US Department of Agriculture Forest Service
Pacific Northwest Research Station
Oregon Coast Range Spotted Owl Demography Study
2017 Annual Report
January, 2018

1. Title

Demographic Characteristics of Spotted Owls in the Oregon Coast Range, 1990–2017.

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3. Introduction

Background and potential benefit or utility of the study

This study is one of eight long-term demographic studies in the Regional Monitoring Program for the northern spotted owl (*Strix occidentalis caurina*; Lint et al. 1999). These federal demography studies were established to estimate population status and trends by contributing mark-recapture data sets collected on study areas representative of habitat conditions on federal lands in each of the different forest ecoregions within the range of the subspecies. The Coast Range study area was initiated in 1990, and represents the Oregon Coastal Douglas-fir ecoregion. Information on the demography of spotted owl populations is used to estimate population trends and assess the effects of different management strategies on spotted owls. This study provides data that we use to estimate survival, reproduction, and population parameters of spotted owls relative to landscape features in the Oregon Coast Range.

Study objectives

This study was designed to collect long-term information on survival and reproductive rates of spotted owls in the Oregon Coast Range, to include age and sex specific birth and death rates, and population trend estimates.

4. Study Area

The study area is located in the Oregon Coast Range, principally on public forest lands administered by the Siuslaw National Forest and the Salem and Eugene Districts of the Bureau of Land Management (Fig. 1). Municipal, state, and private timberlands are interspersed among the federal lands.

5. Methods

Survey design

Within the study area we visited 172 continuously-monitored spotted owl sites in 2017 to determine residency, nesting status, and reproductive success of all spotted owls detected. We monitored two additional sites where spotted owls were initially detected while surveying adjacent demography sites or that were known from previous years. Cooperators contributed information regarding owl activity at two additional sites along the periphery of the study area, including the identification of an emigrant.

Field methods

The effort to locate, band, and monitor owls consisted of a combination of daytime and nighttime surveys conducted by us and cooperators from the Bureau of Land Management, private consulting firms, and timber companies. Owl sites are typically searched during the day in an effort to relocate resident owls known from preceding years. Night surveys are employed at sites which appeared to have been vacant in previous years, or when we have difficulty relocating owls during day surveys. Night surveys consist of broadcasting or imitating owl calls from stations placed at prominent points, such that a complete calling route covers all of the forest in a particular territory as thoroughly as possible. Calling stations last 10 minutes. When spotted owls are heard responding to our calls at night, we return for a follow-up visit, usually the next day, to attempt to locate the owl. If we locate owls during daytime visits, we offer the owl mice and attempt to identify previously banded individuals, or to capture and band owls when necessary. By offering the owls mice, we are generally able to determine nesting status and locate fledglings. Our field protocols are outlined in Franklin, et al. (1996) and Lint et al. (1999).

Juveniles are captured and fitted with a uniquely numbered USFWS band. A red and white striped plastic band is attached to the opposite leg. When owls originally banded as juveniles are located in subsequent years as territorial members of the population, they are recaptured for identification, and the juvenile color band is replaced with a uniquely colored plastic band. This banding method generally allows us to determine the identity of owls in successive years without having to recapture them.

Analytical methods

Along with collaborating private and tribal studies, each of the eight federal demography study areas meet once every 5 years to participate in a week-long meta-analysis workshop. The most recent workshop was held in January 2014, and included participants from 11 long-term demography study areas. Each of the participants contributes productivity and survival data from their respective study areas with the objective of assessing population status and trends throughout the range of the subspecies, and to explore covariates that may be influencing population parameters on local or range-wide scales. Estimates of fecundity, apparent survival, recruitment, and annual rates of population change are obtained for each study area. Two-species territory occupancy modeling (MacKenzie et al. 2006) was added to the suite of analyses during the 2014 workshop in an effort to investigate the effects of interspecific competition between spotted owls and barred owls on recruitment and extinction rates. The results of the most recent meta-analysis workshop can be found in Dugger et al. (2016).

6. Results

Population trends

The results of the most recent meta-analysis workshop were based on data collected through 2013, and can be found in Dugger et al. (2016). The estimate of mean annual rate of population change (λ_{RJS}) for the Coast Range study area was 0.949 (SE= 0.019; 0.911-0.987 95% confidence interval), and an estimated annual decline of 5.1% (Dugger et al. 2016).

Occupancy

Empirical data collected on the Coast Range Study area indicate declines in the proportion of territories with resident owls (Figs. 2, 3, Table 1). Because detection probabilities are < 1, these empirical data underestimate occupancy. However, the best models for initial occupancy, colonization, and extinction obtained during the 2014 meta-analysis workshop resulted in estimates of probability of territory occupancy that strongly support the declining population trends apparent in detection data obtained on our study area (Dugger et al. 2016).

Number of owls detected

In 2017, we detected owls at 29 of the 172 sites surveyed (Fig. 4, Table 1). Spotted owls were detected at 30 sites in 2016 (Fig. 4, Table 1). We detected 48 non-juvenile spotted owls on the study area. Three of these owls were "extra" individuals detected at sites where another owl of the same sex had already been identified. Additional same-sex owl observations have been a feature of all previous seasons except 1996 and 2011 (Table 1). No subadult owls were detected on the study area in 2017; observations of subadults have been rare in recent years (Appendix B). In 2017, the number of sites with resident pairs was 15, a decrease from the count of 17 pairs in 2016 (Fig. 4, Table 1). We detected single owls at 13 sites (excluding additional owls), an increase from 12 sites in 2015. Male and female spotted owls were detected at one site where pair status was not determined to protocol.

We banded 338 adult, 78 subadult, and 783 juvenile spotted owls on the study area from 1990–2017 (Appendix A). We banded 1 adult male, and 6 juvenile spotted owls on the study area in 2017. We recaptured 1 adult male and 1 adult female on the study area in 2017. Both of these owls were originally banded as juveniles on the study area in previous years.

Age distribution and sex ratio

When the Coast Range Study Area was initiated in 1990, the sample of known age spotted owls was limited to a small number of individuals banded by BLM and USFS personnel in previous years, and those owls encountered in 1990 that we banded as juveniles, or as 1 or 2 year old subadults. Because it was not possible to determine the actual age of owls encountered for the first time as adults, the majority of owls in the early years of the study entered the sample as 3 year old minimum age individuals. In addition, because spotted owls are relatively long-lived, the sample of known age individuals remained skewed toward younger birds over the first 2 decades of the study. However, the age class distribution of known age owls in recent years suggests an aging population with relatively few younger individuals being recruited into the territorial population (Fig. 5).

Over the course of the study, we have consistently observed a slightly greater proportion of males to females in the territorial population. We observed a slightly greater proportion of

females for the first time in 2014. Slightly greater proportions of females were observed in 2016 and 2017 as well. Twenty-one males and 26 females were detected, with a 0.11 proportional difference (Appendix B). The mean difference in the annual proportions of known sex owls detected on the study area in 1990–2017 was 0.08 (SE= 0.01; annual range = 0.01–0.17). We suspect that the disproportionate number of males detected in most years is due to sexual differences in detectability rather than a real difference in the population, but this has not been tested. It remains unclear whether greater proportions of females observed over several recent years represent changes in detectability between sexes, or whether these observations might reflect actual changes in the population.

Number of sites with spotted owls

The percent of sites in which a spotted owl was detected has gradually declined over the course of the study from a high of 88% in 1991 to a low of 17% in 2016 and 2017. In comparison, spotted owls had been detected at 24% of the sites surveyed in 2015 (Fig. 2, Table 1). In 2017, pairs were observed at 9% of the sites. Single owls were observed at 8% of the sites surveyed, a prominent decrease from 12% in 2015, but similar to the 7% observed in 2016. There was one site (1% of total) where both a male and female were detected, but pair status was not established (Fig. 2, Table 1).

Movements

We and cooperators documented 17 owl dispersals on the Coast Range Study Area and adjoining lands in 2017. Fifteen of these movements were breeding dispersals, and two were natal dispersals. Among the breeding dispersals, twelve of these movements involved owls most recently observed elsewhere on the study area as non-juveniles (between-site movements). Two breeding dispersals documented were cases of immigration from sites outside of the demography study area. One breeding dispersal documented by cooperators was a case of emigration. This individual was formerly a territorial resident on the study area, observed in 2017 at a site on BLM lands adjoining our demographic study area (Eugene BLM District). We observed 2 cases of natal dispersal on the study area in 2017. These two owls were originally marked as juveniles on the Coast Range Study Area in previous years. Overall, we observed 2 cases of immigration in 2017, and 1 case of emigration.

Barred Owls

The proportion of sites where at least one barred owl was detected within 1.6 km of the year-specific spotted owl activity center has generally increased throughout the duration of the study, suggesting a steady increase in the barred owl population (Fig. 3, Table 1). We detected barred owls at 92% of the territories in 2017. This was an increase from 90% in 2016. (Fig. 3, Table 1). Our survey methods probably underestimated the number of sites with barred owls because we did not specifically target barred owls during our surveys for spotted owls. The overall increase in the proportion of territories where barred owls were detected is likely due to an increase in barred owl numbers, as well as increased nighttime survey effort at sites where spotted owls have disappeared (Fig. 6). The proportion of total survey time that included surveys at night had more than doubled from 0.38 in 1990 to 0.78 in 2013 (Fig. 6).

Reproduction

Of 16 female spotted owls that met protocols for determination of nesting status in 2017,

six (38%) females made nest attempts (Appendix C). Five of these nesting females (83%) successfully fledged young (Appendix E). Of 18 females that met protocols for reproductive status, only the five females known to have made nest attempts produced young; overall, 28% of the females checked for reproduction produced young in 2017 (Appendices D, E.). The mean estimate of number of young fledged for females in 2017 was 0.39 (SE= 0.16; Fig. 7, Appendix F), which was slightly below the overall annual estimate of 0.46 for all years in the study (SE= 0.02; Fig. 7, Appendix F). The five females that fledged young in 2017 produced 7 young, resulting in a mean brood size estimate of 1.4 (SE= 0.24; Appendix G). During the first decade of this study, nesting and reproductive estimates followed a cyclic biennial pattern with higher reproduction in even-numbered years. This pattern was not apparent during the latter decade of the study, during which high, low, and intermediate annual reproductive estimates occurred in both odd and even years (Fig. 7, Appendices C–G).

Nest tree characterization

A specific nest tree was identified in 730 nesting attempts made by spotted owl pairs since 1990, resulting in identification of 501 unique nest trees on the study area. Seventy-four percent of these nest trees were used a single time, while the remaining 26% were re-used in at least one subsequent year. In one extreme case, the same nest tree was used in 10 nest attempts between 1996 and 2008. Among 6 nest attempts identified in 2017, two nests were in trees used in previous years, and 4 were in new nest trees. All 6 of these were top cavity nests located in the broken tops of old growth Douglas-firs. Top cavities have been the most prevalent nest structures observed (70%), typically located in the broken boles of large trees (or similarly broken out large side arms, or secondary tops). The other nest structures identified include side cavities (21%), and more rarely, platform nests (9%). Nests are typically located in senescent living trees (83%), but also occur in snags (17%). Among the nest trees for which we have completed a more comprehensive suite of measurements, the median diameter at breast height is 156 cm (range 33-286 cm, n= 235). The majority of nests were in Douglas-fir (86%), and Western Red-cedar (9%). Western Hemlock, Big-leaf Maple, Red Alder, and Sitka Spruce were rarely used; these species combined account for only 5% of the nest trees on this study area.

Diet

Owl pellets were collected when spotted owls we encountered egested pellets, as well as from frequented roost locations. An analysis of prey animals identified from spotted owl pellets collected at sites in the central Oregon Coast Range by Forsman et al. (2004) found that spotted owl diets were comprised chiefly of nocturnal animals. Northern flying squirrels were the most important prey species, constituting 49.5% of the prey items, and an estimated 58.3% of biomass consumed. Red tree voles and deer mice were also found to be numerically important prey items (12.7% and 10.5%, respectively), but due to their relatively small size, together constituted 6.2% of prey biomass. Several larger mammals together accounted for 84.3% of prey biomass; in addition to northern flying squirrels, these animals were woodrats, rabbits, and hares (Forsman et al. 2004). Dwindling owl encounters have resulted in fewer opportunities to collect pellets in recent years, but we continue to collect pellets when such opportunities occur.

7. Discussion

Trends

We have observed a decline in the proportion of territories in which spotted owls were detected from a high of 88% in 1991, to a low of 17% in 2016 and 2017. Similarly, resident pairs were observed at 62% of the territories in 1994 and 1997, while pairs were observed at only 9% of the territories in 2017. Estimates of female productivity indicate declining reproduction in recent years. The 3 lowest annual estimates of female productivity have occurred in the past decade, and above average reproductive years were observed in only 3 years during this same period (Appendix F). These empirical results were supported by those of the 2014 meta-analysis workshop, which estimated an annual rate of decline of 3.8% throughout the range, and a 5.1% annual decline on the Coast Range Study Area (Dugger et. al 2016).

Summary

We surveyed 172 continuously-monitored sites on the study area, and completed the 28th field season on the Coast Range Study Area in September 2017. We banded 6 fledglings, 1 adult male, and identified 37 previously marked owls on the study area. We met territory survey protocols with at least 3 surveys conducted to each of the sites on the study. Protocols for nest status determinations were met for 16 females, and number of young fledged for 18 females. We detected fewer individuals, at fewer sites, than in any previous year. The next meta-analysis workshop is scheduled to take place in January 2019.

8. Acknowledgments

We are indebted to Ray Davis (USDA FS, PNW Research Station) for his tireless efforts in securing continued funding for our research, assistance with all things GIS, and for his indispensable resourcefulness in covariate crisis prevention during the 2014 meta-analysis. We owe thanks to Katie Dugger (USGS) for all of her work on the 2014 meta-analysis and manuscript. ODF has assisted with monitoring at several sites within the study area, as well as providing us with logistical support in the form of a parking site for field vehicles. The USFS and USDI Bureau of Land Management have provided most of the funding necessary for the continued function of this study**.** Last, but nearest and dearest, we would thank all of the field biologists whose dedicated efforts on this study area have provided the priceless gift of quality data.

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10. Tables

Table 1. Historic spotted owl sites surveyed per year and the number of these with pairs, singles, and unknown status, as well as spotted owl–barred owl hybrid owls, mixed species pairs, and barred owls in the Oregon Coast Range Study Area, 1990–2017. Additional same-sex individuals at a territory were excluded from the counts of pairs, singles, and unknown status owls.

Year	Sites surveyed	Pairs[a]	Singles[b]	Unk[c]	Multiple same sex owl sites[d]	Hybrid[e]	Mixed spp. pairs[f]	Spotted owl sites[g]	Barred owl sites[h]
1990	141	63	41	6	6	0	0	110	3
1991	141	64	46	14	8	0	0	124	7
1992	165	95	28	5	7	0	0	128	10
1993	166	78	41	13	2	0	0	132	16
1994	170	105	27	9	5	0	1	141	14
1995	177	98	26	6	2	0	0	130	11
1996	186	104	28	5	0	0	2	137	20
1997	184	114	12	7	3	0	1	133	26
1998	194	117	23	5	5	1	1	145	39
1999	193	102	30	9	5	1	1	141	41
2000	200	98	27	9	7	1	1	134	55
2001	202	94	31	6	3	0	0	131	74
2002	204	88	33	9	5	0	0	130	77
2003	204	86	33	5	7	1	0	124	91
2004	204	83	28	3	8	2	2	114	92
2005	204	73	32	2	3	1	1	107	101
2006	204	62	41	2	2	3	2	105	124
2007	203	65	30	7	6	0	0	102	121
2008	203	59	19	4	1	1	1	82	134
2009	173	41	19	10	3	2	2	70	125
2010	172	46	22	3	2	1	1	71	115
2011	172	20	30	5	0	1	0	55	130
2012	172	29	26	2	2	1	0	57	140
2013	172	34	21	1	3	0	0	56	144
2014	172	30	16	2	4	2	0	48	124
2015	172	18	20	3	3	0	0	41	153
2016	172	17	12	1	2	0	0	30	155
2017	172	15	13	1	2	0	0	29	158

[a] Number of sites occupied by a spotted owl pair. Spotted owls paired with barred owls or hybrid owls were categorized as singles.

[b] Number of sites occupied by a single spotted owl. If more than a single spotted owl was detected but the birds were of the same sex, it was classified as a single territory.

[c] Number of sites occupied by a spotted owl of unknown status. These sites had detections of both a male and a female spotted owl, but the birds did not meet pair status.

[d] Number of sites occupied by more than one single spotted owl of the same sex.

[e] Number of spotted owl-barred owl hybrids detected. Hybrid owls were considered present if they were detected within the site boundary. Cases include: single hybrid owls, hybrid males at a territory occupied by a spotted owl, spotted owls paired with hybrid owls, hybrid owls paired with barred owls, and a hybrid male paired with a barred owl at a territory occupied by a spotted owl.
[f] Number of mixed species pairs, which include territories with at least one of the birds had some spotted owl ancestry and it was not a straight-forward spotted owl pair (e.g., spotted owl–hybrid owl, hybrid–barred owl, spotted owl–barred owl, etc.), but pair status was established to protocol.
[g] Number of sites occupied by at least one spotted owl.
[h] Number of sites occupied by at least one barred owl.

11. Figures

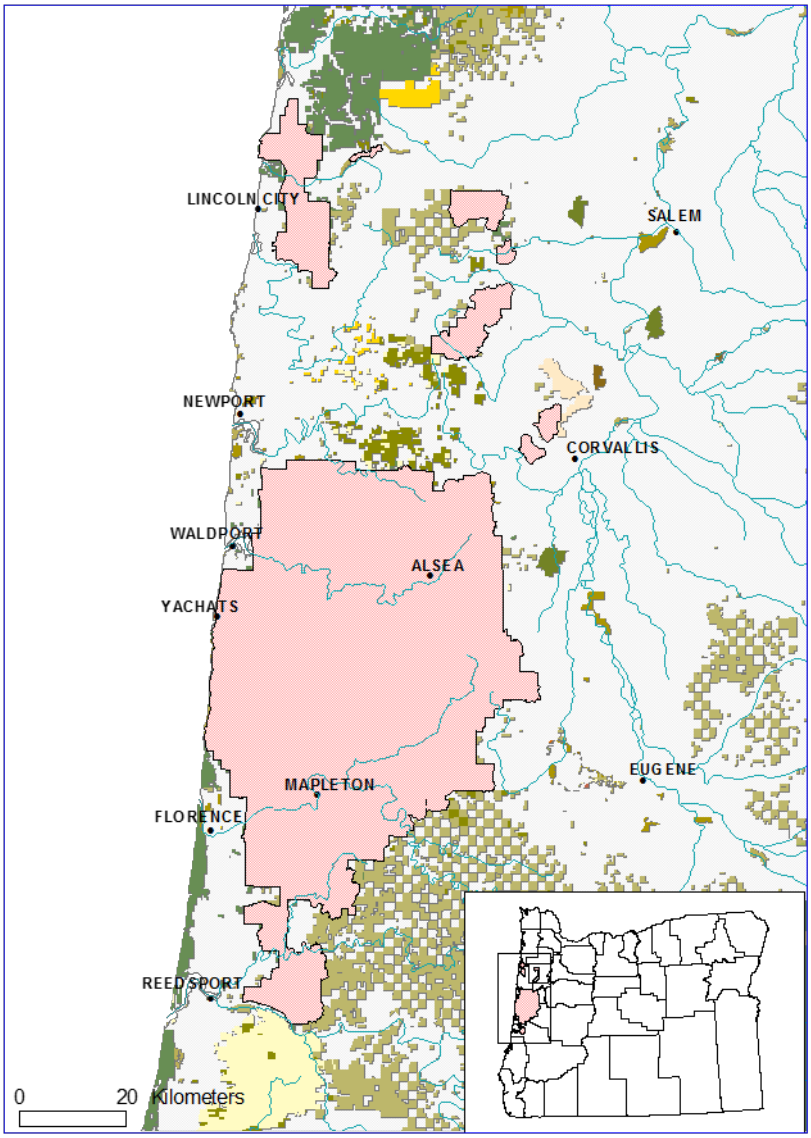

Figure 1. Oregon Coast Range spotted owl Study Area.

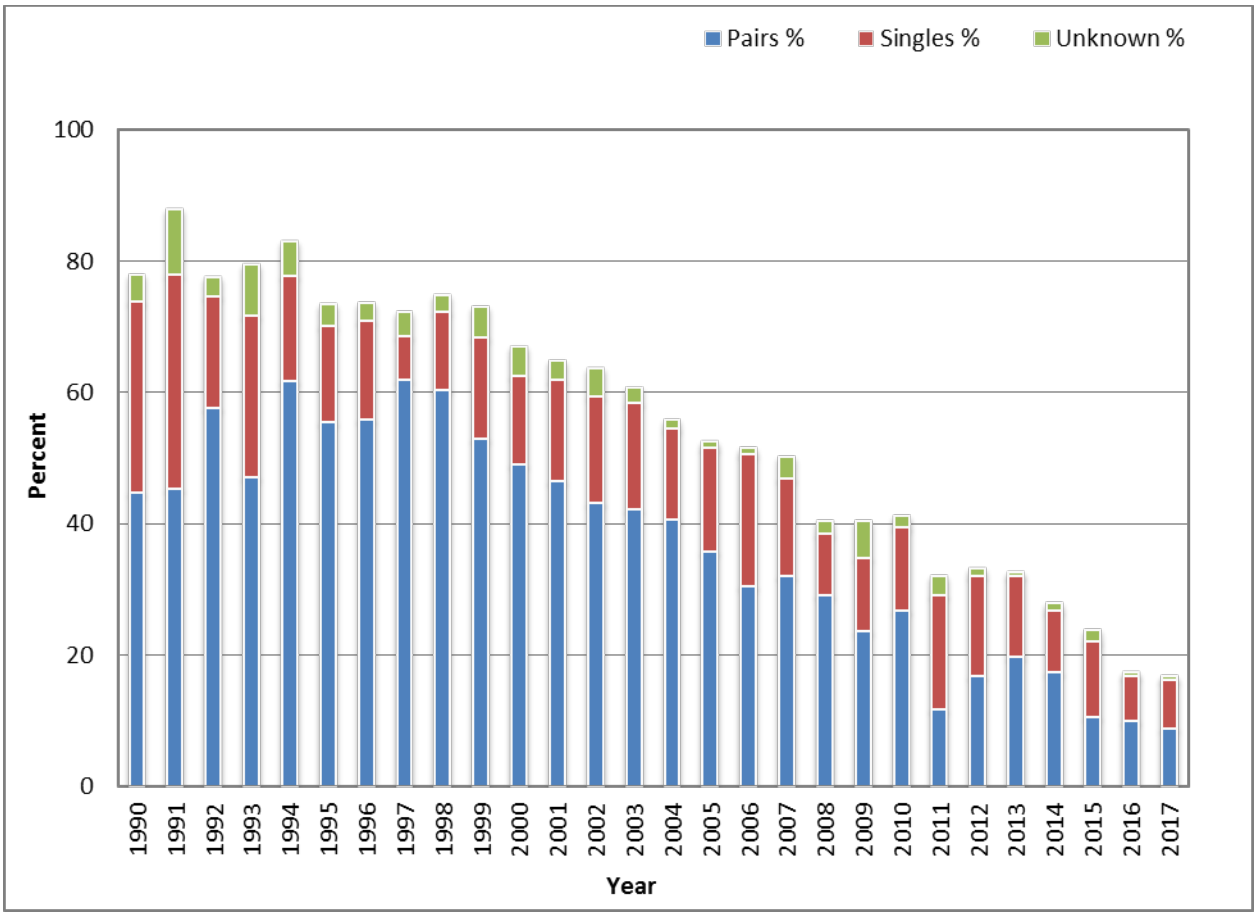

Figure 2. Percent of sites where spotted owl pairs, singles, or males and females of unknown status were detected on the Oregon Coast Range Study Area, 1990–2017.

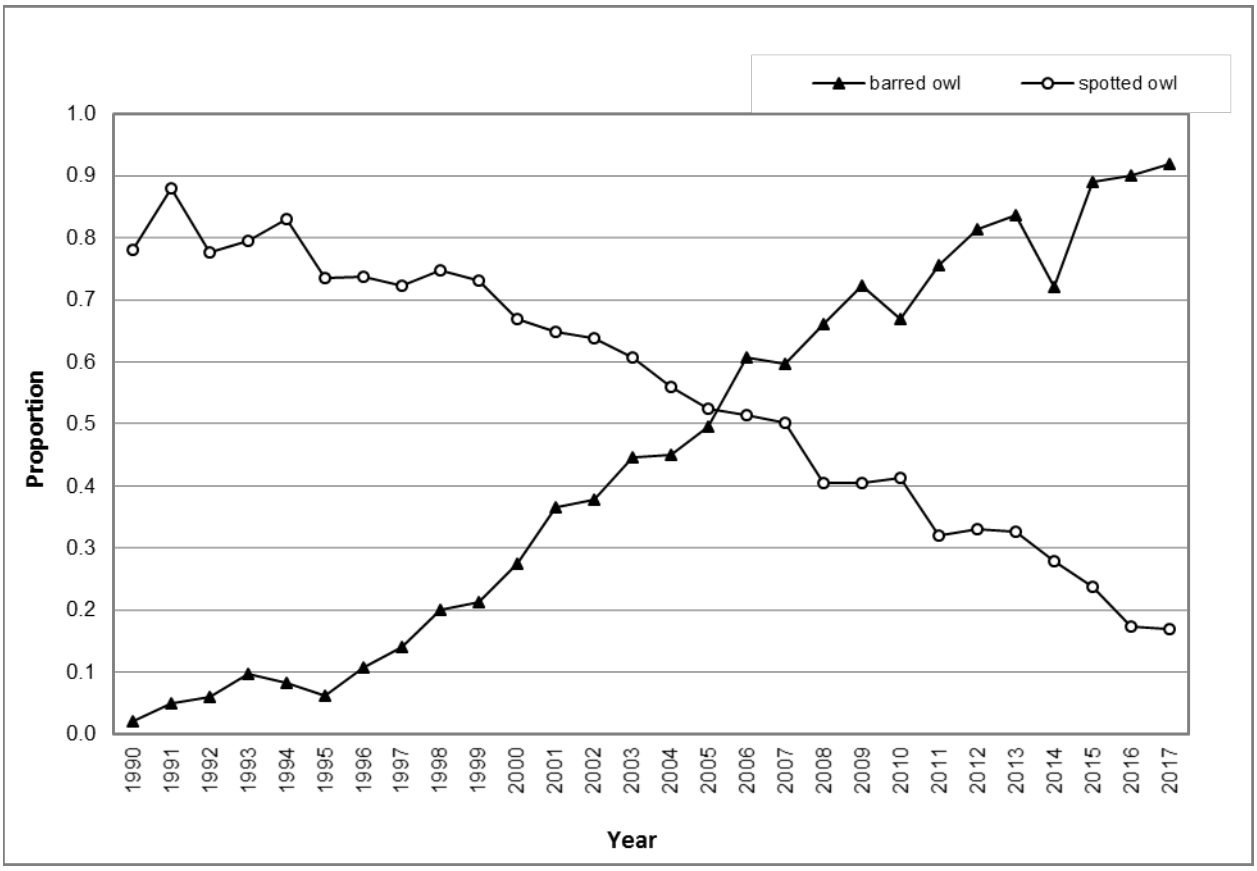

Figure 3. Proportion of spotted owl sites in which barred owls and spotted owls were detected on the Oregon Coast Range Study Area, 1990–2017.

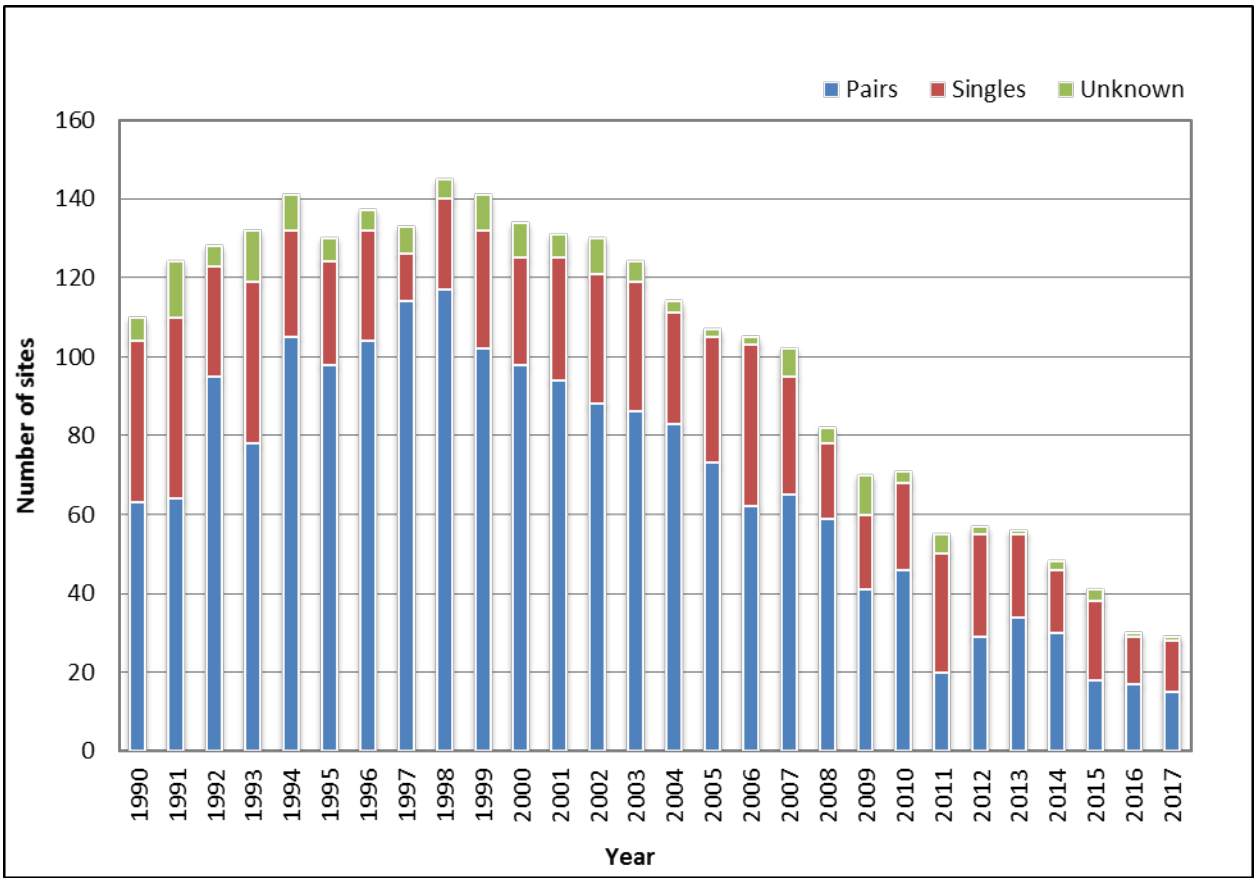

Figure 4. Number of sites where spotted owl pairs, singles, or male and female owls of unknown status were detected on the Oregon Coast Range Study Area, 1990–2017.

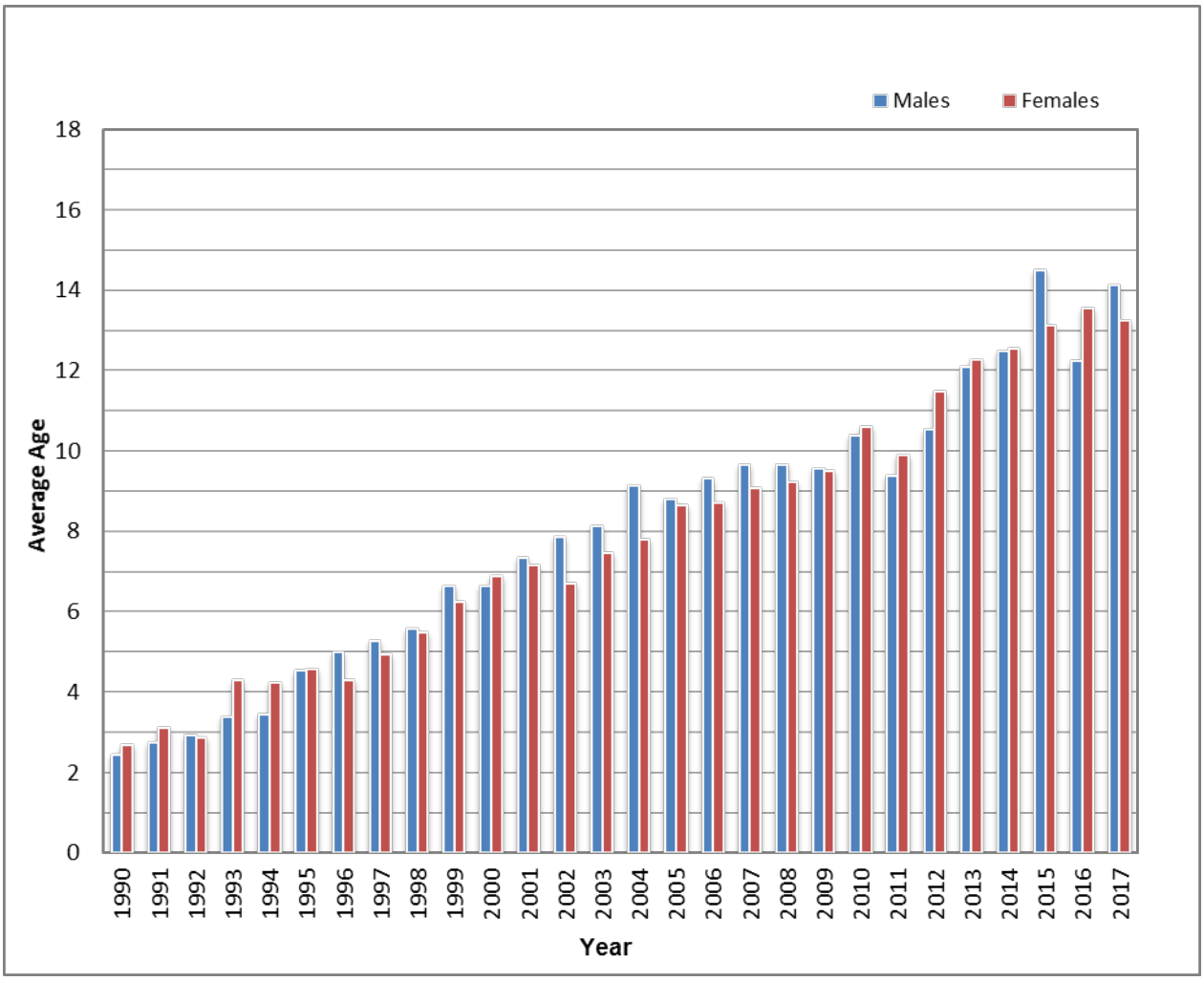

Figure 5. Average ages of non-juvenile male and female spotted owls on the Oregon Coast Range Study Area, 1990–2017.

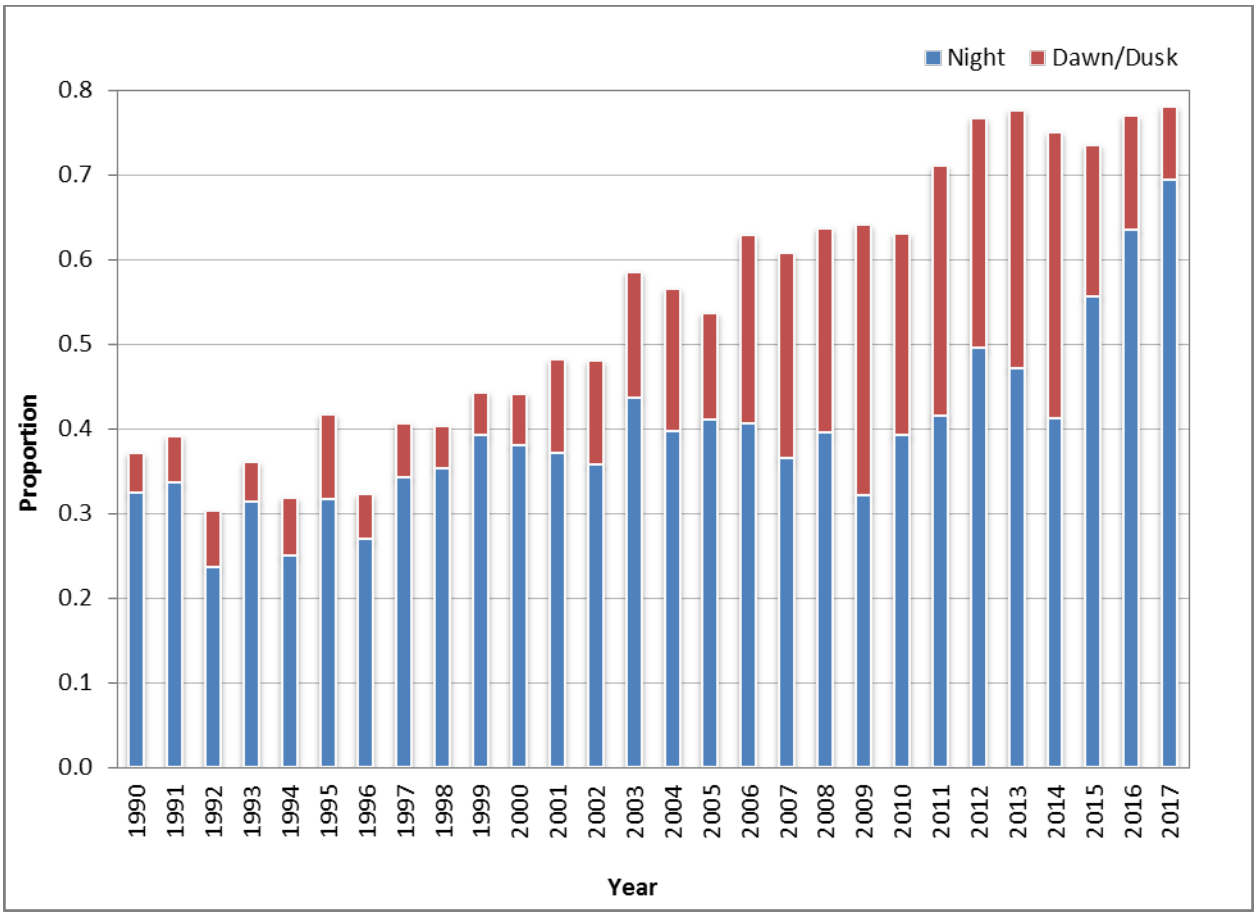

Figure 6. Proportion of survey effort conducted at night or dawn and dusk on the Oregon Coast Range Study Area, 1990–2017.

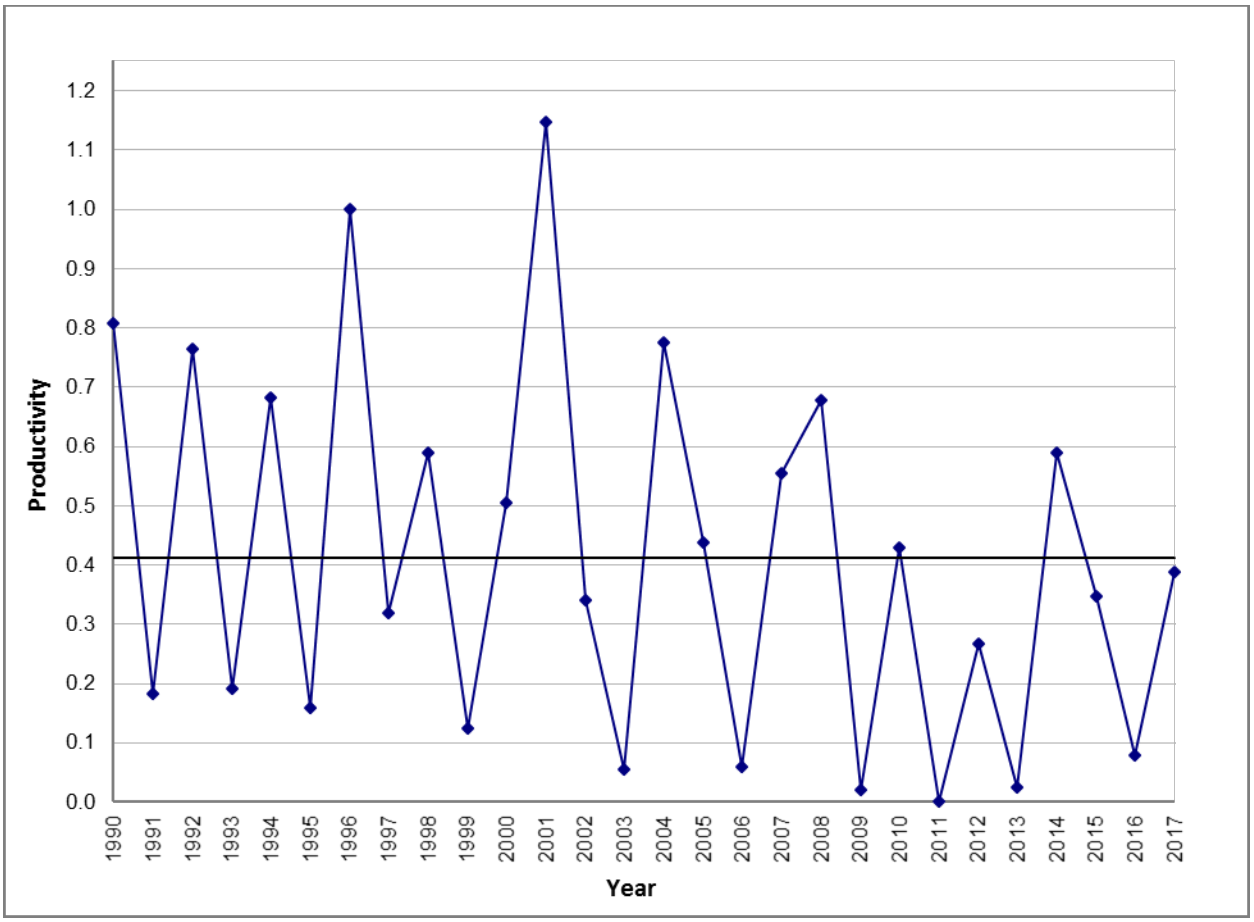

Figure 7. Estimated annual productivity (mean number of young fledged) of female spotted owls on the Oregon Coast Range Study Area, 1990–2017. Horizontal line indicates the mean of yearly means (0.41 ± 0.06 SE).

12. Publications, Presentations, and Data Transfer

Conducted field trips with university students and professional organizations. Provided demographic data to federal, state, and private organizations for their management activities. Provided detailed summary information regarding survey results and territory status determinations to the Siuslaw National Forest and the Eugene, Coos Bay, and Salem Districts of the Bureau of Land Management. Provided updates regarding the current occupancy and reproductive status of owl territories to Oregon Department of Forestry. Provided demographic data, mapping resources, and other supporting information to USGS in association with a barred owl experimental removal study that began in 2015.

13. Interesting observations and problems encountered

Road closures and a reduction in forest road maintenance have greatly restricted access and resulted in considerable increase in the number of areas that need to be accessed on foot. Diminished access has led to increased survey times. In addition, the gradual reduction in sites occupied by spotted owls means that we now have to spend much more time conducting night surveys at historical sites where it used to be easy to locate spotted owls during diurnal visits. This situation is not likely to change in the foreseeable future.

14. Appendices

Appendix A. Number of spotted owls banded on the Oregon Coast Range Study Area, 1990–2017.

	Adults		Subadults		
Year	Males	Females	Males	Females	Juveniles
1990	43	31	8	3	32
1991	25	23	2	4	7
1992	28	30	4	4	61
1993	6	8	2	0	13
1994	15	18	3	1	62
1995	5	8	1	2	13
1996	7	1	4	4	100
1997	3	7	4	0	36
1998	2	2	5	1	57
1999	3	5	1	1	10
2000	4	9	1	0	51
2001	1	1	0	3	99
2002	4	1	2	3	28
2003	2	1	1	2	5
2004	4	1	0	2	59
2005	3	2	1	0	24
2006	1	4	1	2	2
2007	3	3	0	0	31
2008	3	2	0	0	36
2009	2	1	3	0	1
2010	1	0	1	1	15
2011	2	1	0	0	0
2012	4	1	0	0	7
2013	1	2	0	0	1
2014	1	2	1	0	18
2015	0	0	0	0	8
2016	0	0	0	0	1
2017	1	0	0	0	6
Total	174	164	45	33	783

Appendix B. Number of spotted owls detected on historic sites in the Oregon Coast Range Study Area, 1990–2017.

	Adults		Subadults		Age unk			
Year	Males	Females	Males	Females	Males	Females	Sex Unk	Juveniles
1990	55	41	10	4	35	28	12	40
1991	78	57	7	4	38	26	1	10
1992	92	87	6	7	19	18	7	69
1993	85	79	5	0	35	19	2	14
1994	99	101	14	8	23	13	2	71
1995	109	97	3	3	17	7	0	15
1996	109	94	9	11	12	10	1	107
1997	116	111	9	6	6	9	1	37
1998	116	107	16	10	13	9	1	68
1999	116	105	3	5	15	8	5	13
2000	118	102	5	4	11	6	2	51
2001	107	88	3	4	17	12	3	109
2002	94	79	7	10	26	13	3	31
2003	96	82	7	7	21	5	5	5
2004	91	84	1	4	16	11	3	65
2005	74	76	6	5	11	9	4	32
2006	70	64	2	3	17	10	5	2
2007	71	63	1	2	17	18	9	33
2008	62	53	1	2	15	12	1	38
2009	45	46	3	1	12	12	5	1
2010	47	45	4	1	13	8	4	19
2011	25	24	0	0	15	12	4	0
2012	36	32	0	0	14	4	4	8
2013	42	38	0	0	6	6	2	1
2014	32	37	1	0	8	6	0	21
2015	25	28	0	0	8	4	0	8
2016	21	24	0	0	1	4	1	2
2017	16	21	0	0	5	5	1	7

Appendix C. Number and proportion of adult (Ad), subadult (S-Ad), and unknown age (Unk) female spotted owls that nested on the Oregon Coast Range Study, 1990–2017. Estimates were calculated for paired or single females whose nesting status was determined by 1 June.

				Nesting Adults		Nesting Subadults		Combined	
Year	Ad	S-Ad	Unk	Prop	95% CI	Prop	95% CI	Prop	95% CI
1990	20	2	7	0.9	0.68-0.99	0.5	0.01-0.99	0.83	0.64-0.94
1991	37	1	0	0.16	0.06-0.32	0	0.00-0.98	0.16	0.06-0.31
1992	66	6	4	0.71	0.59-0.82	0.5	0.12-0.88	0.68	0.57-0.79
1993	66	0	2	0.24	0.15-0.36	.	.	0.25	0.15-0.37
1994	84	5	2	0.68	0.57-0.78	0.4	0.05-0.85	0.65	0.54-0.75
1995	84	3	0	0.17	0.09-0.26	0	0.00-0.71	0.16	0.09-0.26
1996	84	8	3	0.82	0.72-0.90	0.63	0.24-0.91	0.8	0.71-0.88
1997	100	6	0	0.42	0.32-0.52	0	0.00-0.46	0.4	0.30-0.50
1998	96	8	3	0.61	0.51-0.71	0.25	0.03-0.65	0.6	0.50-0.69
1999	91	2	1	0.18	0.10-0.27	0	0.00-0.84	0.17	0.10-0.26
2000	85	2	0	0.54	0.43-0.65	0.5	0.01-0.99	0.54	0.43-0.65
2001	75	2	2	0.87	0.77-0.93	0	0.00-0.84	0.85	0.75-0.92
2002	64	8	4	0.55	0.42-0.67	0	0.00-0.37	0.49	0.37-0.60
2003	64	5	0	0.06	0.02-0.15	0	0.00-0.52	0.06	0.02-0.14
2004	66	2	2	0.79	0.67-0.88	0.5	0.01-0.99	0.79	0.67-0.87
2005	71	4	1	0.46	0.35-0.59	0.25	0.01-0.81	0.45	0.33-0.57
2006	47	2	1	0.06	0.01-0.18	0	0.00-0.84	0.06	0.01-0.17
2007	48	1	0	0.63	0.47-0.76	0	0.00-0.98	0.61	0.46-0.75
2008	53	1	4	0.74	0.60-0.85	0	0.00-0.98	0.72	0.59-0.83
2009	33	1	0	0.06	0.01-0.20	0	0.00-0.98	0.06	0.01-0.20
2010	35	2	0	0.89	0.73-0.97	0	0.00-0.84	0.84	0.68-0.94
2011	18	0	0	0	0.00-0.19	.	.	0	0.00-0.19
2012	27	0	1	0.44	0.25-0.65	.	.	0.43	0.24-0.63
2013	31	0	0	0.1	0.02-0.26	.	.	0.1	0.02-0.26
2014	33	0	0	0.67	0.48-0.82	.	.	0.67	0.48-0.82
2015	22	0	0	0.23	0.08-0.45	.	.	0.23	0.08-0.45
2016	21	0	0	0.05	0.00-0.24	.	.	0.05	0.00-0.24
2017	15	0	1	0.4	0.16-0.68	.	.	0.38	0.15-0.65
Overall:	1536	71	38	0.48	0.45-0.50	0.23	0.13-0.34	0.47	0.44-0.49

Appendix D. Proportion of adult (Ad), subadult (S-Ad), and unknown age (Unk) female spotted owls that fledged young on the Oregon Coast Range Study Area, 1990–2017. Estimates were calculated for paired or single females for which the number of young fledged was determined before 31 August.

				Adults		Subadults		Combined	
Year	Ad	S-Ad	Unk	Prop	95% CI	Prop	95% CI	Prop	95% CI
1990	34	4	14	0.71	0.53-0.85	0.5	0.07-0.93	0.62	0.47-0.75
1991	51	2	2	0.12	0.04-0.24	0	0.00-0.84	0.13	0.05-0.24
1992	78	7	4	0.54	0.42-0.65	0.14	0.00-0.58	0.48	0.38-0.59
1993	70	0	3	0.11	0.05-0.21	.	.	0.12	0.06-0.22
1994	95	6	3	0.48	0.38-0.59	0	0.00-0.46	0.45	0.35-0.55
1995	91	3	1	0.1	0.05-0.18	0	0.00-0.71	0.09	0.04-0.17
1996	93	10	6	0.67	0.56-0.76	0.4	0.12-0.74	0.63	0.54-0.72
1997	109	6	1	0.24	0.16-0.33	0	0.00-0.46	0.23	0.16-0.32
1998	100	9	3	0.41	0.31-0.51	0.11	0.00-0.48	0.38	0.29-0.47
1999	99	3	3	0.08	0.04-0.15	0	0.00-0.71	0.09	0.04-0.16
2000	97	4	0	0.33	0.24-0.43	0.25	0.01-0.81	0.33	0.24-0.43
2001	87	4	4	0.68	0.57-0.77	0	0.00-0.60	0.65	0.55-0.75
2002	75	9	4	0.27	0.17-0.38	0	0.00-0.34	0.24	0.15-0.34
2003	80	8	1	0.05	0.01-0.12	0	0.00-0.37	0.04	0.01-0.11
2004	86	2	5	0.51	0.40-0.62	0	0.00-0.84	0.49	0.39-0.60
2005	74	4	2	0.32	0.22-0.44	0	0.00-0.60	0.3	0.20-0.41
2006	63	3	1	0.03	0.00-0.11	0	0.00-0.71	0.03	0.00-0.10
2007	63	2	0	0.38	0.26-0.51	0	0.00-0.84	0.37	0.25-0.50
2008	56	2	4	0.46	0.33-0.60	0	0.00-0.84	0.42	0.30-0.55
2009	46	2	0	0.02	0.00-0.12	0	0.00-0.84	0.02	0.00-0.11
2010	45	2	2	0.31	0.18-0.47	0	0.00-0.84	0.31	0.18-0.45
2011	21	0	0	0	0.00-0.16	.	.	0	0.00-0.16
2012	29	0	1	0.21	0.08-0.40	.	.	0.2	0.08-0.39
2013	38	0	1	0.03	0.00-0.14	.	.	0.03	0.00-0.13
2014	34	0	0	0.35	0.20-0.54	.	.	0.35	0.20-0.54
2015	23	0	0	0.17	0.05-0.39	.	.	0.17	0.05-0.39
2016	25	0	0	0.04	0.00-0.20	.	.	0.04	0.00-0.20
2017	17	0	1	0.29	0.10-0.56	.	.	0.28	0.10-0.53
Overall:	1779	92	66	0.31	0.29-0.33	0.1	0.05-0.18	0.3	0.28-0.32

Appendix E. Proportion of nesting adult (Ad), subadult (S-Ad), and unknown age (Unk) female spotted owls that fledged young on the Oregon Coast Range Study Area, 1990–2017. Estimates were calculated for paired or single females whose nesting status was determined by 1 June.

				Adults		Subadults		Combined	
Year	Ad	S-Ad	Unk	Prop	95% CI	Prop	95% CI	Prop	95% CI
1990	17	1	5	0.82	0.57-0.96	1	0.03-1.00	0.74	0.52-0.90
1991	6	0	0	0.67	0.22-0.96	.	.	0.67	0.22-0.96
1992	46	3	2	0.85	0.71-0.94	0.33	0.01-0.91	0.78	0.65-0.89
1993	15	0	1	0.53	0.27-0.79	.	.	0.5	0.25-0.75
1994	57	2	0	0.75	0.62-0.86	0	0.00-0.84	0.73	0.60-0.84
1995	14	0	0	0.64	0.35-0.87	.	.	0.64	0.35-0.87
1996	69	5	2	0.8	0.68-0.88	0.6	0.15-0.95	0.78	0.67-0.86
1997	42	0	0	0.62	0.46-0.76	.	.	0.62	0.46-0.76
1998	59	2	3	0.69	0.56-0.81	0.5	0.01-0.99	0.66	0.53-0.77
1999	16	0	0	0.5	0.25-0.75	.	.	0.5	0.25-0.75
2000	46	1	0	0.65	0.50-0.79	1	0.03-1.00	0.66	0.51–0.79
2001	65	0	2	0.83	0.72-0.91	.	.	0.82	0.71-0.90
2002	35	0	2	0.54	0.37-0.71	.	.	0.54	0.37–0.71
2003	4	0	0	1	0.40-1.00	.	.	1	0.40-1.00
2004	52	1	2	0.79	0.65-0.89	0	0.00-0.98	0.75	0.61-0.85
2005	30	1	0	0.77	0.58-0.90	0	0.00-0.98	0.74	0.55-0.88
2006	3	0	0	0.67	0.09-0.99	.	.	0.67	0.09-0.99
2007	29	0	0	0.76	0.56-0.90	.	.	0.76	0.56-0.90
2008	38	0	2	0.63	0.46-0.78	.	.	0.6	0.43-0.75
2009	2	0	0	0.5	0.01-0.99	.	.	0.5	0.01-0.99
2010	29	0	0	0.41	0.24-0.61	.	.	0.41	0.24-0.61
2011	0	0	0	.	.	.	.	.	.
2012	12	0	0	0.5	0.21-0.79	.	.	0.5	0.21-0.79
2013	3	0	0	0.33	0.01-0.91	.	.	0.33	0.01-0.91
2014	22	0	0	0.55	0.32-0.76	.	.	0.55	0.32-0.76
2015	5	0	0	0.8	0.28-0.99	.	.	0.8	0.28-0.99
2016	1	0	0	1	0.03-1.00	.	.	1	0.03-1.00
2017	6	0	0	0.83	0.36-1.00	.	.	0.83	0.36-1.00
Overall:	723	16	21	0.7	0.67-0.74	0.44	0.20-0.70	0.68	0.65-0.72

Appendix F. Estimated mean productivity of adult (Ad), subadult (S-Ad), and unknown age (Unk) female spotted owls on the Oregon Coast Range Study Area, 1990–2017. Productivity was defined as the number of young fledged per female. Estimates were calculated for any female for which the number of young fledged was determined before 31 August.

				Adults		Subadults		Combined	
Year	Ad	S-Ad	Unk	Mean	SE	Mean	SE	Mean	SE
1990	34	4	14	0.94	0.13	0.5	0.29	0.81	0.1
1991	51	2	2	0.18	0.07	0	0	0.18	0.07
1992	78	7	4	0.85	0.1	0.29	0.29	0.76	0.09
1993	70	0	3	0.17	0.06	.	.	0.19	0.06
1994	95	6	3	0.74	0.09	0	0	0.68	0.08
1995	91	3	1	0.16	0.05	0	0	0.16	0.05
1996	93	10	6	1.04	0.09	0.7	0.3	1	0.08
1997	109	6	1	0.33	0.06	0	0	0.32	0.06
1998	100	9	3	0.64	0.08	0.22	0.22	0.59	0.08
1999	99	3	3	0.12	0.04	0	0	0.12	0.04
2000	97	4	0	0.52	0.08	0.25	0.25	0.5	0.08
2001	87	4	4	1.18	0.1	0	0	1.15	0.09
2002	75	9	4	0.39	0.08	0	0	0.34	0.07
2003	80	8	1	0.06	0.03	0	0	0.06	0.03
2004	86	2	5	0.8	0.09	0	0	0.77	0.09
2005	74	4	2	0.47	0.09	0	0	0.44	0.08
2006	63	3	1	0.06	0.04	0	0	0.06	0.04
2007	63	2	0	0.57	0.1	0	0	0.55	0.1
2008	56	2	4	0.75	0.12	0	0	0.68	0.11
2009	46	2	0	0.02	0.02	0	0	0.02	0.02
2010	45	2	2	0.44	0.11	0	0	0.43	0.1
2011	21	0	0	0	0	.	.	0	0
2012	29	0	1	0.28	0.11	.	.	0.27	0.11
2013	38	0	1	0.03	0.03	.	.	0.03	0.03
2014	34	0	0	0.59	0.15	.	.	0.59	0.15
2015	23	0	0	0.35	0.16	.	.	0.35	0.16
2016	25	0	0	0.08	0.08	.	.	0.08	0.08
2017	17	0	1	0.41	0.17	.	.	0.39	0.16
Overall:	1779	92	66	0.48	0.02	0.15	0.05	0.46	0.02

Appendix G. Mean brood size of adult (Ad), subadult (S-Ad), and unknown age (Unk) female spotted owls on the Oregon Coast Range Study Area, 1990–2017. Mean brood size was defined as the number of young produced per female that fledged at least one young before 31 August.

				Adults		Subadults		Combined	
Year	Ad	S-Ad	Unk	Mean	SE	Mean	SE	Mean	SE
1990	24	2	6	1.33	0.1	1	0	1.31	0.08
1991	6	0	1	1.5	0.22	.	.	1.43	0.2
1992	42	1	0	1.57	0.08	2	.	1.58	0.08
1993	8	0	1	1.5	0.19	.	.	1.56	0.18
1994	46	0	1	1.52	0.07	.	.	1.51	0.07
1995	9	0	0	1.67	0.17	.	.	1.67	0.17
1996	62	4	3	1.56	0.06	1.75	0.25	1.58	0.06
1997	26	0	1	1.38	0.1	.	.	1.37	0.09
1998	41	1	0	1.56	0.09	2	.	1.57	0.08
1999	8	0	1	1.5	0.19	.	.	1.44	0.18
2000	32	1	0	1.56	0.09	1	.	1.55	0.09
2001	59	0	3	1.75	0.06	.	.	1.76	0.06
2002	20	0	1	1.45	0.11	.	.	1.43	0.11
2003	4	0	0	1.25	0.25	.	.	1.25	0.25
2004	44	0	2	1.57	0.08	.	.	1.57	0.07
2005	24	0	0	1.46	0.1	.	.	1.46	0.1
2006	2	0	0	2	0	.	.	2	0
2007	24	0	0	1.5	0.1	.	.	1.5	0.1
2008	26	0	0	1.62	0.11	.	.	1.62	0.11
2009	1	0	0	1	.	.	.	1	.
2010	14	0	1	1.43	0.14	.	.	1.4	0.13
2011	0	0	0	.	.	.	.	.	.
2012	6	0	0	1.33	0.21	.	.	1.33	0.21
2013	1	0	0	1	.	.	.	1	.
2014	12	0	0	1.67	0.14	.	.	1.67	0.14
2015	4	0	0	2	0	.	.	2	0
2016	1	0	0	2	.	.	.	2	.
2017	5	0	0	1.4	0.24	.	.	1.4	0.24
Overall:	551	9	21	1.55	0.02	1.56	0.18	1.54	0.02

Appendix H. Two well-developed spotted owl juveniles from the Baldy Mountain tract, south half Mapleton Ranger District, Siuslaw National Forest. 7/3/2014