Fall Migration and Other Natural History Observations of the Northern Saw-whet Owl in Northern Interior California, 2005-2015

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ABSTRACT

I and a group of volunteers captured and banded Northern Saw-whet Owls (*Aegolius acadicus*) during fall migration at the Big Chico Creek Ecological Reserve (Reserve) in Butte County, California from 2005-2015. Peak migration occurred between mid-October and mid-November. We banded 564 owls, and captured two owls originally banded at other stations, one from Montana and one from Iowa. Most captured owls were females over all years (70%) and during each banding year, as has been reported at other stations across the U.S. Similar numbers of adult owls (49.6%) and young owls (50.4%) were captured over all years but the ratio varied annually. Recapture rates were low; 30 individuals (5%) were recaptured during the same season they were banded, and 2% of owls were recaptured in subsequent years. The longest time between original banding and recapture was approximately three years. The two oldest recaptured individuals were four years old. Based on timing of first annual capture, hatch-year birds undertaking their first migration arrived at the Reserve on average three days earlier than older (after-hatch year) birds. Fall recaptures during the same season and during limited winter and spring mist-netting show that some individuals use the Reserve over the three seasons. Our program offers a regional contribution to Northern Saw-whet Owl natural history in California and to the continental effort, Project Owlnet. More banding stations should be established to identify migration routes and population trends in the region and western states.

Fall migration of the Northern Saw-whet Owl (*Aegolius acadicus*) is well documented in the central and eastern Canadian provinces and United States. Thousands of individuals are captured and banded at mist-netting stations specifically established to monitor saw-whet owl migration each fall (D. Brinker, pers. comm.). Stations have partnered with Project Owlnet (2016) since 1994 to determine regional and continental population trends. Over the past two decades, monitoring has expanded west, with eight active migration banding stations in the western U.S. and 10 stations in British Columbia, Alberta, and Saskatchewan as of 2010 (Figure 1). Other western banding efforts included banding during spring migration in Washington (J. Acker pers.

comm.) and a banding program for owls breeding in nest boxes in Oregon (Marks et al. 2015). Locally, a telemetry study conducted for three years (2010 -2013) on the Big Chico Creek Ecological Reserve researched winter use of the site by saw-whet owls (Shaw 2014).

In 2005, I started a banding program to study Northern Saw-whet Owl fall migration near Chico, California, as a member of Project Owlnet. There has been no previous migration monitoring effort in northern California's Sierra Nevada. Therefore, my main goals were to determine the migration status of the western population of Northern Saw-whet Owl in the area and to contribute to the continental effort. Study objectives were to determine saw-whet owl presence, abundance, annual demographics, and migration patterns on the Reserve, and to determine any migratory link to owl banding stations in the Pacific States. These objectives were consistent with the University's goals for the Reserve, which included protection and monitoring of natural resources (BCCER 2016).

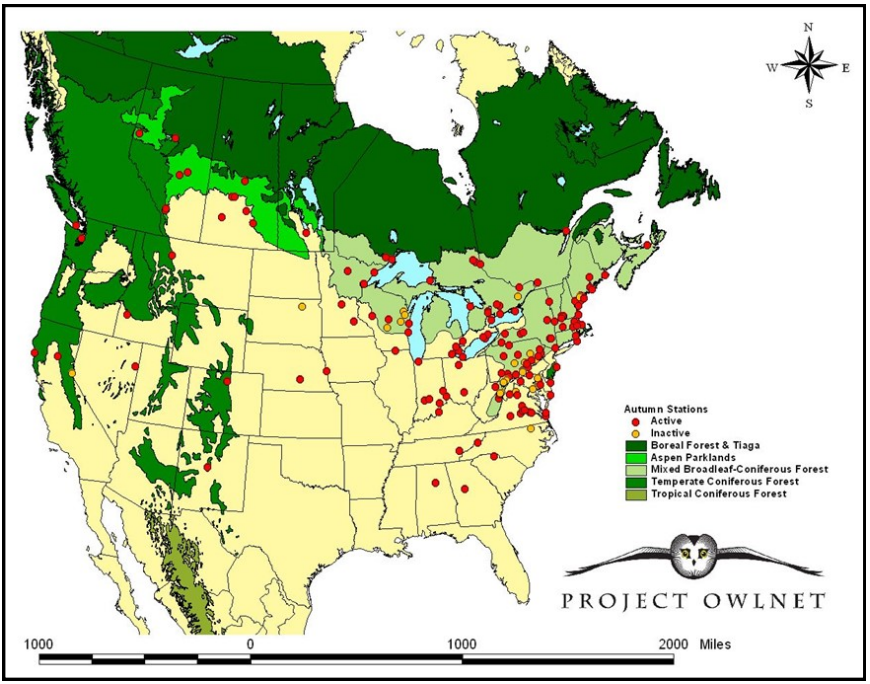

Figure 1. Active NSWO banding stations in 2010 (Project Owlnet 2016).

STUDY AREA

Big Chico Creek Ecological Reserve. The primary banding and monitoring site was the California State University Chico's (University's) Big Chico Creek

Ecological Reserve (Reserve) near State Route (SR) 32 between Chico and Forest Ranch, in Butte County, California (Figure 2). Big Chico Creek flows through the center of the 3,950-acre Reserve and is surrounded by ridge and canyon habitats with steep slopes and rocky faces on both sides. Elevation ranges from 230-670m (75-220 ft) Vegetation consists of mixed-conifer and deciduous woodland, blue oak woodlands, open meadow, chaparral, and riparian communities (BCCER 2016). The southern boundary is contiguous with the City of Chico's Bidwell Park; the northern border includes private properties with low-density residences. The western boundary is the ridgeline of Musty Buck Ridge, and the eastern boundary is State Route (SR) 32. Together the area forms a long wildlife corridor along Big Chico Creek before it flows through the developed portion of Chico. Two small, mostly undeveloped private in-holdings occur within the Reserve boundary but are generally inaccessible and relatively undisturbed by human activity. Occasional vehicles are allowed access for turkey and deer hunting and for seasonal school groups and field trips.

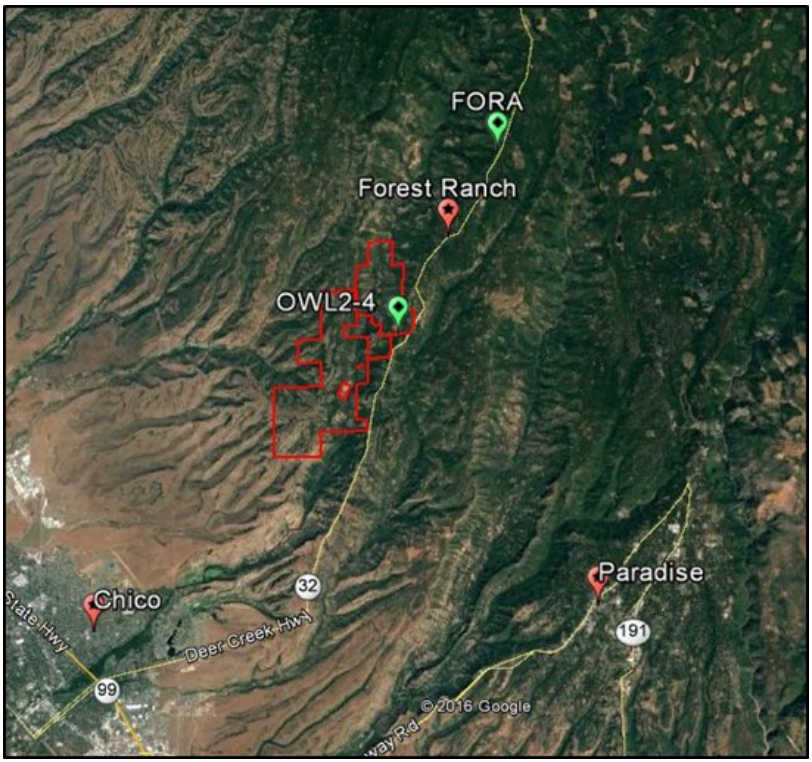

Figure 2. The Big Chico Creek Ecological Reserve (red outline) and banding stations at the Reserve (OWL2-4 and Forest Ranch (FORA), in Butte County within the northern Sierra Nevada foothills.

The Reserve banding stations were established near the eastern Reserve boundary ridge, west of SR 32, within a multi-layered mixed forest habitat dominated by ponderosa pine (*Pinus ponderosa*) and gray pine (*P. sabiniana*), California black oak (*Quercus kelloggii*), big leaf maple (*Acer macrophyllum*) and scattered canyon live oaks (*Q. chrysolepis*) and interior live oaks (*Q. wislizeni*). Small trees of these species comprise the secondary open understory growing within a diverse shrub community including toyon (*Heteromeles arbutifoloia*), manzanitas (*Manzanita spp*.), various ceanothus species (*Ceanothus spp.*), California coffeeberry (*Frangula californica*), and fragrant sumac (*Rhus aromatic*).

Forest Ranch. A secondary higher elevation station was located at 900 m on private property in the community of Forest Ranch. This station was 7 km north of the Reserve and west of Hwy 32 off Conestoga Way (Figure 2). Vegetation was mostly coniferous and dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine, with lesser amounts of incense cedar (*Calocedrus decurrens*), California black oak, and interior live oak.

METHODS

Field Methods

Banding Stations Set-up and Operation. Monitoring methods generally followed the recommendations of Project Owlnet (2016). The banding stations at the Reserve consisted of a mist net array where birds were captured and a processing station where birds were banded, aged, sexed, and released. We initially established station OWL2 in 2005 with a continuous array of four nets with a total net area of 150 m^2 (60-m long x 2.5-m high). In 2007, we established a second station (OWL3) about 400 m northwest and downslope of OWL2. OWL3 was also set in an array of four nets with 150 m^2 area. We switched sites occasionally for owl safety. If predators, specifically gray foxes (*Urocyon cinereoargenteus*) or Great Horned Owls (*Bubo virginianus*), were prevalent at one site, we used the other. We established a third station (OWL4) in 2014 when a change to the Reserve policy prohibited vehicular access to OWL2 and OWL3. OWL4 was located just inside of the Reserve entrance gate, which allowed access on foot. This net array consisted of three nets totaling 105 m^2 (42-m long by 2-m high). OWL4 was located 400 m from OWL3 and 600 m from OWL2. All stations were established in similar mixed forest habitat (Figure 2).

The Forest Ranch station was run multiple times from 2005 through 2008. All other banding was conducted at the Reserve. The net area at Forest Ranch was 150 m^2. I initially established this site expecting that the higher-elevation conifer community would be used more by migrating owls. I stopped banding there, however, because of inconvenient driving distance and efforts at the Reserve were equally productive. I include it only because of a recapture made on the Reserve (see RESULTS).

An audiolure, (boom box) was set in the middle of the net arrays to broadcast the primary call of a male Northern Saw-whet Owl. The audiolure was broadcast at approximately 90 decibels. In 2014, we upgraded the system to increase the volume to 100-110 decibels, based on a suggestion that a louder broadcast would be more likely to attract owls migrating overhead (S. Wiedensaul pers. comm.).

Nets were open at 0.5 hour after sunset for four hours and checked every half hour. Owls were removed from nets, placed in cloth bags, and taken to a station away from the net array for processing.

Timing of Banding. To determine Northern Saw-whet Owl presence and timing of migration we ran a pilot year in 2005 from 3 October to 15 November. Based on 2005 results, we subsequently focused on more standardized monitoring practices (4 hours per night/5 days per week), during the weeks of peak migration 15 October to 15 November, but continued to randomly sample on either end of these dates to determine annual variation of owl arrival and end of migration. We also conducted limited banding efforts into winter and spring to determine seasonal use. These winter-spring efforts were not standardized and the results are discussed separately from results for the fall migration period.

Processing Owls. We banded all owls with a uniquely numbered US Geological Survey band. Owls were aged and sexed using Project Owlnet (2016) criteria. We used molt pattern to age the birds according to the age classes: hatch year (HY, owls hatched the same year of capture), second year (SY, owls in their second year of life beginning January 1), after second year (ASY, owls in their third year or older) or after hatch year (AHY, either SY or ASY but indeterminable as to which). We used an ultraviolet light to illuminate molt patterns and clarify the age of individual owls if we were uncertain (Weidensaul et al. 2011). A chart with the variables wing chord, length, and mass, based on a discriminate function analysis, was used to determine sex (Project Owlnet 2016). Sex was assigned as male (M) or female (F), or unknown (U) when measurements fell into the range of overlap between sexes. Owls were released after banding and recording of metrics, generally within 15 min of capture.

Banding Effort

Fall banding effort is summarized in Table 1. Over all 11 years of 2005-2015, we ran the nets for 262 nights between late September through November (Figure 3). Annual effort averaged 24 nights per season, and varied from a low of 12 nights in 2014 (when vehicle access to our sites was prohibited) to a high of 32 nights in 2010. The most consistent monitoring occurred during the peak migration period of 15 October through 15 November for five consecutive years from 2008 to 2012 (Table 1).

Table 1. Northern Saw-whet Owl fall capture rates and age ratios, and recaptures during fall 2005-2015. HY indicates birds hatched that monitoring year. AHY indicates birds in their 2nd year or older.

Banding Years	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
Total Individual Owls Captured	23	61	51	27	25	93	89	115	18	9	53	564
# Nights Netting Effort	19	20	27	30	28	32	28	29	22	12	15	262
Net-hours	340	322	327	561	550	621	511	480	398	114	266	4,490
Owl Captures/100 Net-hrs	6.8	19.0	15.5	4.8	4.5	14.8	17.6	24.1	5.5	7.9	20.6	12.56
Owl Capture/Unit effort[a]	0.45	1.3	1.0	0.32	0.30	1.0	1.2	1.6	0.30	0.75	1.3	0.84
Hatch Year (HY)	10	37	16	9	11	65	39	55	9	7	26	284
After Hatch Year (AHY)	13	24	35	18	14	28	50	60	9	2	27	280
HY/AHY Ratio	0.77	1.5	0.45	0.5	0.78	2.3	0.78	0.92	1.0	3.5	0.96	1.01
Recaptures												
From Same Season	3	5	3	1	4	9	1	1	1	1	1	30
From Previous Years			2			1	2	2	1		1	9
Foreign Recoveries[b]							1		1			2

[a]owls/net hour/net area (m^2) x 1,000 (as per Project Owlnet 2016)

[b]originally banded at another banding station

We also operated nets in *winter* over 10 years (2006-2015) from 7 December through 28 February, and in *spring* for five years (2006-2007, 2009-2011) from 1 March through 16 May. These efforts totaled 42 nights, 22 nights in the winter and 20 nights in the spring. Most of our winter efforts (n=16, 73%) were in January and most spring efforts were in March (n=12, 60%). Two efforts were conducted on 5 and 16 May at the Forest Ranch site and Reserve, respectively.

Data Analysis

The number of owls captured each year cannot be directly compared due to the variability in the banding station locations, number of nets, days, and hours that the nets were open. Therefore, we standardized capture results for comparison between years by calculating the number of owls captured per 100 net-hours. Net-hours were defined as one 12 m (36 ft) net open for one hour (DeSante et al. 2016). For example, a 12 meter net open four hours represented four net-hours and an 18-meter net set for four hours was six net-hours. For future comparisons between other stations, I have included the calculation of owl "capture per unit effort" (owls/net hour/net area (m^2) x 1,000) as recommended by Project Owlnet (2016) (Table 1).

I describe differences in age composition between years based on two categories, HY and AHY. The AHY category included both second year (SY) and after second year (ASY) birds. I also evaluated age-related differences in migration timing over all years by comparing the average dates of first annual capture of all individuals, using Student's t-test.

RESULTS

Captures by Season

Over the course of the 11-year study, we banded 605 different individual Northern Saw-whet Owls; 564 during fall migration (Table 1), 27 owls during winter and 14 owls during spring netting efforts.

Timing of Fall Migration

Most Northern Saw-whet Owls arrived (i.e., were captured) during fall migration in our study area from 10 October through 16 November (Figure 3). The median capture date was October 30. The earliest owl arrivals in various years were 28 September and during the first week of October. In some years owls continued to be captured through our latest fall banding date on 30 November.

Numbers of migrants and the pattern of migration varied among different years (Table 1). Over the 11 years of banding, owls appeared to arrive in three distinct patterns: spiked (38% of years), continuous (27%), bimodal (18%), or a hybrid of those (18%). In years with the spiked pattern, most owls were captured in one night. In years with a continuous capture pattern, owls were

captured almost every night in a season, with none-to-few zero-capture nights. In the bimodal pattern, two obvious owl capture peaks occurred.

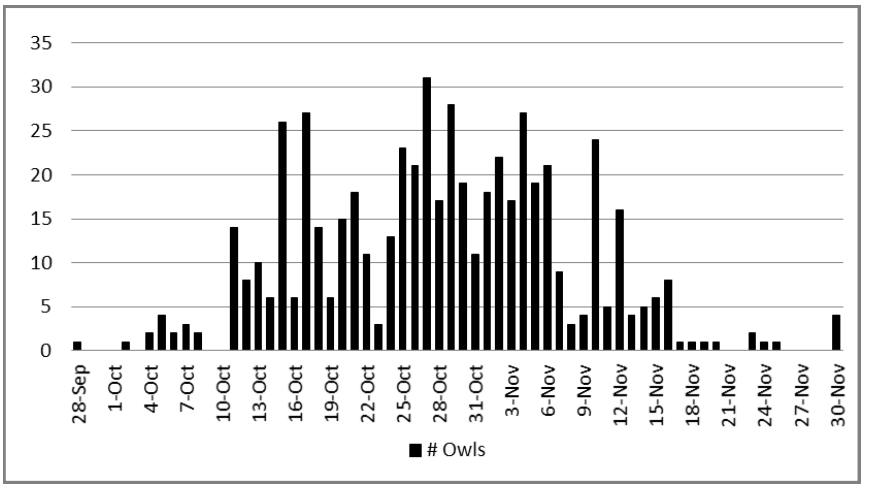

Figure 3. Fall migration timing at the Big Chico Creek Ecological Reserve study area over all sampling dates and years, 2005-2015.

The average date of arrival over the 11-year study period, as measured by the first seasonal capture of each individual during each year (i.e., excluding recaptures), was 3.4 days earlier for HY owls (27 October ± 6.4 days [standard error]) than for AHY owls (30 October ± 7.4 days). This difference was statistically significant (2-tailed Student's t-test, t=3.77, degrees of freedom= 562, p=0.00002).

Winter and Spring Captures. We captured a total of 41 owls on 24 (57%) of 42 banding nights from 17 December through 16 May. No owls were captured during our six nights of netting from 7 April to 16 May. We captured 27 owls in winter on 17 (77%) of 22 nights and 14 owls in spring on 7 (35%) of 20 nights. Notably, we banded six nights during a concerted effort from 3 March through 4 April 2010. One owl was captured on 3 March and one on 4 April, but no owls were captured on four nights between 11 March and 25 March. All other spring captures (n=18) were made during 4-25 March over the five years of spring effort.

Demographics

Of the 564 Northern Saw-whet Owls captured and banded during fall migration over all years (Table 1) 50.4% were hatch-year birds and 49.6% were after-hatch-year birds (AHY, SY, and ASY). Only two of all HY owls, captured in 2006 and 2013, exhibited the brown, loosely-textured plumage

seen in juvenile owls, indicating that they had fledged, perhaps locally, from a late clutch (Figure 5). All other HY owls exhibited adult-type plumage, regardless of degree of preformative molt (Figure 6).

The ratio of HY to AHY owls varied considerably each year (Table 1, Figure 4). Hatch year birds outnumbered adults in three years: 2006, 2010 and 2014. The years 2007 and 2008 produced the fewest numbers of HY birds relative to adults. Age ratios in other years were closer to equal (Table 1, Figure 4).

The number of owls captured/100 net hours ranged from lows of 4.5 and 4.8 in 2009 and 2008 to highs in two years of 24.1 and 20.6 owls/100 net hours in 2012 and 2015 (Table 1, Figure 4).

Of 564 owls captured, we identified 402 females (71%), 55 males (10%) and 107 (19%) of unknown sex.

Band Recoveries

Fall Recaptures. We recaptured 41 individuals (7.2% of total captures), including owls we banded that were recaptured in the same season, subsequent year, and foreign recoveries (Table 1). Thirty-two individuals were captured during the same season they were banded and two of these on the same night. The recapture intervals of the same-season captures averaged 11

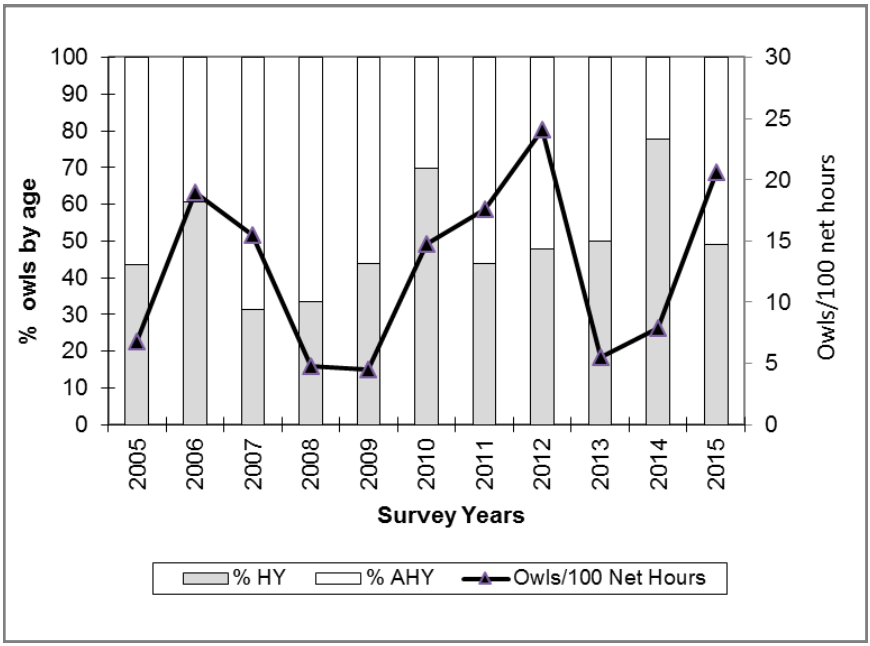

Figure 4. Northern Saw-whet Owls capture rates by age class during fall in 2005-2015.

days (range=1-45 days). One individual was recaptured two times and two individuals were recaptured three times in the same season. Nine other owls (1.6%) were recaptured in later years. Four individuals banded during fall were recaptured in the subsequent winter. One of these owls was banded on 31 October 2005 recaptured in December 2005 and again on 21 January 2007, 1.2 years from original capture.

The longest time interval between recaptures was 3.1 years (1,124 days), a male originally captured as an HY in November 2010 and recaptured in November 2013, in its 4th year. A second-year owl that we originally banded in 2009 was recaptured in 2011 also in her 4th year. One individual originally banded on 10 October 2014 at the Forest Ranch station, flew 7 km south and was recaptured 10 days later at the OWL2 site (Figure 2).

Winter and Spring Recaptures. Of the total of 41 individual owls captured during winter and spring, seven (17%) were recaptures. In addition, two owls originally banded during the winter were recaptured during later fall monitoring. The first owl originally banded in the winter in February 2006, was recaptured in the fall in October 2007, 1.8 years later. The second owl was banded on 25 January 2015 and recaptured in the fall on 13 November 2015, 301 days later.

Foreign Recoveries. We had two foreign recoveries (i.e., birds banded elsewhere). An SY female that was originally banded on 28 September 2011 at the Owl Research Institute (ORI), Bitterroot Valley, Montana, approximately 950 km NE of the Reserve (Figure 1) was recaptured by us 35 days later (2 November 2011). A second foreign recovery was also a SY female originally banded as a HY bird 6 November 2012 at Hitchcock Nature Center, Pottawatomie County, Iowa. This site is 2,200 km due east of our study site (Figure 1). She likely flew north to breed in the spring in 2013, and then flew south to our station during fall migration where we caught her on 6 November 2013.

None of the birds we banded at the Reserve have been recovered elsewhere.

Incidental Captures and Detections of Other Owls. Over all study years we incidentally captured 22 Western Screech Owls (*Megascops kennicotti*), and aurally and or visually detected five other owl species: Northern Pygmy (*Glacidium gnoma*), Western Screech Owl, Barn Owl (*Tyto alba*), Great Horned Owl, and California Spotted Owl (*Strix occidentalis occidentalis*).

DISCUSSION

Migration

Migration Timing. The range and peak periods of Northern Saw-whet Owl migration through the Reserve are similar to the timing at other stations at

this latitude in the eastern U.S. (Beckett and Proudfoot 2011, Frye 2012, Project Owlnet 2016). Not surprisingly, owl migration periods are later in the fall at lower latitudes. The peak capture period at the Reserve is 2-3 weeks later than on Vancouver Island, British Columbia (A. Nightingale, pers. comm.) and Bainbridge Island, Washington (J. Acker, pers. comm.). Three stations run by the Mendocino Redwood Company (2010), in Mendocino County, California at a similar latitude as the Reserve, captured Northern Saw-whet Owls at a similar time as we did, between 7 October and 10 November 2010 with peak captures banded on 26 October and 10 November.

Migration Route and Origination. The owls we captured in fall likely were following a southwardly migration or moving downslope from higher elevation in the Sierra Nevada. Migratory patterns described in the east, based on same season owl captures and subsequent recoveries at other stations, followed a southerly pattern (Rasmussen 2008, Brittain et al. 2009, Beckett and Proudfoot 2011, Project Owlnet 2016), although east/west shifts are also reported (Project Owlnet listserve; https://groups.yahoo.com/neo/groups/sawwhetnet/files/Papers/).

Our data did not reveal a migratory link between the stations north of us in the western US. Other than our same season foreign recovery of the owl originally banded in Montana, the origin and migratory route of our fall migrants is still unknown. We did not recapture any of the 6,700 fall individuals banded since 2002 on Vancouver Island or the 450 banded since 2004 on Bainbridge Island. Nor did we capture any of the birds banded from closer sites at the Mendocino banding stations in Northern California west of the Reserve, or any of 168 owls banded at the Boardman Tree Farm in Oregon (Marks et al. 2015).

Northern Saw-whet Owls are known to have moved distances as long as those between our established western stations (Project Owlnet 2016), as illustrated by a same season band recovery in Mendocino, CA from an owl originally banded at the Vancouver Island site (Mendocino Redwood Company 2010), and our recovery of the Montana bird. However, the long distances between the Reserve and northern banding sites in the west and the small areas surveyed by banding stations, leaves a substantial area of suitable coniferous forest breeding habitat in northern California, Oregon, and Washington that could be a source of unbanded owls that could have moved through the Reserve.

It is also possible that many of the birds captured at the Reserve may breed in the adjacent upslope Sierra Nevada. I have regularly detected territorial saw-whet owls when conducting summer California Spotted Owl (*Strix occidentalis occidentalis*) surveys in areas of adjacent Plumas County that have similar habitat to areas upslope of the Reserve (unpub. data). Snow cover or cold temperatures may trigger migration from the higher Sierra to

the more temperate, lower elevation Reserve and valley habitats (Lukas 2011, Beedy and Pandolfino 2013).

Annual Abundance, Age and Sex Differences

The annual variability in capture rate we detected at the Reserve is consistent with known population dynamics of the species. Northern Saw-wet Owls are irruptive with large annual fluctuations in numbers. Irruptive years are dominated by HY birds (Brinker et al. 1997, Whalen and Watts 2002, Rasmussen 2008, Brittain et al 2009). Capture rates at the Reserve followed this pattern, with high capture rates and high HY-AHY ratios in 2006 and 2010 (Table 1, Figure 4).

Some studies suggest that owl irruptions track the abundance of their rodent prey (Whalen and Watts 2002, Cote et al. 2007, Bowman et al. 2009) sometimes on a four-year cycle (Rasmussen 2008, Cheveau 2014). Cheveau et al. (2014) showed four-year invasion cycles for the Boreal Owl (*Aegolius funereus*), Northern Hawk Owl (*Surnia ulula*) and Great Gray Owl (*Strix nebulosa*) south of their boreal habitats when vole densities were low. Capture data from the Reserve consistently show a four-year peak in HY-AHY ratios, but do not show a corresponding four year pattern in abundance (as characterized by netting rate; Figure 4).

The different seasonal capture patterns at the Reserve are likely influenced by the numbers of the owls present, the age of the owls arriving, weather, and other random factors. Hatch-year owls have been shown to arrive before adults at some stations, creating a bimodal abundance (Rasmussen 2008). Also, because we banded only for the first four hours per night on five days per week, we may have missed owl flights through the sites. Stations report higher captures at different times in the night, which likely depends on locations and other factors (Project Owlnet 2016).

We identified most owls as female (71% female, 10% male, 17% unknown). These results concur with analysis of over 40,000 individual saw-wet owls in the eastern US, revealing sex-specific migration; more males are banded at higher-latitude stations, and many more females are banded overall (Brinker et al. 1997, Beckett and Proudfoot 2012). Hypotheses to explain this phenomenon include a combination of factors including: males may remain on breeding territories in winter, migration routes may differ between the sexes, and males may avoid audiolures (Brinker et al. 1997, Whalen and Watts 1997, Brittain et al. 2009).

The earlier arrival of HY birds than ASY birds at the Reserve (ave.=3 days), although statistically significant, is a minor difference and both age groups overlap substantially. Earlier arrival by HY birds has been shown in one eastern North American study, but several others showed that adults migrated earlier and another showed no difference (Rasmussen et al 2008).

Figure 5. Northern Saw-whet Owl with juvenal body plumage captured on 5 October 2013 during the fall migration period. This browner, wispier, body plumage is evidence of a late hatch, and was only one of two individuals exhibiting this plumage type in over 500 captures. *Photo by Steve King*

Recaptures and Site Fidelity

Although only a small proportion of owls we captured were recaptured in the same season and subsequent seasons (7.2%), our recaptures show two things: at least a few individuals exhibit migration site fidelity and some individuals overwinter on the Reserve. Recapture of nine owls (1.4%) in years after initial capture shows that birds have some fidelity to the Reserve as a migratory route or wintering site (Table 1). High migration route fidelity during the fall has been suggested in the Eastern U.S. (Beckett and Proudfoot 2012).

Figure 6. Northern Saw-whet Owl adult-type body plumage and typical of individuals captured during fall migration. *Photo by Steve King*

Winter and Spring Use of the Reserve

Some Northern Saw-whet Owls winter on the Reserve, based on our 25 winter captures, four winter recaptures from original fall banding, and telemetry data (Shaw 2014). Shaw (2014) found that nine (47%) of 19 owls on which telemetry transmitters were installed during fall 2010-2013, stayed on the Reserve during December-February. Of these owls, however, only three stayed longer than 27 days and the remainder averaged 6.7 days on the Reserve. One owl had stayed 91 days when we removed the transmitter before the battery expired (Shaw 2014).

The late March and early April captures suggest that saw-whet owls also may use the Reserve during spring migration. The two late April (2006) and two May (2010) netting efforts are our only attempts to determine if owls may nest on the Reserve, and more study is needed to answer that question. Lukas (2011) suggests they may stay to breed in oak woodland-mixed ponderosa pine forests after wintering in these habitats. Peeters (2007) describes pine-oak woodlands as Northern Saw-whet Owl nesting habitats in the Sierra, as containing the dominant tree species found on the Reserve.

CONCLUSION

This study has added to the limited knowledge of Northern Saw-whet Owl migration and ecology in western North America. The owls use the Reserve primarily as a migratory corridor with some additional use during the winter and spring. Owls that pass through the Reserve have shown no evidence of connection to other monitored populations in the northern Pacific states and British Columbia. The annual variation in numbers, periodic influx of higher numbers of HY birds, and female-dominated captures we observed at the Reserve are consistent with results from other stations in North America. As the only consistent continuously running station in California, our project fills a geographic data gap and contributes to a goal of Project Owlnet to support of the continued expansion of a network of NSWO banding stations (Project Owlnet 2016). More migration stations in the west could elucidate the pattern of movements and source of owls migrating through our site, as they have in the eastern and central U.S.

We will continue our long-term fall monitoring project to help reveal Reserve owl population trends. Our questions about where fall migrants originate and migration routes could be answered with satellite telemetry with funding and availability of tags for this small owl. We intend to conduct greater efforts in spring to confirm and establish timing of spring migration. To determine the potential use of the Reserve as a breeding site, nest boxes will be installed in 2017 with subsequent monitoring. Summer monitoring could also include broadcast surveys along the Reserve road system for comprehensive coverage.

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