

**WILDLIFE HABITAT RELATIONSHIPS
IN WASHINGTON AND OREGON
FY2002**

1. Title: **December 2002**

Demographic characteristics of northern spotted owls (*Strix occidentalis*) on the Tye Study Area, Roseburg, Oregon: 1985-2002.

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

Dr. E.D. Forsman (PI), Lead Biologist: J. A. Reid, Pacific Northwest Research Station Biologists: S. A. Graham, J. S. Mowdy, A. L. Price.

3. Study Objectives:

- a. Elucidate the population ecology of the spotted owl on the Tye Study Area, northwest of Roseburg, Oregon, to include estimates of population age structure, reproductive rates, survival rates, and population trends.
- b. Document trends in numbers of spotted owls in a bounded study area.
- c. Document social integration of juveniles into the territorial population, to include age at pair formation and age at first breeding.

4. Potential Benefit or Utility of the Study:

The Tye Demographic Study on the Roseburg District was designed to monitor age-specific birth and death rates of spotted owls, thereby allowing estimates of population trend over time. From these trends we make inferences regarding the suitability of the current habitat conditions and the effects of different landscape conditions on spotted owls. This study is one of eight long-term demographic studies that constitute the federal monitoring program for the Northern Spotted Owl.

Management of forest lands by the BLM and private landowners within the boundaries of the Tye Study Area has led to a reduction of suitable owl habitat during the last 40-50 years (Thomas et al. 1993). Even though rates of harvest on BLM lands have declined since 1990, habitat conditions are still changing fairly rapidly in the study area, particularly on private lands. While the data collected during this study cannot be used to accurately predict future conditions, they can be used to assess predictive models that examine population projections under varying landscape conditions or management regimes (Anthony et al. 2000).

We have attempted to band all known fledglings produced in the study area since 1985. As a result, we know the origin and age of most individuals that are recruited into the population, and have detailed information on population age structure and internal and external recruitment in the

study area.

5. Research Accomplishments:

Study Area and Methods

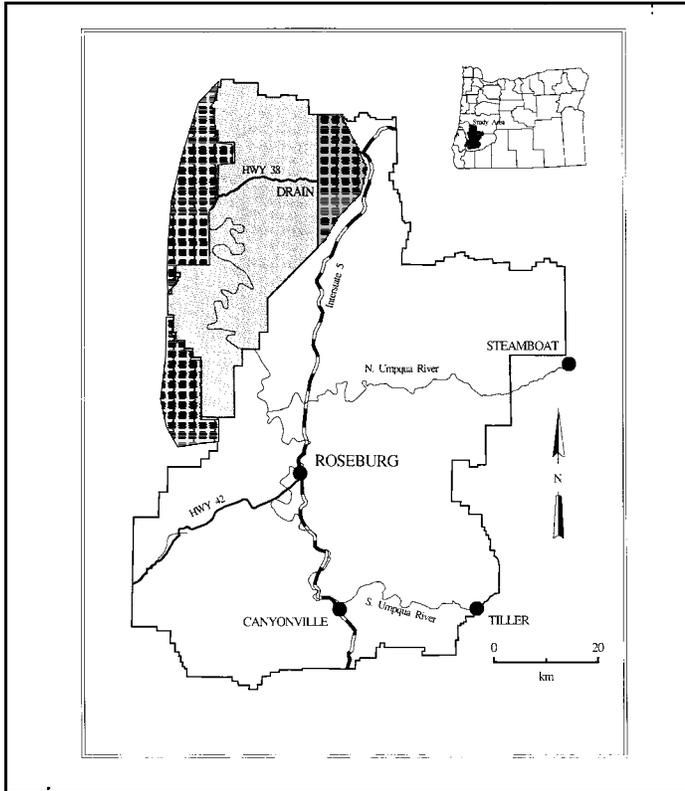


Fig 1. Tye Study Area, Roseburg, Oregon. The shaded area represents the density study area (DSA). Areas indicated by the dark grid indicate areas outside the DSA.

The Tye Study Area includes a 1025 km² Density Study Area (DSA) northwest of Roseburg, Oregon, plus adjacent areas on the Coos Bay and Roseburg BLM Districts within 6 miles of the western and eastern boundaries of the DSA (Fig. 1). The study area includes all or part of 4 Late-Successional Reserves (LSR's) as identified in the Northwest Forest Plan land-use allocations (USDA and USDI, 1994). Total size of the study area including the buffer area is approximately 1490 km². The 6 mile "buffer" around the DSA is intended to reduce the potential effects of non-juvenile emigration on estimates of adult survival in the DSA (Reid et al. 1996).

The DSA is subjected to a complete survey each year, allowing an estimate of the actual number of territorial birds. In contrast, surveys in the buffer area are primarily limited to historical sites where owls have been banded in previous years.

reproductive parameters were described in Lint et al. (1999). Resightings and recaptures of previously banded owls are used to estimate survival rates (Pollock et al. 1990, Burnham et al. 1996).

Methods used in this study and other demographic studies of spotted owls have been described in a variety of published sources (e.g., Forsman 1983, Franklin et al. 1990, Franklin 1992, Franklin et al. 1999). Protocols used for determination of

Numbers of owls on the Tye Study Area

Between March 1983 and October 2002, we banded 924 spotted owls on the Tye Study Area, including 232 adults, 82 subadults, and 610 young of the year. The sex ratio of > 2-yr-old owls in the banded sample was slightly skewed towards males. By comparison, the sex ratio of subadults was approximately 1:1 (Appendix 1). The disproportionate number of males in the adult sample is most likely because males, especially unpaired males, are more detectable than females (Reid et al. 1999).

In 2002, we documented 146 non-juvenile owls in the DSA, including 64 pairs and 18 other

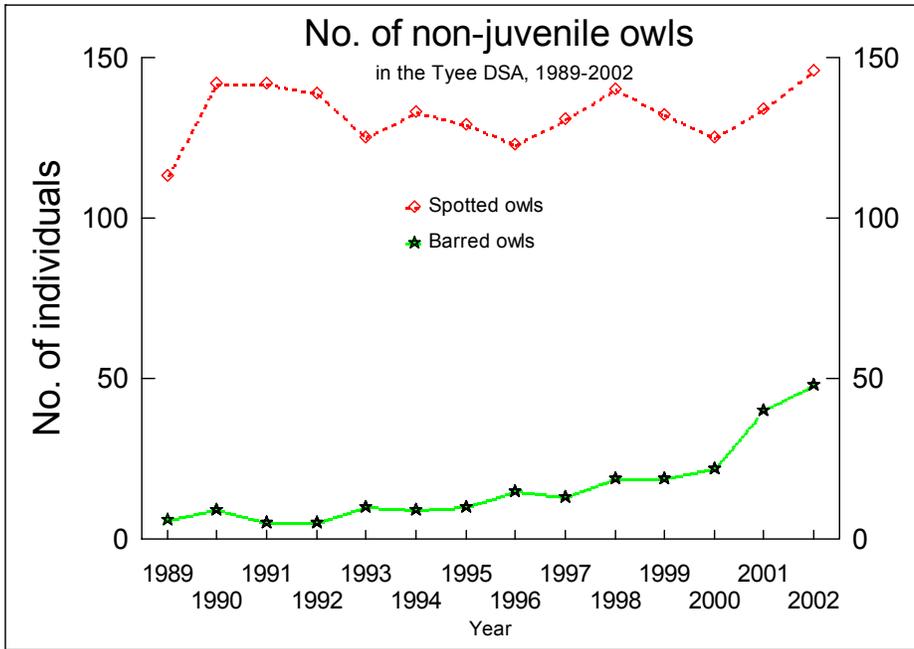


Fig. 2. Number of non-juvenile spotted owls and barred owls on the Tye DSA, Roseburg, Oregon, 1990-2002.

individual owls. These counts were the highest on record since the study was initiated in 1985 (Fig. 2, Appendix 2). The increase in numbers appeared to be due primarily to an increase in the subadult population, resulting from high reproduction in 2001 (Fig. 4, Appendix 2). The number of subadults detected in the DSA doubled from 2001 to 2002, largely due to recruitment of 1-yr-old owls (Appendix 2). The number of barred owls detected in the DSA also continued to increase in 2002 (Fig. 2).

Estimated average age of territorial individuals detected in 2002 was 8.82 ± 0.60 years for females and 7.04 ± 0.43 years for males (Fig. 3). We documented 51 movements of individuals within the Tye Study Area in 2001-2002. Of the owls that moved, 29 were banded as juveniles and had not been previously documented in the territorial population (new recruits).

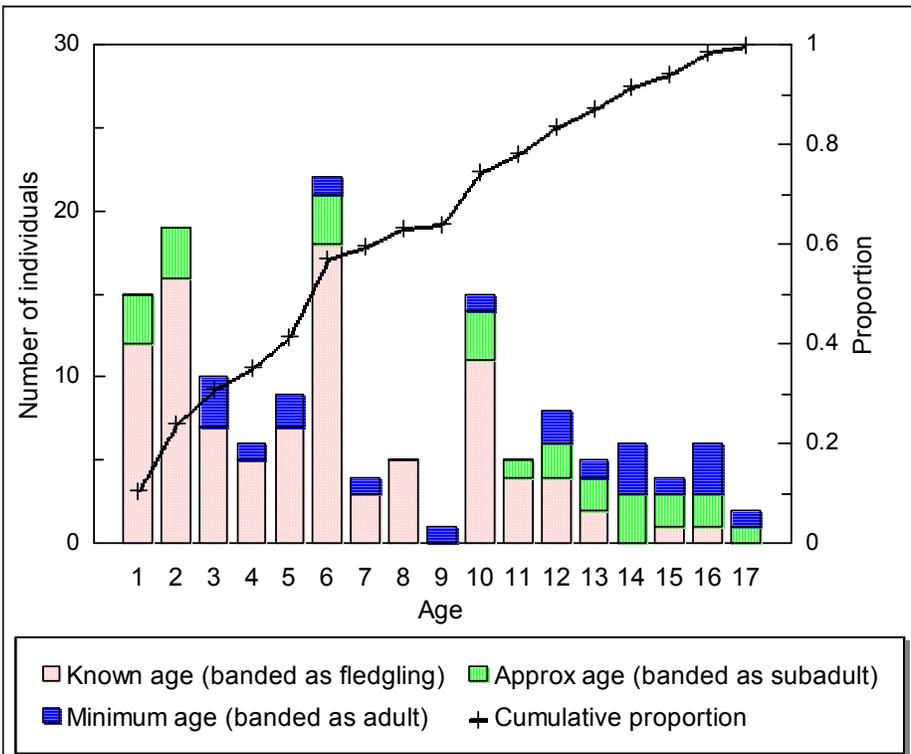


Fig. 3. Age distribution of spotted owls in the Tye DSA, Roseburg, Oregon, 2002. Numbers and cumulative proportion in population.

Average age at pair formation was 2.40 ± 0.11 years for males and 1.88 ± 0.10 years for females. Average age at first nesting was 3.88 ± 0.16 years for males and 3.4 ± 0.16 years for females.

The largest age classes on the Tye DSA study area were 1-, 6-, and 10- yr-old owls from the high reproductive years of 2001, 1996, and 1992, respectively (Fig. 3). In recent years (1998-2002), less than 27% of the new individuals recruited into the resident population have been unbanded (Appendix 1).

Reproduction

2002 was an average nesting year,

with 58% of females nesting, and 37% of females fledging young (Table 2). For all years combined, the percentage of females that nested each year averaged 56%, and the percentage of females that fledged young averaged 38% (Table 2).

Table 2. Proportion of female spotted owls that nested, fledged young, and nested and fledged young, Tyee Study Area, Roseburg, Oregon: 1985-2002.

Year	Proportion nesting ¹			Proportion fledging young ²			Proportion nesting that fledged ³		
	N	Prop.	95% C.I.	N	Prop.	95% C.I.	N	Prop.	95% C.I.
1985	11	0.182	0.00-0.45	15	0.067	0.00-0.21	2	0.000	0.00-1.00
1986	18	0.833	0.64-1.00	22	0.682	0.47-0.89	15	0.733	0.48-0.99
1987	8	0.500	0.00-0.95	10	0.400	0.03-0.77	4	0.750	0.00-1.00
1988	18	0.389	0.14-0.64	25	0.200	0.03-0.37	7	0.429	0.00-0.92
1989	21	0.762	0.56-0.96	32	0.469	0.29-0.65	16	0.625	0.36-0.89
1990	63	0.730	0.62-0.84	76	0.487	0.37-0.60	46	0.696	0.56-0.83
1991	68	0.426	0.31-0.55	75	0.253	0.15-0.34	29	0.586	0.40-0.78
1992	74	0.568	0.45-0.68	80	0.475	0.36-0.59	42	0.833	0.72-0.95
1993	64	0.250	0.14-0.36	72	0.111	0.04-0.19	16	0.438	0.16-0.71
1994	72	0.556	0.44-0.67	75	0.387	0.27-0.50	40	0.700	0.55-0.85
1995	63	0.365	0.24-0.49	72	0.208	0.11-0.30	23	0.522	0.30-0.74
1996	61	0.820	0.72-0.92	70	0.629	0.51-0.74	50	0.800	0.69-0.91
1997	61	0.574	0.45-0.70	66	0.348	0.23-0.47	35	0.657	0.49-0.82
1998	70	0.557	0.44-0.68	77	0.416	0.30-0.53	39	0.744	0.60-0.89
1999	53	0.472	0.33-0.61	66	0.273	0.16-0.38	25	0.680	0.48-0.88
2000	62	0.484	0.36-0.61	67	0.313	0.20-0.43	30	0.633	0.45-0.82
2001	68	0.824	0.73-0.92	72	0.639	0.53-0.75	56	0.946	0.61-1.00
2002	71	0.577	0.46-0.70	80	0.375	0.27-0.48	41	0.659	0.51-0.81
Total	926	0.557	0.53-0.59	1052	0.380	0.35-0.41	516	0.707	0.66-0.76

¹ Estimates were calculated for females whose nesting status was determined by 1 June.

² Estimates were calculated for females whose reproductive status was determined by 31 August.

³ Estimates were calculated for females whose nesting status was determined by 1 June and reproductive status by 31 August.

Average female fecundity (the estimated number of female offspring produced per resident female) in 2002 was 0.313, and the overall average for 1985-2002 was 0.301 (Figure 4, Appendix 2). Mean brood size (number of young produced per female that successfully fledged young) was 1.7 in 2002, and 1.6 for all years combined (Appendix 3). Nesting success, which we defined as the proportion of nesting females that fledged young, averaged 0.707 for 1985-2002 (Table 2). When combined with data from previous years, the data continue to indicate that most measures of reproductive performance of spotted owls are lowest for 1-yr-old owls, intermediate for 2-yr-old owls, and highest for adults (Tables 3-4). Regression of fecundity on female age suggested a non-linear relationship in which annual fecundity increased rapidly during the first 2-3 years of life, and then increased more gradually thereafter (Fig. 4; $r^2 = 0.914$, 11df, $P < 0.0001$). The high among-year variation in reproductive rates that we observed (Fig. 5) is typical of spotted owls

(Forsman et al. 1984, Franklin et al. 1999). However, in contrast to some other study areas, high and low reproductive years on the Tyee Study Area did not consistently follow an alternate year pattern (Fig. 5). For example, there were 4 consecutive below average years of fecundity from 1997-2000, followed by a year of the highest fecundity documented in the study area (Figure 5, Appendix 3).

Table 3. Average reproductive parameters of female spotted owls on the Tyee Study Area, Roseburg, Oregon: 1985-2002.

Age	Proportion nesting ¹			Proportion fledging young ²			Proportion nesting that fledged young ³		
	N	Prop.	95% C.I.	N	Prop.	95% C.I.	N	Prop.	95% C.I.
1 st yr subadult	51	0.137	0.00-0.24	63	0.060	0.00-0.13	7	0.571	0.01-1.00
2 nd yr subadult	65	0.415	0.29-0.54	74	0.230	0.13-0.33	27	0.593	0.39-0.79
Adult	797	0.595	0.56-0.63	882	0.414	0.38-0.45	474	0.724	0.67-0.78
Unknown	13	0.615	0.31-0.92	33	0.424	0.25-0.60	8	0.250	0.00-0.64

¹ Estimates were calculated for females whose nesting status was determined by 1 June.

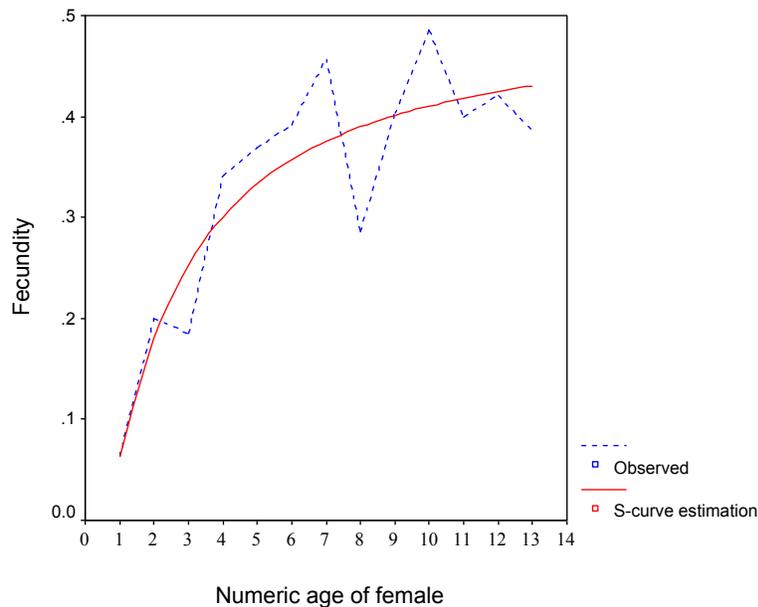
² Estimates were calculated for females whose reproductive status was determined by 31 August.

³ Estimates were calculated for females whose nesting status was determined by 1 June and reproductive status by 31 August.

Table 4. Average fecundity and brood size of female spotted owls on the Tyee Study Area, Roseburg, Oregon: 1985-2002.

Age	Fecundity ⁴			Mean brood size		
	N	Mean	SE	N	Mean	SE
1 st yr subadult	63	0.063	0.031	4		
2 nd yr subadult	74	0.203	0.045	17	1.765	0.106
Adult	882	0.328	0.014	365	1.584	0.026
Unknown	33	0.258	0.058	14	1.214	0.114

⁴ Fecundity is defined as number of female young produced per female.



Other Findings in 2002

This year we documented a case of inbreeding between two siblings that were produced in different years by the same pair of owls. The male sibling was from the 1997 cohort and the female was from the 1999 cohort. Inbreeding between more distant relatives is fairly common on our study area, but close inbreeding between siblings or parents and offspring is rare.

Fig. 4. Annual fecundity of female spotted owls relative to female age on the Tyee Study Area, Roseburg, OR, 1985-2002.

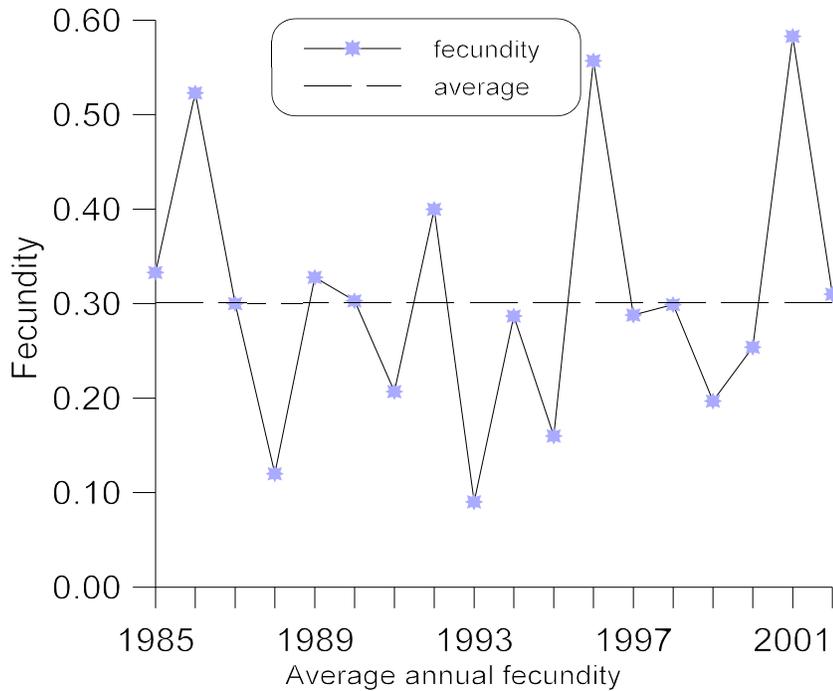


Fig. 5. Average annual fecundity on the Tyee Study Area, Roseburg, Oregon, 1985-2002.

6. Discussion

Based on the count of owls and owl territories detected in the DSA, it appears that the spotted owl population on the DSA was relatively stable in 1985-2002. Franklin et al. (1999) reach a similar conclusion based on an analysis of survival and reproductive rates of owls on the Tyee (Roseburg) Study Area in 1985-1998. To date, there is little evidence that the increasing presence of barred owls on the study area is causing the spotted owl population to decline. However, we have witnessed some cases where spotted owls have been displaced by barred owls.

7. Publications and Presentations:

- a. Lint, J. 2002. Northern spotted owl effectiveness monitoring, Northwest Forest Plan, 2001 Annual Summary Report.
- b. USDA, Forest Service, Pacific Northwest Region. Interagency Regional Monitoring, Annual Report, 2001. R6-NWFP-TP-08-02. July 2002.
- c. Forsman, E. D., R. G. Anthony, J. A. Reid, P. J. Loschl, S. G. Sovern, M. Taylor, B. L. Biswell, A. Ellingson, E. C. Meslow, G.S. Miller, K. A. Swingle, J. A. Thraikill, F. Wagner, and D. E. Seaman. 2002. Natal and breeding dispersal of northern spotted owls. Wildlife Monographs No. 149.
- d. Provided technical advice and field presentation for lead on the Quality Assurance and Data Management team.
- e. We provided information to many different private and state organizations for their management purposes.
- f. Presentation on *Demographic Performance of Spotted Owls in Relation to Landscape Patterns* was given to representatives of the 3 major timber companies which own land within the study area.
- g. Provided information and a field tour to Ron Gaines, Environmental Services Northwest, the biological consultant for Lone Rock Timber Company.
- h. We gave field tours and provided historical spotted owl data to Starfire Lumber Company and their consultants, BIS and Mickey Bellman, for owl sites on their land and adjacent federal land. Data included demographic survey information as well as radio-telemetry data. We also provided literature on spotted owls and cruising string.
- i. We provided survey information to the Eugene District and Coos Bay District of the BLM of the sites that we surveyed in their district. We provided site and summary information to the Oregon State Office of the BLM for the Coos Bay and Roseburg Districts.
- k. USDI, Bureau of Land Management. 2002. *Upper Umpqua Watershed Analysis*. Roseburg District Office, 777 NW Garden Valley Blvd. Roseburg, Oregon 97470.
- l. Hart, Emily. 2001. *The God Squad and the case of the northern spotted owl*. A documentary film. 15A Orchard Hill Road, Woodside, CA 94062
- a. Preparation of manuscript for publication on *Demographic Performance of Spotted Owls in Relation to Landscape Patterns*.

8. Acknowledgments

This study was funded by the USDI Bureau of Land Management and the USDA Forest Service, Pacific Northwest Forestry Sciences Lab. The Roseburg District of the BLM provided invaluable support in all phases of the research. We would like to thank the Weyerhaeuser Company, Roseburg Resources, Juniper Properties, Seneca Timber Company, and Starfire Lumber for

allowing us access to their lands. The consultants *Biota Pacific, Environmental Services, Northwest, Willamette Industries* and ABR provided spotted owl visit information to us.

9. Literature Cited:

- Anthony, R., G. Olson, E. Forsman, J. Reid, P. Loschl, W. Ripple, E. Glenn, and K. Harkins. 2000. Predicting Abundance and Demographic Performance of Northern Spotted Owls from Vegetative Characteristics. Report on Phase I: Evaluation of Different Methods for Habitat Mapping. 100pp.
- Burnham, K.P., D.R. Anderson, and G.C. White. 1996. Meta-Analysis of vital rates of the northern spotted owl. *Studies in Avian Biology* 17:92-101.
- Forsman, E. D., E. C. Meslow, and H. M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. *Wildlife Monographs* No. 87.
- Forsman, E. D. 1983. Methods and materials for locating and studying spotted owl. USDA For. Serv. Gen. Tech. Rept. PNW-162.
- Franklin, A. B., J. P. Ward, R. J. Gutiérrez, and G. I. Gould. 1990. Density of northern spotted owls in northwest California. *J. Wildl. Manage.* 54:1-10.
- Franklin, A. B. 1992. Population regulation in northern spotted owls: theoretical implications for management. Pages 815-827 in D. R. McCullough and R. H. Barrett, eds. *Wildlife 2001: populations*. Elsevier applied sciences, London. 1163pp.
- Franklin, A. B., K. P. Burnham, G. C. White, R. G. Anthony, E. D. Forsman, C. Schwarz, J. D. Nichols, and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. 71 pp.
- Lint, J.B., B.R. Noon, R.G. Anthony, E.D. Forsman, M.G. Raphael, M. I. Collopy and E.E. Starkey. 1999. Northern spotted owl effectiveness monitoring plan for the Northwest Forest Plan. U.S. Department of Agriculture - Forest Service. Gen. Tech. Rpt. PNW-GTR-444. 43pp.
- Pollock, K. H., J. D. Nichols, C. Brownie, and J. E. Hines. 1990. Statistical inference for capture-recapture experiments. *Wildl. Soc. Monograph* No. 107. 97pp.
- Reid, J. A., E. D. Forsman, and J. L. Lint. 1996. Demography of northern spotted owls on the Roseburg District of the Bureau of Land Management, Oregon. Pp. 59-66 In Forsman, E. D., S. DeStefano, M. G. Raphael, and R. J. Gutiérrez [eds.], *Demography of the northern Spotted owl*. *Studies in Avian Biology* No 17.
- Reid, J. A., R. B. Horn and E. D. Forsman. 1999. Detection rates of spotted owls based on acoustic-lure and live-lure surveys. *Wildl. Soc. Bull.* 27(4):986-990.
- Thomas, J. W., M. G. Raphael, R. G. Anthony, E. D. Forsman, A. G. Gunderson, R. S. Holthausen, B. G. Marcot, G. H. Reeves, J. R. Sedell, and D. M. Solis. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth

forests of the Pacific Northwest. The report of the scientific analysis team. USDA Forest Service, Portland, OR. 530pp.

USDA and USDI. 1994. Final supplemental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. 2 volumes. U. S. Department of Agriculture - Forest Service and U.S. Department of Interior - Bureau of Land Management, Portland, Oregon, USA.

Appendix 1. Number of spotted owls banded, Tye Study Area, Roseburg, Oregon: 1983-2002.

Year	Adults		Subadults		Fledglings
	Male	Female	Male	Female	
1983					2
1984	2	1		1	2
1985	13	13			1
1986	14	9			20
1987	11	9	2	3	10
1988	16	15	8	5	8
1989	18	8	3	2	22
1990	24	16	6	9	40
1991	8	9	6	3	28
1992	5	9	2	4	60
1993	2	4	1	2	13
1994	2	2	3	2	38
1995	1	1	0	1	21
1996	2	1	0	0	70
1997	1	0	0	0	33
1998	1	1	1	2	42
1999	1	3	2	1	33
2000	1	2	1	0	34
2001	3	1	2	3	82
2002	2	1	2	5	51
Total	127	105	39	43	610

Appendix 2. Number of spotted owls detected within the Tye Density Study Area (DSA), Roseburg, Oregon: 1987-2002.

Year	Pairs	<u>>2yr-old</u>		<u>1- 2-yr-old</u>		<u>Age Unknown</u>		Fledglings	Non-juveniles detected
		M	F	M	F	M	F		
1987	27	25	20	2	3	6	4	10	60
1988	37	30	28	10	7	6	3	6	84
1989	47	46	39	4	2	11	11	23	113
1990	58	61	49	7	10	7	8	34	142
1991	55	60	51	12	6	7	6	26	142
1992	57	60	52	10	8	4	5	48	139
1993	54	56	44	8	9	4	4	11	125
1994	59	60	51	10	9	1	2	33	133
1995	55	63	54	1	3	2	6	18	129
1996	53	56	51	5	5	4	2	60	123
1997	53	57	49	14	6	4	1	29	131
1998	60	53	46	18	14	5	4	38	140
1999	51	58	50	8	4	9	3	29	132
2000	52	57	53	5	2	5	3	28	125
2001	58	61	51	9	8	1	3	67	135
2002	64	60	48	17	17	3	1	67	146

M=Males, F=Females

Appendix 3. Estimated fecundity (**b**) and mean brood size of female spotted owls on the Tyee Study Area: 1985-2002. Fecundity defined as the number of female young produced per female owl. Estimates were calculated for individual females for which reproductive output was documented by 31 August.

Year	Fecundity			Mean brood size		
	N	Mean	SE	N	Mean	SE
1985	15	0.033	0.033	1		
1986	22	0.523	0.090	15	1.533	0.133
1987	10	0.300	0.133	4	1.500	0.289
1988	25	0.120	0.052	5	1.200	0.200
1989	32	0.328	0.070	15	1.400	0.131
1990	76	0.303	0.040	37	1.243	0.072
1991	75	0.207	0.044	19	1.667	0.114
1992	80	0.400	0.051	38	1.684	0.076
1993	72	0.090	0.032	8	1.625	0.183
1994	75	0.287	0.046	29	1.483	0.094
1995	72	0.160	0.039	15	1.533	0.133
1996	70	0.557	0.055	44	1.773	0.064
1997	66	0.288	0.052	23	1.652	0.102
1998	77	0.299	0.045	32	1.438	0.089
1999	66	0.197	0.043	18	1.444	0.121
2000	67	0.254	0.049	21	1.619	0.109
2001	72	0.583	0.056	46	1.809	0.064
2002	80	0.313	0.048	30	1.667	0.088
Total	1052	0.301	0.013	400	1.583	0.025