SYMPOSIUM ABSTRACTS

Extinction or management of owls: the dilemma of the barred owl invasion in California

Date: 5 February 2018
Room: Alexander I

0815-0830
Introduction

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The invasion of the barred owl (*Strix varia*) into the range of the spotted owl (*Strix occidentalis*) in California started at least as early as 1981. Barred owls now occupy all the range of the northern spotted owl (*S. o. caurina*) and at least half of the range of the California spotted owl (*S. o. occidentalis*) in the Sierra Nevada. Whereas the barred owl was historically present only in the eastern North America, it was not present in western North America. It is also a legally protected species. On the other hand, the northern spotted owl is listed as a threatened species under the Endangered Species Act and the California spotted owl is declining in most of its range. The barred owl is behaviorally dominates the spotted owl and the two species have broadly overlapping diet and habitat use. Therefore, the barred owl is a serious threat to the viability of the spotted owl in California. This invasion has created a management dilemma – should we manage barred owls or allow them to continue their invasion with the possible consequence of the extinction of the spotted owl over large portions of its range? This symposium will provide new information about the impact of barred owls on spotted owls and end with a panel discussion among managers and scientists about this invasion and its consequences.

0830-0910
Status of Spotted Owls, Barred Owls, and Removal Experiments in Oregon and Washington

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Competition with barred owls (*Strix varia*) is a major contributor to population declines of the federally threatened northern spotted owl (*S. occidentalis caurina*). A pilot study in California demonstrated that removal of barred owls in combination with habitat conservation may be able to slow or even reverse population declines of spotted owls. It remains unknown, however, whether similar results can be obtained in areas with different forest conditions, greater densities of barred owls, and fewer remaining spotted owls. Here, we report initial results from a before-after-control-impact (BACI) experiment implemented on three study areas in Oregon and Washington to determine the demographic response of northern spotted owls to the removal of barred owls. During 2015 – 2017 we removed >1,200 barred owls from treatment areas (257 – 607 km^2 in size) and used standardized field methods to track population responses of both owl species relative to control areas without barred owl removal. Preliminary results suggest that recolonization rates of post-removal landscapes by each owl species can vary considerably among and within study areas depending on the regional availability of surplus individuals (i.e. floaters) and site-specific environmental conditions that promote habitat use and territory establishment. We observed little response from spotted owls to initial removal efforts, but additional years of study are needed to determine if removal of barred owls can ultimately benefit spotted owls.

0910-0940

The Effects of Barred Owls on Northern Spotted Owl Populations on Federal Lands in Northwestern California

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Since first documented in 1981, barred owls (*Strix varia*) have increased throughout northwestern California. The presence of barred owls (*Strix varia*) also appears to have

increasing negative impacts on northern spotted owl (*Stix occidentalis caurina)* populations on federal lands in this region. To document this potential threat, we collected information on barred owl detections as part of our 33-year demographic study of northern spotted owls, began surveys using barred owl vocalizations in 2009, and began a formal design to estimate the extent of barred owl use on our study area in 2014. Barred owls have had negative effects on apparent survival of northern spotted owls in our region, especially during periods of climatic stress, which in turn has had negative effects on rates of population change. Relative to other factors, the increase in barred owls on our study areas seems to be a dominant driver of recent population declines in northern spotted owls. Based on occupancy estimators, barred owls are using 67-76% of our study area since 2014 and intensity of use has increased, probably because of the increase of established barred owls pairs. Our study currently serves as the control for experimental removal of barred owls on Hoopa Tribal lands; this experiment is intended to further elucidate the effects of barred owls on northern spotted owl populations.

0940-1010

Hoopa Experimental Barred Owl Removal: Update and Preliminary Results

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Northern spotted owls (*S. occidentalis caurina*) have been declining across the majority of their range for at least the last two decades. Competition with barred owls (*Strix varia*) has been identified as a significant threat to spotted owls and likely had been a major contributing factor to the declining spotted owl population at Hoopa up through 2013. Hoopa began the experimental removal of barred owls under the U.S. Fish and Wildlife Service's "Experimental Barred Owl Removal" project starting in October 2013. In 2013-2015, removals were only conducted during the fall-winter period. In 2016 and 2017 we conducted removals year round. Following the initial removal period of fall-winter 2013-14 where 64 of 71 barred owls were adult birds, the majority of birds removed have been re-colonizing first or second year sub-adults. Using both passive acoustic recorders and conspecific broadcast call surveys we suspect that recolonizing birds are potentially detected in multiple locations prior to settling into territories. Recolonizing barred owls appear to most frequently settle into lower elevation areas of the reservation along the Trinity River corridor and towards the northwest corner of the study area. Northern spotted owl demographic analysis has not yet shown any statistically significant improvement in survival, recruitment or lambda as a result of the removal of barred owls. However, the rapid decline of spotted owls at Hoopa has

slowed and spotted owl reproduction has improved based on the raw data collected. More data and further analysis will be necessary to determine if these demographic parameters are actually improving.

1030-1100

Range Expansion of the Barred Owl in the Sierra Nevada, California

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Barred owls are currently expanding their range into the Sierra Nevada and are an increasing threat to California spotted owls (*Strix occidentalis occidentalis*). Barred owls were first recorded in western North America from British Columbia in 1943 and are now sympatric across the entire range of the northern spotted owl (*S. o. caurina*). A barred owl was first recorded in the Sierra Nevada in Lassen County in 1989. Through 2001, only 3 barred owls and 1 "sparred" (spotted x barred hybrid) owl had been detected in the northern Sierra, despite extensive surveys for spotted owls by the US Forest Service across the Sierra Nevada from 1987-1992. From 2002-present, detections of barred and "sparred" (hybrid) owls have increased in the northern Sierra Nevada and southern Cascades, including barred owl nesting pairs. The first barred owl detected in the central and southern Sierra Nevada was in 2004, with >6 barred owls detected in the region since 2011. Through 2013, 51 barred and 27 sparred owls have been in the range of the California spotted owl. The pattern of range expansion – a slow increase followed by a rapid increase and the detection of long-range dispersers – was also observed in the Pacific Northwest. Because barred owls have not reached high densities and not fully colonized the Sierra Nevada, removal may be effective for maintaining numbers below those leading to exponential population growth, which would hinder future efforts to reduce barred owl impacts on spotted owls.

1100-1130

Northern Spotted and Barred Owls Exposed to Rodenticides in California and Oregon and the Evidence of Food Web Contamination

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The use of anticoagulant rodenticides (AR) and exposure to these pesticides in non-target wildlife have been well documented in urban and peri-urban settings throughout the Western United States. AR contamination in wildlife occupying remote forest environments was unreported until recent studies documented approximately 85% of sampled California fisher (*Pekania pennanti*) tested positive. The fisher studies exposed an emerging issue of environmental degradation from illegal pesticide use on illegal marijuana (*Cannabis sp*.) cultivation sites in remote forests. Until recently, it was unknown if either spotted owls (*Strix occidentalis)*, or barred owls (*Strix varia*), had been exposed to these toxicants. A new study showed that 34 (40%) of 84 barred owls collected during removal experiments on private timberlands in California were exposed to ≥1 AR. In addition, 7 (70%) of 10 spotted owls collected in northwestern California tested positive for AR. Because of dietary differences between fishers and spotted/barred owls, our data indicated that the spotted owls' food web was contaminated and secondary poisoning via contaminated prey was actively occurring in occupied spotted owl territories. We extended these studies to include investigation of AR exposure of barred owls and rodents in Oregon. We also examined differences in exposure rates between barred owls removed from tribal lands in California and private timberlands with no public access. Finally, we discuss the infusion of "legal" private land cultivation sites in and near critical habitat designated for spotted owls and its potential threats to the species. We suggest that AR contamination coupled with the current lack of sufficient environmental regulatory oversight of the marijuana industry poses a significant environmental stressor for spotted owls and other species. With the voter-initiated law allowing production/cultivation of marijuana in California set to begin in 2018, wildlife managers will need to determine what addtional regulatory oversight is necessary to eliminate these new risks to spotted owls.

1130-1200

Extent of Introgression Detected in Spotted Owls and Western Barred Owls

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The barred owl (*Strix varia*) has invaded the western U.S. in the last 50-100 years. Over this period it has become broadly sympatric with the spotted owl (*Strix occidentalis*), now extending from British Columbia to the southern Sierra Nevada, California. This represents one of the few documented cases of natural, dynamic, and ongoing invasion with secondary contact that can be studied across space in real time. Although it is well documented that barred owls ecologically displace spotted owls, debate remains as to whether the situation is being exacerbated via hybridization between these two species. To explore this question we have assembled a northern spotted owl genome from an individual collected prior to contact with barred owls. Prompted by the observation that some barred owl populations have high frequencies of morphotypes that appear intermediate between barred and spotted owls, we expected to detect owls representing admixed individuals. We report our results based on a whole-genome assessment of hybridization from over 50 individuals from throughout the range of overlap between the two species.

1330-1400

Acoustic Monitoring of Barred Owls in the Northern Sierra Nevada: Preliminary Results

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Passive acoustic monitoring may be a viable alternative to traditional call-based surveys of owls. However, the efficacy of this alternative has not been evaluated for either barred or spotted owls (*Strix varia*, *S. occidentalis*, respectively). Therefore, we deployed an array of autonomous recording units over the Lassen and Plumas National Forests, and developed a semi-automated procedure to identify focal species vocalizations. Initial single-species occupancy models indicate that this approach yielded relatively

high detection probabilities for barred owls and spotted owls. We summarize the weaknesses and strengths of acoustic monitoring for forest owls revealed through this pilot study. Implementing passive monitoring for owls at a large scale requires a large initial capital investment as well as processing, managing, and storing large amounts of data. It is also sensitive to changes in the frequency of focal species vocalizations and it does not provide demographic information (e.g., reproductive status). However, acoustic monitoring offers the opportunity for monitoring at unprecedented spatial and ecological scales. It can provide long-term occupancy data about barred and spotted owls across the landscape (a four-person crew surveyed a ~9,000 km^2 study area), rather than just within relatively small demographic study areas. Community-level analyses may also be possible: a cursory review of some of the data collected revealed the presence of seven species of owls. In summary, acoustic monitoring has the potential to be an effective survey tool for owls in the Sierra Nevada and elsewhere.

1400-1430

A model to evaluate barred owl (*Strix varia*) removal strategies for northern spotted owl (*Strix occidentalis caurina*) conservation

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In ecosystems throughout the world, lethal removal of one species is sometimes seen as necessary for the conservation of another. Modeling alternative removal strategies can inform decision-making so that resources are not directed towards ineffective or inefficient actions and, perhaps more importantly, to avoid culling animals using strategies with little to no conservation benefit for the species of concern. Lethal removal of barred owls has been proposed as a management option for the conservation of northern spotted owls. We developed an individual-based spatially explicit population model to compare the efficacy and efficiency of alternative barred owl removal strategies. Simulations indicated that as removal areas are scaled up in size, large removal areas may require fewer removals per unit area to maintain lower numbers of barred owls when compared to smaller removal areas. Simulations showed that on one large removal area had similar, but dampened, benefits relative to several small removal areas that had the same spatial extent as the large removal area. The model also suggested that if removals were initiated while barred owl density was low, much less effort was required to maintain low barred owl density within an area compared to initiating removals after their populations were well established.

1430-1500

Over My Dead Body: Regulatory and Implementation Issues for Removal of Barred Owls

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Abstract: Although biologists and wildlife managers understand that sometimes we may need to kill members of one species to protect or conserve rare species, even some may have trouble when the targeted species is iconic or charismatic. Wildlife managers and scientists debate the ethics surrounding human culpability in creating a situation that might require control and the appropriateness of human intervention even when applying science and experimentation to reach decisions. Members of the modern public are less conflicted, but less likely to condone the killing one species to save another. Some animal activists are unwilling to accept any killing as necessary and ethical, and in our litigious society they can significantly delay or undermine control programs. Existing regulations and permitting requirements also may inadvertently complicate management programs. Still, it is possible to succeed, but only if we respond to the public image issues and concerns directly. Using the ongoing barred owl removal experiment for the conservation of the northern spotted owl as a case study, I will describe our stakeholder process that paved the way for the acceptance of our experiment and provide suggestions for approaching the removal of barred owls for the conservation of the California spotted owl (*Strix occidentalis occidentalis*).

1520-1700

Panel Discussion

R. J. Gutiérrez	MODERATOR; Department of Forest and Wildlife Ecology, University of Wisconsin
Kim Turner	USFWS California Field Office
Zach Peery	Department of Forest and Wildlife Ecology, University of Wisconsin
Carie Battistone	California Department of Fish and Wildlife
Sara Sawyer	U. S. Forest Service
J. David Wiens	US Geologic Service
Robin Bown	USFWS Oregon Field Office