WILDLIFE HABITAT RELATIONSHIPS
IN WASHINGTON AND OREGON
FY2001

June 2002

1. Title:

Demographic characteristics of spotted owls in the Oregon Coast Ranges, 1990-2001.

2. Principal Investigator(s) and Organization(s):

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3. Study Objective(s):

Elucidate the population ecology of the spotted owl in the Oregon Coast Ranges, to include age and sex specific birth and death rates, and population trend estimates.

4. Potential Benefit or Utility of the Study:

Information on the demography of spotted owl populations is needed to estimate population trends and assess the effects of different management strategies on spotted owls. This study provides data that can be used to assess survival, reproduction and population trends of spotted owls relative to landscape features in the Oregon Coast Ranges.

5. Research Accomplishments for FY 01:

Study Area and Methods

The study area included a 578 km^2 Density Study Area (DSA) in which we tried to achieve a total population count in 8 of the 12 years of the study, and a General Study Area (GSA) in which we tried to band as many owls as possible, but did not try to achieve a total population estimate. The DSA included most of the north half of the Mapleton Ranger District and that portion of the Alsea Ranger District south of Township 14 South. The GSA encompassed the rest of the Siuslaw National Forest and adjacent Eugene and Salem BLM lands west of Interstate 5, south of State Highway 18, and north of or proximal to State Highway 126. Interspersed areas of state, municipal, and private lands were also included in the GSA.

The entire DSA was surveyed each year with the exception of 1994, 1997, 1999, and 2001 when only known historic sites were monitored. Protocol on the DSA and GSA required a minimum of 3 complete visits before concluding that an area was not occupied.

Number of Areas Where Owls Were Located

The effort to locate, band, and monitor owls in 1990-2001 consisted of a combination of our surveys and inventories conducted by personnel from the Siuslaw National Forest, Bureau of Land Management, and Oregon State University. Additional surveys were done on the DSA and GSA by private consulting firms and timber companies. If it met our protocol, the data from these efforts was combined with our data. In 2001 we conducted surveys at 204 historic owl territories. We detected 235 non-juvenile spotted owls at 132 sites, including 94 pairs, 35 single owls, and 6 sites where a male and female were detected but pair status was not determined (Fig 1). Three of the 35 single owls were extra birds located at sites that also had pairs or other owls of the same sex. We confirmed the production of 109 young.

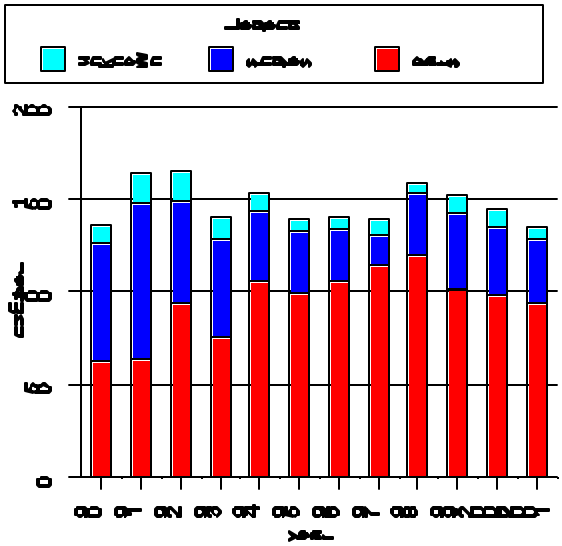

Figure 1. Number of sites occupied by pairs, singles or males and females of unknown status on the DSA and GSA on the Oregon Coast Ranges Study Area, 1990-2001.

Number of Owls Marked

We banded 104 spotted owls in 2001, including 1 adult male, 1 adult female, 3 subadult females, and 99 juveniles. We replaced color bands on 10 owls that were originally banded as juveniles.

Movements, Emigration and Immigration

We confirmed movement between sites by 35 owls in 2001, including 30 owls that moved between sites in the Coast Ranges Study Area and 5 owls that moved between the Coast Range Study Area and adjacent areas. Movements within our study area included 8 owls banded as juveniles and not observed since they were first banded, 1 owl last observed as a subadult, and 21 owls banded or last observed as adults.

In 2001 we confirmed 4 cases of emigration and 1 new immigrant into the study area. Emigrants included 3 owls originally banded as juveniles and 1 that was banded and last observed as an adult on the Oregon Coast Ranges Study Area. Two of the emigrants were relocated on Roseburg BLM and two were relocated on Eugene BLM lands. The immigrant was last observed as an adult at a location on private land.

Numbers of Owls Detected Within the Density Study Area

There were 40 non-juvenile owls detected on the Siuslaw DSA in 2001. The count ranged from 31 in 1995 to 53 in 1991. In 1994, 1997, 1999, and 2001 the survey effort on the DSA was reduced to include only those sites where occupancy had been established during previous years. Because of the reduced coverage we are only able to report a minimum count of adults and subadults on the DSA in those years. A large "floater" population and increased survey effort by Siuslaw National Forest personnel may have contributed to the relatively high owl counts during the first 3 years of the study. When the years of reduced survey coverage are excluded, counts of individuals on the DSA appear to indicate a decline between 1991 and 1995 and an increase between 1995 and 2001. In 2001 there were 14 pairs detected on the DSA. We also counted 12 single owls on the DSA. The single owls included 4 cases where a male and female were detected at the same site but pair status was undetermined. While the total number of adults and subadults on the DSA has fluctuated greatly with maximum and minimum estimates in 1991 and 1995, the number of pairs detected has remained relatively stable (Fig 2). Therefore, the large fluctuation in density area counts appears to be the result of fluctuations in the number of single owls rather than the number of resident pairs.

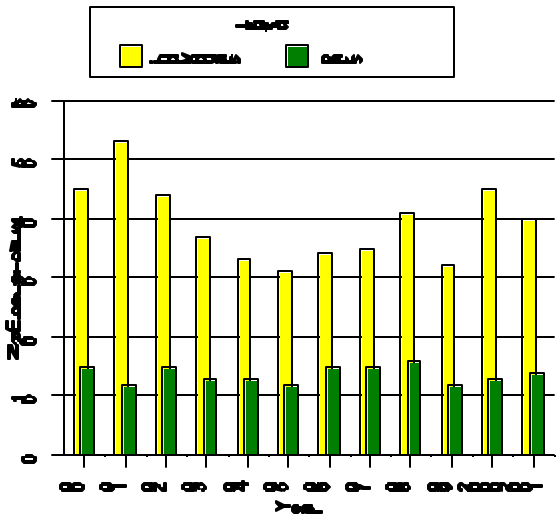

Figure 2. Number of individual and pairs of non-juvenile spotted owls on the DSA on the Oregon Coast Ranges Study Area, 1990-2001.

Sex Ratio of Adults and Subadults

The sex ratio of non-juvenile owls detected on the study area was weighted towards males in all years. The mean difference in the proportions of known sex owls detected was 0.10 with a maximum difference of 0.24 in 1991 and minimum of 0.02 in 1997. We suspect that the disproportionate number of males was due to sexual differences in detectability rather then real differences in numbers.

Survival Rates

Survival rates of color-marked owls were estimated using mark-recapture models in Program MARK. The model that provided the best fit to the data was one in which there were four age classes, juvenile survival was constant (mean = 0.37, SE = 0.038) and non-juvenile survival had a positive linear time

effect (symbolically denoted as {N(J.,[NJ+T]), p(a4', [NJ+T). Survival estimates for non-juveniles increased from 0.83 (SE = 0.022) to 0.93 (SE = 0.012) over the period of study.

Reproduction

Reproductive parameter estimates in 2001 were among the highest observed for all years of the study. Prior to 2001, reproductive estimates were observed to follow a consistent "even-odd pattern" with higher reproduction in even numbered years and lower estimates in odd years (Fig 3).

The estimate of proportion of females nesting in 2001 was 0.848, and varied among years, ranging from 0.154 in 1991 to 0.889 in 1990 (P^2=236.710, 11 df, P<0.001). The proportion of females nesting in 2001 was the second highest annual estimate and much higher then the mean of 0.502 for all years. Estimates of the proportion of females nesting may be slightly inflated, because of differences in detectability of nesting and non-nesting pairs.

The proportion of females fledging young in 2001 was 0.649 and was higher then all other years of the study. The proportion of females fledging young varied among years ranging from 0.086 in 1999 to 0.649 in 2001 (P^2=201.232, 11 df, P <0.001).

The proportion of nesting females that successfully fledged young in 2001 was 0.821 and was higher than all other years of the study. The 2001 estimate of nest success reflects 12 failures out of 67 nesting attempts. Nest success ranged from 0.500 in 1999 to 0.821 this year and did not vary among years (P^2=16.394, 11 df, P=0.127).

Estimated fecundity in 2001 was 0.000 for 1-2-yr-old females and 0.593 for >2-yr-old females. Estimated annual fecundity for all non-juvenile females was 0.569 and was the highest for all years of the study. Fecundity for non-juvenile females ranged from 0.062 in 1999 to 0.569 this year and varied among years (F=20.702, 11 df, P<0.001).

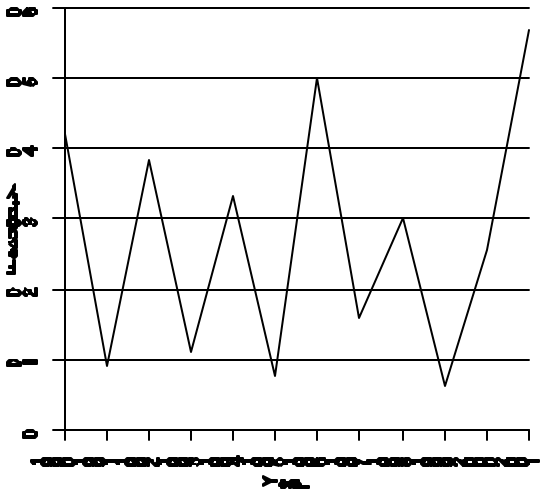

Figure 3. Estimated annual fecundity of female spotted owls on the Oregon Coast Ranges Study Area 1990-2001.

Mean brood size, defined as the number of young produced per female that nested and produced at least 1 young,

was 1.754 (SE = 0.060) in 2001 and was higher than all other years of the study. Among year variation in mean brood size ranged from 1.313 in 1990 to 1.754 this year (F=2.091, df=11, p=0.020).

6. Problems Encountered:

Road closures and a reduction in forest road maintenance have gradually restricted access and resulted in a considerable increase in number of areas that need to be accessed on foot. This increase in walking surveys has lead to increased survey times.

7. Research Plans for FY 02:

a. Continue demographic study, begin field work in March 2002.

b. Complete analysis of Oregon Coast Ranges Nest Tree data collected through 1997.

c. Collect GPS locations for historic spotted owl nests on the study area.

d. Discontinue survey of Density Study Area due to poor access and lack of adequate resources to completely survey the entire area.

8. Publications and Technology Transfer Activities:

a. Selected demographic data were shared as needed with various federal, state, and private organizations for their management activities.

b. Detailed summary information regarding survey results and site status determinations were provided to the biologists at the Siuslaw National Forest and the Eugene and Salem BLM Districts.

c. Continued to collaborate with John Perkins and Gail Olson on a study to describe spotted owl nest trees and local characteristics around nests in the Oregon Coast Range Mountains. Analysis is in progress.

d. Escorted Peter Annin and Andrew Weegar of the Institutes for Journalism and Natural Resources along with a group of their fellows to view spotted owls in the field. A diverse group of participants including university researchers, local timber industry representatives, and small private land owners were invited to take part in a discussion regarding forest management and spotted owl issues in the Northwest.

e. Loschl gave a presentation on spotted owls to a local cub scout den and Forsman gave a presentation on spotted owls and red tree voles to a 3rd grade class.

9. Duration of Study:

a. Initiated in FY 1990.

b. Contingent upon future funding. Currently funded through FY 2002.

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FY2001

February 2002

1. Title:

Demographic characteristics of spotted owls in the Oregon Coast Ranges, 2001.

The following pages include data tables not included in the 2001 Annual Report.

Table 1. Number of pairs and single spotted owls located on the 578 km^2 Density Study Area (DSA) and the General Study Area (GSA) on the Coast Ranges Study Area, Oregon: 1990-2001.

	Pair		Single[a]		Total adults/subadults		Total
Year	DSA	GSA	DSA	GSA	DSA	GSA	
1990	15	48	15	68	45	164	209
1991	12	52	29	87	53	191	243
1992	15	79	14	73	44	231	275
1993	13	63	11	64	37	190	227
1994	13	93	7	49	33	235	268
1995	12	87	7	39	31	213	244
1996	15	91	4	36	34	218	252
1997	15	100	5	27	35	227	262
1998	16	104	9	36	41	244	285
1999	12	90	8	51	32	231	263
2000	13	85	19	38	45	208	253
2001	14	80	12	35	40	195	235

[a] Defined as any owl that could not be confirmed as paired. This category included 3 spotted owls that were paired with barred or hybrid owls on the study area.

Table 2. Number of spotted owls banded on the Coast Ranges Study Area, Oregon: 1990-2001.

Year	Adults[a]		Subadults		Juveniles
	M	F	M	F	
1990	43	31	7	2	31
1991	28	24	2	4	7
1992	28	31	4	4	60
1993	6	8	2	0	13
1994	15	18	3	1	62
1995	5	8	1	2	13
1996	8	1	4	4	102
1997	3	8	5	0	36
1998	3	2	5	1	57
1999	2	5	1	1	10
2000	4	9	1	0	51
2001	1	1	0	3	99
Total	146	146	35	22	541

[a] M = male, F = female.

Table 3. Number of spotted owls detected on the 578 km² Density Study Area (DSA) and the General Study Area (GSA) on the Coast Ranges Study Area, Oregon: 1990-2001. M = male, F = female, U = unknown sex.

	Adult[a]		Subad.		Unknown age adult/subad.			Juv.	Non-juv. Count
Year	M	F	M	F	M	F	U		
DSA									
1990	16	10	5	2	5	4	3	9	45
1991	21	13	3	0	10	3	3	2	53
1992	15	17	1	0	6	2	3	12	44
1993	15	15	0	0	3	1	3	2	37
1994	14	14	2	0	1	1	1	12	33
1995	14	13	0	0	3	1	0	3	31
1996	12	15	4	1	2	0	0	14	34
1997	15	15	2	0	1	2	0	5	35
1998	16	15	3	1	5	1	0	8	41
1999	15	13	1	1	1	0	1	1	32
2000	20	11	2	3	5	3	1	3	45
2001	17	14	1	1	3	2	2	13	40
GSA									
1990	39	30	4	2	39	33	17	33	164
1991	62	49	6	3	41	21	9	8	191
1992	79	74	7	7	36	22	6	58	231
1993	70	64	5	0	32	17	2	12	190
1994	87	87	13	8	27	13	0	58	235
1995	98	85	3	4	15	6	2	12	213
1996	100	81	5	10	12	10	0	94	218
1997	101	97	8	6	7	7	1	32	227
1998	104	95	14	8	11	12	0	59	244
1999	105	93	2	3	14	9	5	12	231
2000	98	89	3	1	10	5	2	48	208
2001	90	73	2	3	14	12	1	96	195
COMBINED									
1990	55	40	9	4	44	37	20	42	209
1991	83	62	9	3	51	24	12	10	244
1992	94	91	8	7	42	24	9	70	275
1993	85	79	5	0	35	18	5	14	227
1994	101	101	15	8	28	14	1	70	268
1995	112	98	3	4	18	7	2	15	244
1996	112	96	9	11	14	10	0	108	252
1997	116	112	10	6	8	9	1	37	262
1998	120	110	17	9	16	13	0	67	285
1999	120	106	3	4	15	9	6	13	263
2000	118	100	5	4	15	8	3	51	253
2001	107	87	3	4	17	14	3	109	234

[a] M = male, F = female, U = unknown sex.
[b] Because of an incomplete survey effort on the DSA in 1994,1997, 1999, and 2001 this is a minimum count.

Table 4. Proportion of female spotted owls that nested on the Coast Ranges Study Area, Oregon: 1990-2001. Estimates were calculated for both paired and single females whose nesting status was determined by 1 June.

Year	No. of females by age class[a]			Proportion nesting					
				Adult		Subadult		Combined	
	A	S	U	Prop.	95% C.I.	Prop.	95% C.I.	Prop.	95% C.I.
1990	19	2	6	0.895	0.60-0.99	1.000	0.07-1.00	0.889	0.66-0.98
1991	38	1	0	0.158	0.05-0.33	0.000		0.154	0.05-0.32
1992	66	6	4	0.712	0.56-0.83	0.500	0.06-0.89	0.684	0.55-0.80
1993	69	0	1	0.232	0.12-0.36			0.229	0.12-0.36
1994	86	5	2	0.663	0.53-0.77	0.400	0.01-0.87	0.634	0.51-0.74
1995	86	3	0	0.163	0.08-0.27	0.000		0.157	0.08-0.26
1996	84	8	3	0.821	0.70-0.90	0.625	0.17-0.92	0.800	0.69-0.88
1997	100	6	0	0.420	0.31-0.53	0.000		0.396	0.29-0.51
1998	98	7	3	0.602	0.48-0.71	0.286	0.01-0.73	0.593	0.48-0.70
1999	91	2	1	0.176	0.09-0.28	0.000		0.170	0.09-0.27
2000	85	2	2	0.541	0.41-0.66	0.500	0.00-0.99	0.540	0.41-0.66
2001	75	2	2	0.867	0.75-0.94	0.000		0.848	0.73-0.92
Average				0.494	0.47-0.54	0.341	0.18-0.51	0.502	0.46-0.54

[a] A = adult, S = 1-2-year-old subadult, U = unknown age adult/subadult.

Table 5. Proportion of female spotted owls that fledged young on the Coast Ranges Study Area, Oregon: 1990-2001. Estimates were calculated for both paired and single females where number of young fledged was determined before 31 August.

Year	No. of females by age class[a]			Proportion of females fledging young					
				Adults		Subadults		Combined	
	A	S	U	Prop.	95% C.I.	Prop.	95% C.I.	Prop.	95% C.I.
1990	33	4	13	0.697	0.48-0.85	0.750	0.09-1.00	0.640	0.46-0.78
1991	53	2	1	0.132	0.04-0.27	0.000		0.125	0.04-0.25
1992	80	7	4	0.538	0.40-0.66	0.143	0.00-0.61	0.495	0.37-0.61
1993	71	0	2	0.113	0.04-0.22			0.123	0.05-0.23
1994	96	6	3	0.469	0.35-0.58	0.000		0.438	0.33-0.55
1995	93	3	1	0.097	0.04-0.19	0.000		0.093	0.04-0.18
1996	93	10	5	0.667	0.54-0.77	0.400	0.08-0.76	0.630	0.51-0.73
1997	110	6	0	0.246	0.16-0.35	0.000		0.233	0.15-0.33
1998	101	8	4	0.396	0.28-0.51	0.125	0.00-0.55	0.372	0.27-0.48
1999	101	2	2	0.079	0.03-0.16	0.000		0.086	0.03-0.17
2000	96	4	0	0.333	0.23-0.45	0.250	0.00-0.83	0.330	0.23-0.44
2001	86	4	4	0.674	0.55-0.78	0.000		0.649	0.53-0.75
Average				0.357	0.32-0.39	0.179	0.08-0.32	0.350	0.32-0.38

[a] A = adult, S = 1-2-year-old subadult, U = age unknown adult/subadult.

Table 6. Proportion of nesting female spotted owls that produced young on the Coast Ranges Study Area, Oregon: 1990-2001. Estimates were calculated for females whose nesting status was determined by 1 June.

Year	No. of females by age class[a]			Proportion of nesting females fledging young					
				Adult		Subadult		Combined	
	A	S	U	Prop.	95% C.I.	Prop.	95% C.I.	Prop.	95% C.I.
1990	16	2	5	0.813	0.48-0.96	1.00	0.07-1.00	0.739	0.47-0.90
1991	6	0	0	0.667	0.14-0.96			0.667	0.14-0.96
1992	47	3	2	0.830	0.66-0.93	0.333	0.00-0.92	0.789	0.62-0.90
1993	15	0	0	0.533	0.22-0.80			0.533	0.22-0.80
1994	57	2	0	0.737	0.58-0.85	0.000		0.712	0.55-0.83
1995	14	0	0	0.643	0.29-0.88			0.643	0.29-0.88
1996	69	5	2	0.783	0.64-0.88	0.600	0.07-0.95	0.763	0.63-0.86
1997	42	0	0	0.619	0.43-0.78			0.619	0.43-0.78
1998	59	2	3	0.678	0.52-0.80	0.500	0.00-0.99	0.641	0.49-0.77
1999	16	0	0	0.500	0.20-0.77			0.500	0.20-0.77
2000	46	1	0	0.652	0.47-0.80	1.00	0.00-1.00	0.660	0.48-0.80
2001	65	0	2	0.831	0.69-0.92			0.821	0.68-0.91
Average				0.724	0.67-0.77	0.533	0.22-0.80	0.707	0.66-0.75

[a] A = adult, S = 1-2-year-old subadult, U = unknown age adult/subadult.

Table 7. Estimated fecundity ($\hat{\$}$) of female spotted owls on the Coast Ranges Study Area, Oregon: 1990-2001. Fecundity was defined as the number of female young produced per female, assuming a 1:1 sex ratio of offspring. Estimates were calculated for individual females for which the number of young fledged was determined before 31 August.

Year	No. of females by age class[a]			Fecundity					
				Adults		Subadults		Combined	
	A	S	U	$\hat{\$}_A$	SE	$\hat{\$}_S$	SE	$\hat{\$}$	SE
1990	33	4	13	0.470	0.065	0.375	0.125	0.420	0.052
1991	53	2	1	0.094	0.036	0.000	0.000	0.089	0.034
1992	80	7	4	0.419	0.048	0.143	0.143	0.385	0.045
1993	71	0	2	0.085	0.030			0.096	0.032
1994	96	6	3	0.359	0.043	0.000	0.000	0.333	0.040
1995	93	3	1	0.081	0.027	0.000	0.000	0.077	0.026
1996	93	10	5	0.522	0.044	0.350	0.150	0.500	0.042
1997	110	6	0	0.168	0.030	0.000	0.000	0.159	0.029
1998	101	8	4	0.312	0.042	0.125	0.125	0.296	0.040
1999	101	2	2	0.059	0.021	0.000	0.000	0.062	0.021
2000	96	4	0	0.260	0.041	0.125	0.125	0.255	0.039
2001	86	4	4	0.593	0.049	0.000	0.000	0.569	0.048
Average				0.279	0.013	0.134	0.041	0.273	0.012

[a] A = adult, S = 1-2-year-old subadult, U = age unknown adult/subadult.

Table 8. Mean brood size of female spotted owls on the Coast Ranges Study Area, Oregon: 1990-2001. Estimates were calculated for all females for which the number of young fledged was determined before 31 August.

Year	No. of females by age class[a]			Mean brood size[b]					
				Adults		Subadults		Combined	
	A	S	U	x̄	SE	x̄	SE	x̄	SE
1990	23	3	6	1.348	0.102	1.000	0.000	1.313	0.083
1991	7	0	0	1.429	0.202			1.429	0.202
1992	43	1	1	1.558	0.077	2.00		1.556	0.075
1993	8	0	1	1.500	0.189			1.556	0.176
1994	45	0	1	1.533	0.075			1.522	0.074
1995	9	0	0	1.667	0.167			1.667	0.167
1996	62	4	2	1.565	0.063	1.750	0.250	1.588	0.060
1997	27	0	0	1.370	0.095			1.370	0.095
1998	40	1	1	1.575	0.087	2.000		1.595	0.084
1999	8	0	1	1.500	0.189			1.444	0.176
2000	32	1	0	1.563	0.089	1.000		1.545	0.088
2001	58	0	3	1.759	0.062			1.754	0.060
Average				1.561	0.027	1.500	0.167	1.557	0.026

[a]A = adult, S = 1-2-year-old subadult, U = age unknown adult/subadult.

[b]Mean brood size was defined as the number of young produced per female that nested and produced at least one young.