeting ID and password information provided for each event:

162.255.37.11 (US West), 162.255.36.11 (US East)

115.114.131.7 (India Mumbai), 115.114.115.7 (India Hyderabad)

213.19.144.110 (EMEA), 103.122.166.55 (Australia)

209.9.211.110 (Hong Kong SAR), 64.211.144.160 (Brazil)

69.174.57.160 (Canada), 207.226.132.110 (Japan)
This year we have the privilege of hosting Dr. Elizabeth Hennessy as our keynote speaker. She will be speaking how the Galápagos Islands have long been called a “natural laboratory of evolution.” Since the mid-twentieth century, conservationists have worked diligently to protect evolutionary processes in the equatorial archipelago. Some have even attempted to restore the islands to their “pristine” condition in 1534, the year before Spanish conquistadors first stumbled ashore. But just how does one restore evolution? What happens when conservationists try? Through stories of giant tortoise discoveries, goats run wild, and indefatigable blackberry brambles, in this talk I explore the contradictions of goals to return to an “evolutionary Eden,” the unforeseen novelty of ecosystem dynamics, and the politics of what I call “conservationist selection”—the ethical decisions conservationists make about which kinds of human and nonhuman life belong in the archipelago, and which do not. I argue that history is valuable not as a baseline against which to measure ecosystem purity, but rather as an analytical lens for understanding the weighty consequences of the ways we approach restoration work.

ABOUT DR. HENNESSY:
Dr. Hennessy is an associate professor of history and environmental studies at the University of Wisconsin – Madison. She studies the intersection of environmental history, political ecology, science and technology studies, and multispecies studies with a regional focus on Latin America. Her current project addresses the palm oil industry in Ecuador, particularly how a bud rot disease is reconfiguring local economies, and with them the racial and class politics of agrarian land tenure.

Find out more about Dr. Hennessy here: https://history.wisc.edu/people/hennessy-elizabeth/
Workshop

Data visualization with R:
Tips & tricks to publish & communicate your science

Dr. Solène Derville
Post-Doctoral Scholar of the Marine Mammal Institute

Thursday, April 14th from 3:00-5:00 pm

Interested in learning creative ways to visualize your data? Data visualization is the graphical representation of information and data. A great variety of tools and approaches are available to produce figures adapted to your audience, support medium, message or type of data. In this workshop we will cover the basic sets of rules to improve figure design for different purposes, from scientific publication to general public outreach. The R programming software (www.r-project.org) will be used in combination with Canva (www.canva.com) to produce visuals from ecological data of various types. The workshop will specifically provide insights and tips to enhance figure aesthetic, use different fonts and color palettes, combine multiple types of information and data, produce quality maps, leverage the ggplot2 package extensions and deal with resolution and formatting. The general objective is to help you make impactful scientific communication! The workshop will be held over two hours: the first hour will be dedicated to theory and the second hour will be organized into five practical challenges!

Registrants will be sent information on necessary materials in addition to a private Zoom link prior to the workshop.
Oral Presentation Abstracts

Talk Session #1: April 15th, 2022: 9:30 – 10:30 AM
Construction and Engineering Hall

Please use the Zoom link below to attend RAFWE virtually!
https://oregonstate.zoom.us/j/93484119454?pwd=NlhHR2ZIRkhrdUFYL20wWEpCZIZMQT09
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Ryan C. Baumbusch*

Doñana Biological Station, CSIC, Seville, Spain
*ryan.baumbusch@oregonstate.edu

In recent decades Bonelli’s Eagle (Aquila fasciata) and Golden Eagle (Aquila chrysaetos) populations have grown on the Iberian Peninsula. Both species primarily nest on cliffs, but as their populations have grown, they have increasingly nested in trees. Using multi-decadal data sets on the number of young produced by each species across Andalusia in southern Spain, we assessed the reproductive value tree nests and whether new recruits to each population are relegated to breeding in sub-optimal habitat or they are exploiting this previously unused resource. We found that the number of young fledged by Golden Eagles did not differ between nests in cliffs and trees and that Bonelli’s Eagles fledged slightly more young when they nested in trees. Most variation in the number of young fledged was accounted for by the age of the parents. We suspect that historic persecution of these eagles across Spain may have prevented nesting in trees as they are easier to access by humans than cliff nests. As attitudes shifted and persecution diminished, both species may now be able to establish territories in areas lacking cliffs available for nesting. Much of the previous research on the habitat requirements of these eagles emphasized the importance of cliffs for nesting, and while we still see an apparent preference for nesting in cliffs in our data, knowing that nesting in trees provides comparable reproductive value could provide increased flexibility in conservation planning for the future.

9:45 – A population in peril: sage-grouse nest ecology in a degraded landscape in Modoc county California, USA

Chelsea E. Sink*1,2, Katie M. Dugger2,3, Christian A. Hagen2, John W. Beckstrand4, John Vradenburg4

1 Oregon Cooperative Fish and Wildlife Research Unit
Greater sage-grouse (*Centrocercus urophasianus*) in Modoc County California are geographically isolated from other populations and have been subsidized by translocation to prevent inbreeding depression since 2005. Despite significant efforts to increase the population through a combination of translocations and habitat improvement by the cutting of encroaching juniper (*Juniperus occidentalis*), only a single lek remains (from 56 in the 1940s) for this population. The occurrence of several large wildfires since 2017 have led to an increase in invasive grasses (e.g., cheatgrass (*Bromus tectorum*), and medusahead (*Taeniatherum caput-medusae*)) that has degraded important nesting habitat for grouse. Nest survival is hypothesized to be a limiting factor for this population’s growth, therefore we monitored 39 nests of females with GPS PTTS from 2019 to 2021 to assess vegetation factors that influence daily nest survival at the microhabitat and landscape level scales using known-fate models. Average nest success for the three years of the study across a 29 day incubation period was 29% (95% CI 17.1 – 44.8) which is much lower than published estimates for nearby populations in California. At the microhabitat scale, shrub and medusahead cover were the two most supported single covariate models explaining nest survival. Nest survival increased as shrub cover increased (β = 3.3, 95% CI 0.89 – 5.8), but had decreased as medusahead cover increased (β = -2.8 95% CI -5.0 – -0.56). At the landscape scale the log-linear structure of annual grass and forb cover at 400m around the nest had the strongest effect on nest survival (β = 3.0 95% CI 0.28 – 5.8). As the frequency and severity of wildfires in sagebrush communities increases and invasive grasses become more dominant on the landscape, understanding their effect on sage-grouse demographics and where the threshold lies in the amount of invasive grass cover that can be tolerated before observing significant declines in survival will be important to aid in future management decisions.

10:00 – Foraging ecology of coastal wolves in Katmai National Park & Preserve

Ellen Dymit*

Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
*ellien.dymit@oregonstate.edu

Although wolves throughout most of their range are assumed to be obligate ungulate predators, wolf populations with access to resource subsidies from the marine system may demonstrate incredible dietary flexibility. Wolves are seen frequently on the coast of Katmai National Park & Preserve in Southwest Alaska, but their role in the nearshore system is not well understood. On the Katmai coast, black bears are completely excluded by brown bears, and beavers and moose occur at very low densities. We hypothesize that these circumstances drive coastal wolves to forage extensively in the marine system and exploit seasonal salmon availability. Katmai wolves have been observed catching salmon alongside bears, carrying sea otter carcasses at offshore haul-outs, and in one instance killing an adult harbor seal in an intertidal area. In 2021 we began a project using noninvasive genetic sampling techniques and automatic digital cameras to study wolf foraging ecology on the Katmai coast. The main objectives of this study are to reconstruct coastal wolf diet through fecal metabarcoding, document intertidal foraging activity and predation/scavenging of marine mammals using automatic digital cameras, and obtain a baseline estimate for wolf abundance in key regions by genotyping scat samples using single-nucleotide polymorphisms (SNPs). Initial metabarcoding results from 174 scats revealed striking differences in wolf diet between Katmai’s isolated coast and the park’s interior. Wolves living on the coast appear to consume ground squirrel, sea otter, seal, salmon, and flounder in abundance, while inland wolves primarily consume snowshoe hare, beaver, small rodents, and birds. Multiple data streams from scat, hair, and saliva samples collected during
our 2021 summer field season (May through September) will further elucidate these regional differences in foraging ecology.

10:15 – Assessing how morphology of female desert bighorn sheep varies with climate in the Mojave Desert of California

Jose Alberto Torres*, Lindsay Millward¹, Richard Ianniello², Clinton Epps¹

1 Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
2 California Department of Fisheries and Wildlife
*torresj3@oregonstate.edu

Understanding how spatial variation in climate correlates with phenotypic variation within species may offer insights about local adaptation, population performance, and how species may respond to climate change. Desert bighorn sheep (*Ovis canadensis nelsoni*) experience a broad range of temperature and aridity, inhabiting mountain ranges in the Mojave Desert of California with elevations ranging from 284 m to 2417 m. We used morphological data on female bighorn sheep collected by California Department of Fisheries and Wildlife (CDFW) from 1978-2020, including horn length, horn circumference, body length, chest girth, metatarsal length, and neck circumference measurements to determine if elevation, precipitation, and temperature affect morphology. We found that body length, chest girth, metatarsal length, and neck measurements were positively correlated with elevation and precipitation, but negatively correlated with temperature. Horn length and circumference were negatively correlated with mountain range elevation and positively correlated with average annual maximum temperature; models describing a curvilinear relationship where horn size was maximized at intermediate elevation and temperatures also had some support. Our analysis established evidence that bighorn sheep morphology varies with climate; we suggest this could be due to local adaptation to environmental factors and differences in nutrition.
10:45 – Estimating occupancy and pair status of northern spotted owls using passive acoustic monitoring

Cara Appel*1, Damon Lesmeister1,2, Taal Levi1, Raymond Davis3, Matt Weldy4, Adam Duarte2

1 Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
2 Pacific Northwest Research Station, USDA Forest Service
3 Region 6, USDA Forest Service
4 Department of Forest Ecosystems and Society, Oregon State University
* cara.appel@oregonstate.edu

Population monitoring of the threatened northern spotted owl (Strix occidentalis caurina) is transitioning from mark-recapture methods to exclusively passive acoustic monitoring by 2023. The ability to estimate detection probability and occupancy of paired and unpaired spotted owls will be critical to the continued monitoring of population trends, conservation assessments, and effects of landscape disturbance. We constructed a multi-state occupancy model with 3 states: unoccupied, occupied by paired owls, and occupied by non-paired owls. We conducted 6-week bioacoustic surveys in 207 5-km² hexagons, each with 5 autonomous recording unit (ARU) stations, during March–September 2018, in the Oregon Coast Range and the Olympic Peninsula in Washington State. Weekly detection probabilities for spotted owls in hexagons where they were paired and not paired were 0.484 (SD 0.090) and 0.219 (SD 0.077), respectively. Overall occupancy rate was 0.206 (SD 0.040), with non-pair occupancy of 0.121 (SD 0.042) and pair occupancy of 0.085 (SD 0.033). We found a negative relationship between detection probability and the amount of background noise but no difference in detection probability of early vs late season surveys. The intensity of barred owl (S. varia) calling had a weak effect on detection probability and occupancy, as barred owls were ubiquitous in both study areas, with occupancy rates near 1. Finally, we found a modest effect of increasing nesting forest suitability on occupancy. This work demonstrates an effective framework to quantify important population metrics, including pair status, using passive acoustic monitoring for this increasingly rare species.

11:00 – Demographic recovery of a reef fish population over 30 years of spawning aggregation site protection

Claire Rosemond*
Over 200 species of reef fish around the world form spawning aggregations to reproduce at specific times and locations. Red Hind (Epinephelus guttatus), a species of grouper important to Caribbean fisheries, migrate to form spawning aggregations, which have historically experienced intense fishing pressure. The Red Hind Bank Marine Conservation District (MCD) was established in the United States Virgin Islands (USVI) to protect a known Red Hind spawning aggregation site. The MCD was closed seasonally to fishing in 1990 and then permanently in 1999. Our goal was to evaluate the success of this marine conservation effort by assessing how the Red Hind population at the spawning aggregation responded to changing levels of protection. We documented Red Hind population demographics at the spawning aggregation site in the MCD during peak spawning events from 2018 to 2020. After 30 years of protection, the mean size of Red Hind at the spawning aggregation increased by >35% and the population sex ratio of females to males was less skewed compared to population characteristics at the spawning aggregation prior to protection. To evaluate stock status relative to management benchmarks, we used a length-based stock assessment model that combined in situ size distribution data spanning 1988 to 2020 to estimate population spawning potential ratio (SPR) over time. We found that the SPR of the Red Hind population at the spawning aggregation prior to protection was 0.32 (95% CI: 0.25, 0.39) and under permanent protection, SPR increased to 0.49 (95% CI: 0.42, 0.56), above the benchmark value considered sustainable for many fish species.

11:15 – Anchors Away! Understanding historical Anchorworm parasitism of introduced warmwater fishes in the Willamette Basin, Oregon

Elena Eberhardt*, Bill Gerth¹, Christina Murphy², Peter Konstantinidis¹, and Ivan Arismendi¹

¹ Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
² USGS Maine Cooperative Fish and Wildlife Research Unit, University of Maine
* eberhael@oregonstate.edu

Anchorworms (Lernaea spp.) are parasitic copepods with a wide range of known hosts. Yet, little is known about anchorworm prevalence, distribution, and host preference within Oregon. Historical fish collections are an untapped resource that can provide a look into past fish and their health. Here, we examined 1,039 specimens from the Oregon State Ichthyology Collection to detect the presence of anchorworms on non-native warmwater fishes introduced to the Willamette River, Oregon. Examined specimens were collected between 1941 and 2014. Out of the seventeen different species that we examined, anchorworms were present on eleven of them. Most infected species included Common Carp (Cyprinus carpio), Bluegill (Lepomis macrochirus), and Smallmouth Bass (Micropterus dolomieu). Our findings reveal unique insights that will serve as a baseline to detect changing parasite loads in the Willamette River Basin in the future. In addition, our study highlights the potential for warmwater fishes to act as hosts for this understudied parasite in this region and elsewhere.

11:30 – Predicting decomposition rates along the mainstem and riparian zones of Lookout Creek

Meagan White*

Department of Microbiology, Oregon State University
* whitemea@oregonstate.edu
Nutrient cycling in lotic ecosystem has long since been a topic of interest as we attempt to understand the process that affect the global ecosystem at large. While we seek to modify human behavior to slow the rate of CO2 and greenhouse gasses into the atmosphere, it is also imperative that we understand the cycling of carbon as a whole and analyze our carbon sinks. While the many river system studies that aim to cohesively identify the factors that influence stream nutrient cycling have provided us with a working model, there are details that appear to be overlooked particularly regarding both time and space of these systems. Additionally few studies have made the link between the decomposition rates of the riparian zone with the aquatic decomposing rates along the same elevation gradient. Here, we used a standardized cotton strip assay approach to assess the decomposition rates from upstream to downstream on Look Out Creek in the HJ Andrews Experimental Forest. We conducted samples during both summer and fall in an elevation gradient. This will give us a spatial and temporal understanding of the decomposition rates at broader context. We collected information of several covariates including temperature, dissolved oxygen, surber samples, water depth, and algae concentrations measurements to understand potential factors that mediated microbial decomposition. Lastly, we conducted similar essays in terrestrial habitats adjacent to the instream sites. Looking at the nutrient cycling of the system from a lens of an elevation gradient can allow us to make important connections of how the nutrient cycling efficiencies play a part in the larger stream function.

11:45 – How do knowledgeable stakeholders feel about Oregon marine reserves?

Brian Erickson*

Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
* brian.erickson@oregonstate.edu

Even though emotions play a major role in public evaluation of conservation processes and projects, they are typically understudied in human dimensions research. Scientists, policy makers, and practitioners often dismiss public emotional reactions as irrational and subjective. However, these reactions can provide insight into people’s genuine interests and concerns. Also, they may indicate support or violation of people’s core values. The formation of Oregon’s marine reserve system was a decade-long process that created public conflict, contention, and a wide-range of emotional reactions. With the reserves currently under a 10-year review, this presentation explores how knowledgeable stakeholders feel about Oregon marine reserves. I will share preliminary results from a card sorting activity that had 53 participants rate how much they felt 29 emotions. Cluster analysis identified two subgroups based on patterns of responses. I’ll explore these subgroups’ reported feelings and lay out my plans for additional analysis to understand why respondents feel the way they do.
Talk Session #3: April 15th, 2022: 1:00 – 1:45 PM
Construction and Engineering Hall

Please use the Zoom link below to attend RAFWE virtually!
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1:00 – Hunting Tiny Vampires: Modeling the distribution of a salmonid ectoparasite in Willamette Valley reservoirs

Kelsi Antonelli*, Christina A. Murphy2, Amanda Pollock1, William Gerth1, Ivan Arismendi1

1 Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
2 U.S. Geological Survey
*antonelk@oregonstate.edu

The freshwater copepod *Salmincola californiensis* is an ectoparasite affecting salmonids in the genus Oncorhynchus. Chinook Salmon reared in reservoirs of the upper Willamette River Basin have been reported to experience higher rates of infection by *S. californiensis* than would be experienced by their counterparts reared in streams. These high levels of infection can lead to decreased fish fitness and survival, especially when simultaneous stressors are present, which may ultimately hinder the recovery of these threatened salmon.

Currently, the relationship between reservoir conditions and infection rates is poorly understood. Here, we aim to inform these associations by modeling the occupancy and abundance of the free-living, infective stage (copepodid) of *S. californiensis* in relation to environmental factors (e.g., temperature, water clarity, reservoir plankton profiles, and season). We sampled *S. californiensis* in three reservoirs from the upper Willamette River Basin. Information gained from our modeling effort will be useful for guiding management decisions made by biologists and reservoir operators regarding salmon populations in reservoirs.

1:15 – Coralline algae and species richness

Dylan Heppell*

College of Earth, Ocean, and Atmospheric Sciences, Oregon State University
*heppelld@oregonstate.edu

Coralline algae builds its shell out of calcium carbonate. As a result, corallines have the potential to be impacted by ocean acidification. Corallines are an important ecosystem engineer, particularly in nearshore habitats, so the loss of coralline algae could have impacts on community composition. This brought up the question: is there a correlation between the amount of coralline algae in a tidepool and the species richness of a tidepool. To address
this question, I divided Boiler Bay into 3 separate zones, based on the dominant biota found in each zone (mussel, seagrass, and urchin), and sampled five tidepools in each zone from April to August 2021. I sampled each tidepool seven times for coralline algae cover, fleshy algae cover, and species richness. I also sampled the physical characteristics of the tidepools (depth, perimeter, height on beach) to examine if the physical aspects of a pool contribute to coralline algae cover or species richness. Using this data, I created scatterplots to determine correlation between species richness and coralline algae cover. I found that there was, surprisingly, a weak negative relationship between total coralline algae, just crustose coralline algae, and just articulated coralline algae and species richness. I then performed an ANCOVA analysis to determine which physical characteristics were having a significant effect on coralline algae cover and species richness. Finally, I also correlated coralline algae cover with fleshy algae cover to determine if composition between those photosynthesizing organisms was having an effect.

1:30 – The potential effects of invasive red imported fire ants on monarch butterfly reproductive success

Remy Sutherland*

Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
*remy.sutherland@oregonstate.edu

Red imported fire ants (RIFA) are an invasive species found throughout the southeastern United States. Known for their aggressive foraging behavior, RIFA have an extensive prey profile that includes numerous vertebrates and hundreds of species of invertebrates. Infestations have been linked with reduction in native arthropod abundance, richness, and diversity as well as negative impacts to species of conservation concern. In recent years, monarch butterfly populations have declined at an alarming rate resulting in an extensive conservation effort across the species’ migratory range. One hypothesis for declining populations is decreasing survival of monarch eggs and larvae during the spring migration. The eastern monarch population’s first generation occurs in the southeastern U.S. as adults migrate northward from their wintering grounds in Mexico and deposit eggs along the way. This potential population bottleneck coincides with the introduced range of RIFA. In this presentation I will summarize the results of a pilot study I conducted in 2020 examining monarch reproductive success at the Attwater Prairie Chicken National Wildlife Refuge in Colorado County, Texas. Approximately 50% of the 10,500-acre refuge is annually treated with a fire ant insecticide. Results from the 2020 study indicate that there were significantly more monarch caterpillars/milkweed in areas treated with the fire ant insecticide than untreated areas (p-value = 0.006). I will also present on my current research investigating this relationship using a Bayesian state-space model to estimate monarch larval survival from stage-based field count data and the potential direct and indirect impacts of RIFA on monarch oviposition selection.
2:00 – Grouse groceries in the Sagebrush Steppe: impacts of juniper removal on herbaceous vegetation and invertebrate diversity

Kim Haab*¹, Christian A. Hagen¹, Kate Yates², Tim Bowden³, Bryan Endress⁴, Sandy DeBano¹

¹ Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University
² Bureau of Land Management Lakeview District Office
³ Bureau of Land Management Applegate Field Office
⁴ Department of Animal and Rangeland Sciences, Oregon State University

*kimberly.haab@oregonstate.edu

Greater sage-grouse are sagebrush obligate species that rely on sagebrush for every phase of their life cycle. One identified threat to sage-grouse is encroachment of conifers, such as western juniper, into previously-intact sagebrush, which suppresses native plant species by outcompeting them for limited water and nutrients. Sage-grouse rely on a diversity of native vegetation throughout their life cycle, for foraging, concealment, and thermoregulation. Forbs and terrestrial surface-dwelling invertebrates are an essential source of energy and nutrients, especially for sage-grouse chicks. This study was conducted in the sagebrush steppe of the Warner Mountains in Washoe County, NV and Modoc County, CA in 2020 and 2021 to assess the impact of juniper removal on herbaceous forage and invertebrate diversity. Vegetation and invertebrates were sampled from old cuts (completed ≤ 2013), mid cuts (completed 2014-2016), recent cuts (completed 2017-present), and controls (areas of encroached juniper where no cuts have occurred). Mean forage quantity was significantly higher in old cuts (17.4 g/m², SE=0.3) than in mid cuts (13.4 g/m², SE=0.2), recent cuts (12.6 g/m², SE=0.2), and controls (11.2 g/m², SE=0.2). Forage crude protein was significantly higher in mid cuts (11.6%, SE=0.2) than in old cuts (10.6%, SE=0.2), recent cuts (10.0%, SE=0.1), and controls (9.8%, SE=0.2), but no other forage quality metrics were significantly different between cuts (p<0.05). Understanding how juniper removal impacts herbaceous vegetation and the invertebrate community is important for land managers making decisions about such treatments. Our work indicates that these conservation practices for sage-grouse may extend benefits beyond this focal species.

2:15 – Effects of fuel reduction treatments on surface fire behavior in juniper woodland ecosystems

Claire Williams*
Juniper (Juniperus spp.) woodlands are native but expanding ecological communities that were historically limited by the fire return interval of the sagebrush (Artemisia spp.) steppe. This expansion has lengthened fire return intervals and resulted in a decrease in understory vegetation, shifting fuel sources from the surface to the tree canopy. This is a concern for sagebrush conservation and the conservation of sagebrush-associated wildlife species. Fuel reduction treatments are used throughout the Great Basin in an attempt to limit the expansion of juniper woodlands and reduce fire risk. Field data from a 10 year experiment and the Fuel and Fire Tools fire behavior modeling program were used to determine how treatments (prescribed fire, mechanical removal, and untreated control) impacted modeled surface fire behavior in juniper woodlands. Treatments shifted post-treatment surface fuel loads towards increased herbaceous and shrub cover when compared to pre-treatment data and significantly impacted modeled fire behavior metrics: Rate of spread (ROS; m/min), reaction intensity (RI; kW m\(^{-2}\) min\(^{-1}\)), and flame length (FL; m). Prescribed fire increased ROS by 25 fold, tripled the FL, and increased RI by 30.5% in fully cured plots from pre-treatment to year 10 following treatment. ROS increased by 15 fold, FL by 3.8 fold, and RI roughly doubled in fully cured mechanical treatment plots in year 10 compared to pretreatment and to control. This has important management implications - treatments are likely to increase herbaceous vegetation and increase fire behavior in juniper woodlands, indicating potential tradeoffs between desired vegetation and wildfire risk.

2:30 – Targeted grazing of teasel (*Dipsacus fullonum*) with sheep in riparian conservation habitats

Jordan Anderson*, Carlos G. Ochoa, Serkan Ates, and Mary Smallman

Targeted grazing as a vegetation management tool in conservation areas is growing in popularity in both upland and riparian ecosystems. A rotational grazing trial with sheep was conducted to evaluate biomass production, vegetation composition, and soil water content in a CREP (Conservation Reserve Enhancement Program) riparian area and a traditional pasture. Grazing in the CREP riparian area was targeted at the invasive biennial forb, teasel (*Dipsacus fullonum*). Vegetation composition in the CREP riparian area consisted of 44% grasses, 27% teasel, 15% rushes and sedges, 5% legumes and 9% dead material. Due to higher soil water content in the CREP riparian area, quality forages persisted longer throughout the year and annual biomass production in the CREP area was higher than in the traditional pasture (5357 vs. 4206 kg DM ha\(^{-1}\)). This allowed for three grazing rotations in the CREP area, compared to two rotations in the traditional pasture. Two stocking densities were tested, with the higher density treatment achieving greater control of teasel. Grazing while the target species was in early vegetative growth also played a factor to successfully control teasel growth. Palatability of teasel decreased in late summer months and was no longer selected. The results of this study show the potential for effective targeted grazing of teasel, with sheep and opportunities for stakeholders to bring CREP riparian areas back into production following livestock exclusion. Further long-term monitoring studies are of interest to document changes in species richness and the effect on riparian ecological functioning.
Ant diversity along a disturbance gradient

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Ants (family Formicidae) play a vital role in the ecology of forests by serving as a food source for beetles, spiders, birds, and bears. Certain ant species also facilitate tree decomposition by chewing holes in live and dead trees to create nesting sites. Disturbances such as logging and fire may impact ant abundance and diversity, which ultimately affects food availability for predators and decomposition rates of coarse woody debris. To explore this, we collected 248 malaise trap samples from 96 sites in and around the H.J. Andrews Experimental Forest during 2 sessions in the summer of 2018. We shotgun sequenced invertebrate samples and identified species using the BOLD database. We calculated species richness at each site and modeled species read counts against environmental covariates such as recency of disturbance and an index of old-growth characteristics. We predicted that there would be a lower diversity of ant species and lower total read abundance in regions that have experienced more recent disturbance, mirroring known diversity and biomass patterns in forest successional theory. We found that ant species composition shifts as forest age and complexity increases, but there was no clear relationship between species richness and recency of disturbance. These results contribute to a deeper understanding of ecosystem response to disturbance, with particular relevance for forest management. It also provides valuable insights on the community’s ability to support larger predators and broader biodiversity.

Temporal changes in stream pool morphology affecting seasonal habitat use for trout and salamanders

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Streams in the Oregon Coast Range display a high degree of dynamism not only between years, but also among seasons. For this study, we surveyed pool habitats from two first-order tributary streams, Griffith Creek and Middle Fork Rock Creek, in the Rock Creek Watershed near Corvallis Oregon. Middle Fork Rock Creek is free flowing while Griffith Creek has been impounded by a concrete structure containing a fish ladder. Pools were identified and initially surveyed in October and November of 2020 continuing for roughly 1 year. Additional seasonal pool surveys documented depth, length, width, canopy cover, presence of morphogenic features, dominant substrate, and pool type. We paired pool characteristic data with mobile tracking data collected on both streams during the same timeframe to identify the presence of PIT-tagged Coastal Cutthroat trout (*Oncorhynchus clarkii clarkii*) and Pacific Giant salamander (*Dicamptodon tenebrosus*) within each pool. Our findings will provide baseline information about seasonal habitat use for aquatic vertebrates in headwater streams.

Evaluating and managing *Oncorhynchus mykiss* life-history diversity in altered landscapes

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Steelhead trout *Oncorhynchus mykiss* have a diverse life history that involves many combinations of freshwater residency and seaward migration. Life history variability creates a spatial mosaic of populations with differing tolerance to environmental disturbances and increases population stability across space and time. For unclear reasons, the proportion of *O. mykiss* that exhibit anadromy has declined in regions associated with urban development. Although the resident form of *O. mykiss* remains abundant throughout much of its range, it is critical to maintain diverse life-histories to ensure resilience to future disturbances and environmental change. The goal of this proposed study is to evaluate how *O. mykiss* express life-history diversity in response to natural and anthropogenic environmental change, and to evaluate how life-history diversity contributes to population resilience in heavily altered landscapes. To accomplish this, we will 1) develop a quantitative model to predict a population’s expected life-history distribution given environmental and demographic variation, 2) identify environmental thresholds that alter the relative fitness of anadromous and resident life-history strategies, and 3) integrate the model into a decision support system to evaluate management and restoration actions centered on anadromous *O. mykiss* in altered watersheds with high demographic uncertainty. The modeling techniques developed during this study will provide a tool that can be used to guide management actions related to *O. mykiss* population dynamics amid unprecedented environmental change.

Dietary Habits of American Black Bears in the H.J. Andrews Experimental Forest, Oregon, USA

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Knowledge of black bear diet is a necessary prerequisite to understanding black bear ecology. Although the food habits of black bears have been thoroughly studied across North America, the literature is lacking in the Pacific
Northwest. Their omnivorous feeding strategy and opportunistic foraging behavior indicate that dietary studies are most useful if performed at the local level. Therefore, we conducted this study to better understand the ecology of black bears in forested systems and to establish a dietary baseline that can be used to document future changes in available food resources. We collected 92 scat samples both opportunistically and using scat detection dogs from October 2017 to August 2019 in Oregon’s H.J. Andrews Experimental Forest. We analyzed the scat using DNA metabarcoding with universal vertebrate, invertebrate, and plant primers. Our initial analysis found that 17.4% of samples contained plant matter, 20.7% contained mammals, 10.9% contained birds, 1.1% contained amphibians, and 1.1% contained crustaceans. The invertebrate DNA did not amplify with the primers we used. These results suggest a generalized dietary strategy. Additionally, Ericaceous plants accounted for 56.3% of the plant matter consumed, suggesting the importance of berry-producing shrubs in the black bear diet. These results fill a key knowledge gap of bear diet at the local level while simultaneously contributing to our understanding of the role of black bears in Pacific Northwest food webs.

Using larval pigment patterns to distinguish between two of Oregon’s endemic sculpin species

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The ability to identify organisms at the species level and all stages of development is critical to conservation and biodiversity studies. Yet, identification keys for cryptic larval species are often nonexistent or only apply to adult forms, which prevents utilization of these organisms in studies. Currently, literature surrounding two of Oregon’s endemic freshwater fishes, the Klamath Basin Slender (Cottus tenuis) and Marbled (C. klamathensis) sculpins, remains inconsistent for adult forms and lacks comprehensive larval descriptions. By creating a reliable key, researchers will be able to utilize historic data and knowledge previously collected from the Klamath Basin allowing them to include species that are critical to the ecosystem’s health and function. Taxonomists have previously cited changes in pigment pattern as a good diagnostic character in the development stages of larval fish. Our objective is to investigate whether pigment pattern can be used as a diagnostic character for these fishes in the early stages of development. We imaged ten individuals of each species across various sizes and documented differences in pigment patterns. It is our hope that this work allows us to create a comprehensive identification key that can be used by researchers to include sculpins in future studies.

Identification of digested salamander species found in the stomach contents of barred owls (Strix varia): assessing the effects of a novel avian predator in the Pacific Northwest

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Barred owls (Strix varia) expanded their range into the western United States where they now outcompete the federally threatened northern spotted owl (Strix occidentalis caurina), yet we know little of the impacts this novel, generalist avian predator may have on the greater ecological community beyond this interspecific competition. A diet study of barred owls using the stomach contents of specimens collected through experimental removal at three study sites in Washington and Oregon found that multiple species of salamanders constituted a large
proportion of the barred owl’s diet. In most cases, salamanders were fully digested and could not be identified to species as the published literature focuses on diagnostic skeletal features that are easily lost during digestion. The aim for our research is to identify and quantify the species of salamanders present in barred owl diets from mandibles, humeri, and femurs. Using a camera-equipped microscope we are photographing and cataloging over 900 salamander specimens removed from barred owl stomachs and comparing these to museum specimens. Identifying diagnostic features of robust salamander bones that withstand digestion can help us understand this newly recognized important prey resource of invasive barred owls.

**Objectively Speaking: A data and community-driven approach to communicating the objectives of the Oregon Marine Reserves to members of the Depoe Bay fishing community**

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The Oregon Marine Reserves are a system of five boundary-based conservation areas closed to extractive activities such as fishing. Acts of state legislation established these areas and directed their management to the Oregon Department of Fish & Wildlife’s Marine Reserve Program. Management of these areas is dictated by three policy-described objectives: “conserve marine habitats and biodiversity; provide a framework for scientific research and effectiveness monitoring; and avoid significant adverse social and economic impacts on ocean users and coastal communities.” Confusion and misperceptions about these objectives were identified in a recent qualitative study of the perceived social and economic impacts experienced by fishing communities as a result of the marine reserves. Based on these secondary findings of the study, the community-engaged researcher developed an outreach product to settle this confusion and correct the misperceptions of these objectives with the study participants and other relevant recipients. The outreach was designed around a new analysis of the existing data that both identified fishermen’s perceptions of the objectives and exposed their preferences for receiving messages about the marine reserves. The findings of this data were paired with theory-driven best practices to develop visual and verbal communication products and a process through which they were delivered by the researcher. This outreach demonstrates a unique opportunity to use community-engaged research data to create a community-delivered communication product.

**Predicting suitable habitat for Western Meadowlark with eBird data in Google Earth Engine: Benefits and challenges**

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Degradation of ecosystem services is associated with the reduction in species distribution. To monitor the long-term dynamics of ecosystem services, species distribution modeling (SDM) helps scientists to predict potential habitats for species. However, insufficient data from planned surveys may not provide an informative insight into species distribution. eBird, unstructured citizen science has the potential to provide abundant data for under-surveyed regions and predict suitable habitats in unsampled regions. eBird data is structured in a way that aggregates into densely populated areas, resulting in autocorrelation biases. In this study, I demonstrated the implementation of random forest (i.e., SDM) and five environmental predictors derived in Google Earth Engine
(GGE) for Western Meadowlark via eBird in the state of Oregon, USA. A spatial blocking technique was applied to take spatial autocorrelation into account. In addition, I illustrated the benefits and solutions to the challenges of using Google Earth Engine to model species distributions. This study provides valuable information for future practical guidelines in species distribution modeling via GGE.

Shore Friendly: A developmental evaluation of waterfront stewardship on private lands

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Nearshore areas provide essential habitat for juvenile salmonids and their prey. Shoreline modification is pervasive in the Puget Sound and the use of physical structures to curtail erosion, known as armoring, degrades ecosystems and reduces salmonid forage opportunities. Shore Friendly, a program of the Washington Department of Fish and Wildlife, supports waterfront stewardship through technical assistance and financial incentive programs that facilitate the removal or reduction of shoreline armor on private lands. Because decision-makers are removed from program implementation, stakeholders take on particular importance in program evaluation. In order to evaluate program effectiveness and strengthen program services, I will gather data through semi-structured interviews with Shore Friendly program staff and participants. These will be evaluated using a qualitative content analysis methodology to improve understanding of barriers to program effectiveness, document inspired ideas and inform strategies for expanding community support.

Characterizing genetic connectivity and investigating sex-specific distribution patterns in Pacific Albacore Tuna (Thunnus alalunga)

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Albacore Tuna (Thunnus alalunga) are a highly migratory marine species that are harvested in commercial and recreational fisheries around the world. Within the Pacific Ocean, Albacore are currently managed as two stocks, North and South, which are assumed to be independently breeding populations. Vaux et al. (2021) recently demonstrated that despite low overall genetic differentiation, North and South Pacific Albacore can be distinguished based on variation at putatively adaptive genetic markers. Using a targeted amplicon sequencing method known as Genotyping-in-Thousands by Sequencing, this research will (i) evaluate genetic connectivity between Albacore sampled in the North and South Pacific Oceans, (ii) identify migrant individuals that have traveled between these oceans and hybrid individuals that exhibit mixed North-South ancestry, and (iii) investigate sex-specific distribution patterns. Fin clip tissue samples were collected from Albacore caught in 2020 and 2021 in waters offshore of Oregon, Washington, California, Japan, New Caledonia, and French Polynesia. Individuals will be genotyped at target genetic markers, and genetic structure will be analyzed through a combination of multivariate and model-based approaches. Results of this study, in conjunction with tagging and population dynamics data, may be used to evaluate stock delineations and other management decisions for Albacore in the Pacific Ocean.
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The RAFWE Organizing Committee would like to thank all of our faculty judges, undergraduate, and graduate student volunteers, and the LaSells Center staff for making our symposium a success.
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