

**WILDLIFE ECOLOGY TEAM
WILDLIFE HABITAT
RELATIONSHIPS
IN WASHINGTON AND OREGON
FISCAL YEAR 2008.**



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Study

Demography of Spotted Owls on the east slope of the Cascade Range, Washington, 1989-2008

Researchers

Dr. E.D. Forsman (PI). Lead Biologist: S. Sovern, Oregon State University, Corvallis, Oregon. Biologists M. Taylor, Oregon State University, Corvallis, Oregon; Joan StHilaire Dale Phipps, USDA Forest Service. Cooperators: Plum Creek Timber Company, Boise Cascade Corporation, American Forest Resources L.L.C., Washington State Department of Natural Resources.

Status

This study is one of eight long-term demographic studies in the Regional Monitoring Program for the Northern Spotted Owl (Lint et al. 1999). The study was initiated in 1989.

Study objectives

Determine demographic trends of Spotted Owls on the east slope of the Cascade Range in Washington, to include age-and-sex-specific survival rates, reproductive rates, and overall population trend.

Potential benefit of the study

This study was designed to collect long-term information on survival and reproductive rates of Spotted Owls on the east slope of the Cascade Mountains in Washington. This information is needed to assess the status of the owl population in this province. In combination with data from other study areas in Washington and Oregon, information from the Cle Elum Study Area is used to assess region-wide trends in the Spotted Owl population (Forsman et al. 1996, Franklin et al. 1999, Lint et al. 1999, Anthony et al., 2006).

Study Area and Methods

The Cle Elum Study Area includes a 1,787 km² General Study Area (GSA), and a 204 km² Density Study Area (DSA) that is contained within the GSA (Figure 2). The U. S. Forest Service administers approximately 60% of the area within the GSA. The GSA and DSA are composed of 34 % and 88 % designated Late Successional Reserves (LSR), respectively. These LSR's were allocated by the Northwest Forest Plan to benefit species associated with late successional forest (USDA and USDI 1994).

Within the GSA we survey all historic owl territories each year to locate and confirm previously banded owls, determine the number of young produced at each territory, and band new owls (Forsman 1983, Franklin, et al., 1996, Lint et al., 1999). We conduct a complete survey of the DSA each year in order to estimate the number of resident owls within the area. On both areas we use standard protocols to confirm bands of owls that are relocated and we band all new owls with a numbered USFWS band and a uniquely colored plastic leg band (Figure 1).



Figure 1. Adult spotted owl with yellow and black leg band

In 2005 and 2006, we collected blood samples for future genetic study, and to determine the sex of juvenile owls. We also collected oral swabs from most owls we captured to test for the presence of [West Nile Virus](#). West Nile Virus has been identified as a potentially significant source of mortality among Spotted Owls (Courtney et al. 2004). None of the samples we submitted tested positive for the presence of West Nile Virus. In neighboring Yakima County, 13 cases of West Nile Virus were documented in horses, 3 in birds, and 17 in mosquito samples in 2008.

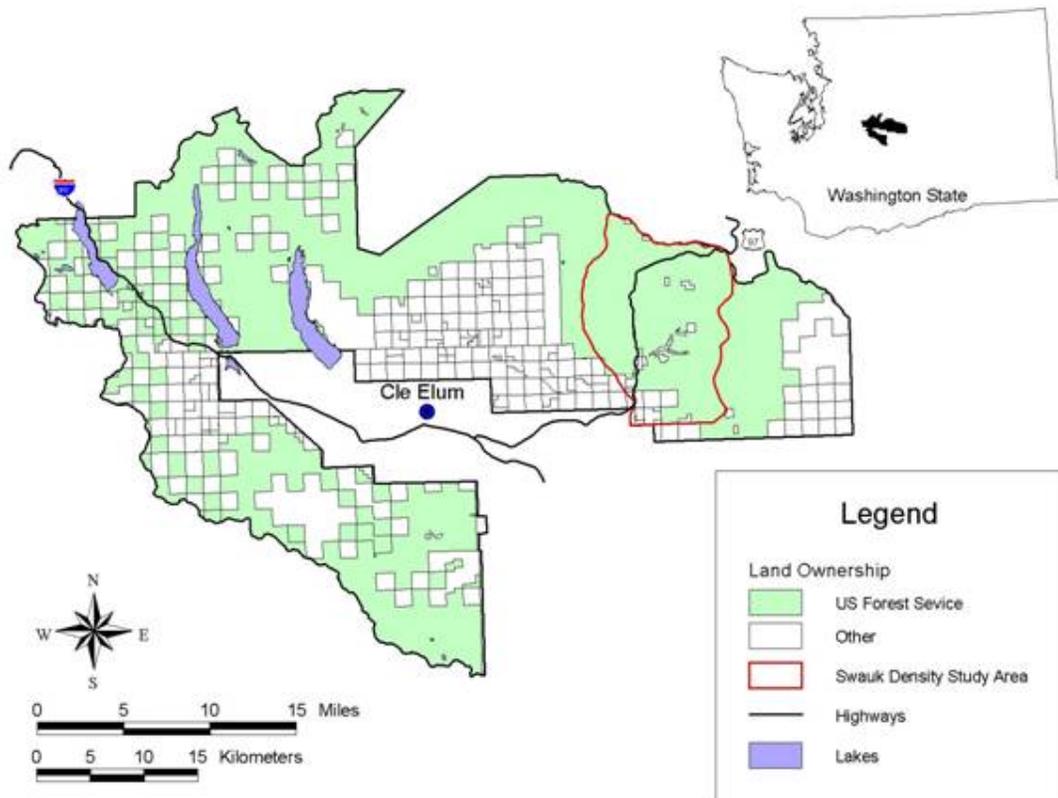


Figure 2. The Cle Elum Study Area, Washington.

RESULTS

Population Trends

General Study Area

We banded 9 juvenile owls and 1 subadult in 2008 bringing the total number of owls banded during 1989-2008 to 801 (66 subadults, 156 adults, 579 juveniles Table 1).

Our monitoring effort has remained relatively consistent after 1992, except for 8-10 territories we began monitoring with only 1 visit per year beginning in 2002. None of these “minimum-protocol” territories were occupied in 2008. In 2008, we confirmed the bands of 24 owls and detected another 12 owls on 26 occupied territories. This compares to a high of 120 owls on 64 territories in the same area in 1992 (Figure 3, Table 2).

We have noted a decline of approximately 70 % in the number of owls detected on the study area since 1992. The rate of population change (λ) calculated by Anthony et al. (2006) for the Cle Elum Study Area for 1989-2003 was 0.938 (SE = 0.019), indicating a population decline of 6.2% per year (95% CI = 2.5 – 10.0% decline).

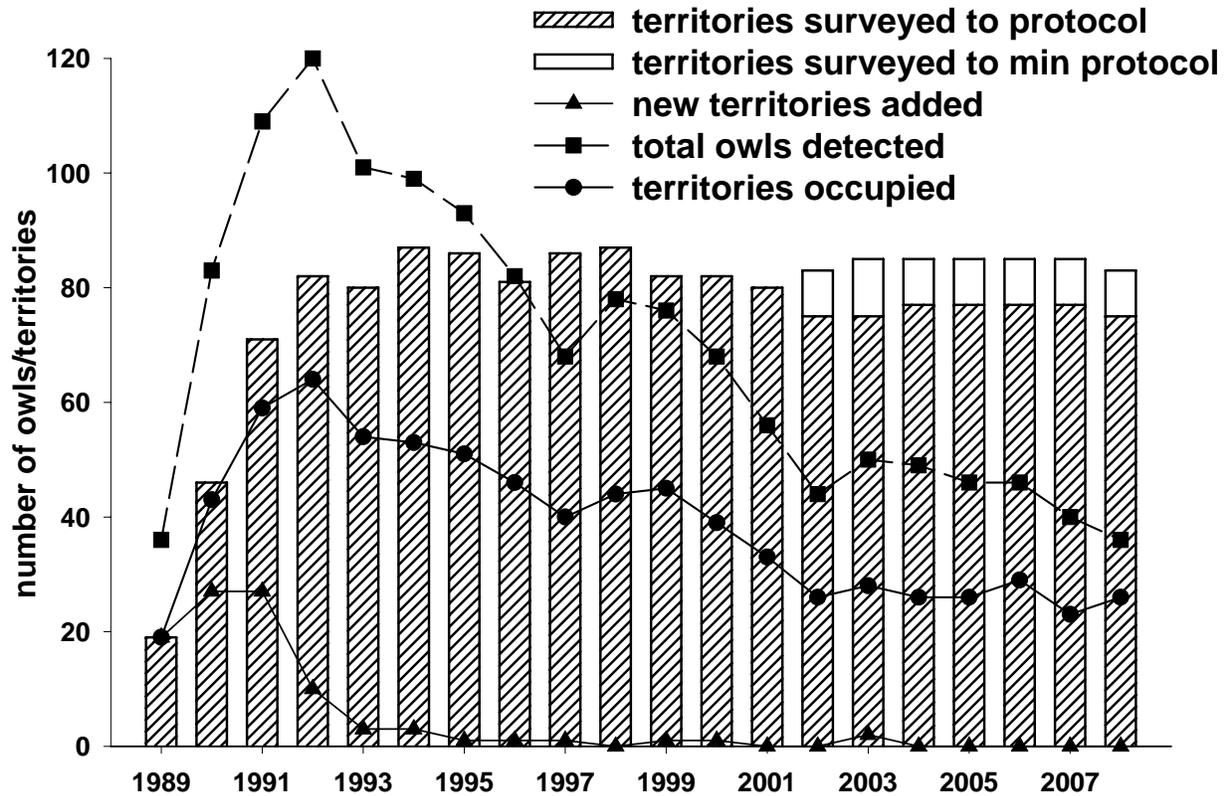


Figure 3. Number of Spotted Owls detected, number of territories occupied, number of territories surveyed, and number of new territories added by year on the Cle Elum Study Area, Okanogan-Wenatchee National Forest, Washington, 1989-2008. Minimum protocol territories included 8-10 territories that we visited only once per year beginning in 2002. A territory was considered occupied if a single owl response was detected which was not associated with a neighboring territory.

Six territories showed increases in occupancy between 2007 and 2008: 5 vacant territories became occupied by single owls, and 1 territory occupied by a single owl became occupied by a pair of owls. However, 8 of 17 (47%) territories occupied by pairs in 2007 held only single male owls (5), single female owls (1), or were vacant (2) in 2008 (Figure 4).

Elsewhere on the Wenatchee National Forest, we continued banding owls on a portion of what was the Wenatchee Demography Study Area (WEN, Figure 10). The WEN was monitored by National Council for Air and Stream Improvement from 1990-2003, in cooperation with the Wenatchee National Forest. We banded 6 new owls (3 adults, and 3 fledglings) at 17 occupied territories on the WEN, and changed bands or confirmed bands on another 23 adult owls. We surveyed 29 territories to protocol. We plan to monitor a subset of the WEN owl territories until the next Demography Workshop, as resources allow.

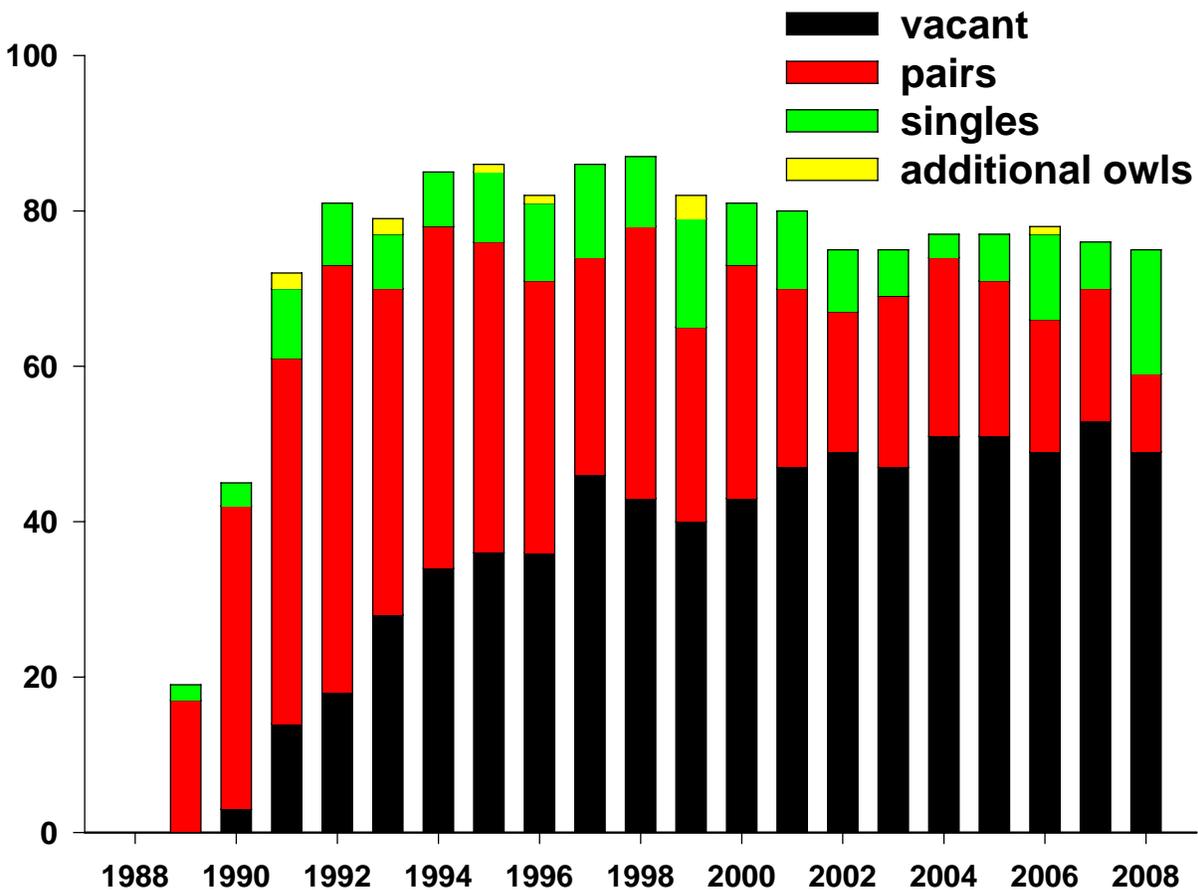


Figure 4. Number of vacant territories and number of territories occupied by singles, pairs, and additional owls on the Cle Elum Study Area, Wenatchee National Forest, Washington, 1989-2008. An additional owl is counted at a territory when a single owl is detected at a territory where a pair has already been confirmed, and the single owl response cannot be attributed to an adjacent territory. Totals do not include 8-10 vacant sites where we made less than 3 complete visits in a year starting in 2002.

Density Study Area

We attempted a complete count of Spotted Owls in the 204 km² Swauk Creek Density Study Area (Figure 2) each year beginning in 1991. The DSA survey involves reproducing Spotted Owl calls at each established call station on 3 occasions during the March – August field season (Forsman 1983, Lint et al. 1999, Reid et al. 1999). The call stations are positioned so that we achieve a 100 % auditory coverage of the entire DSA. The DSA survey data indicate an overall decline in the number of owls detected in the DSA since 1991 (Figure 5).

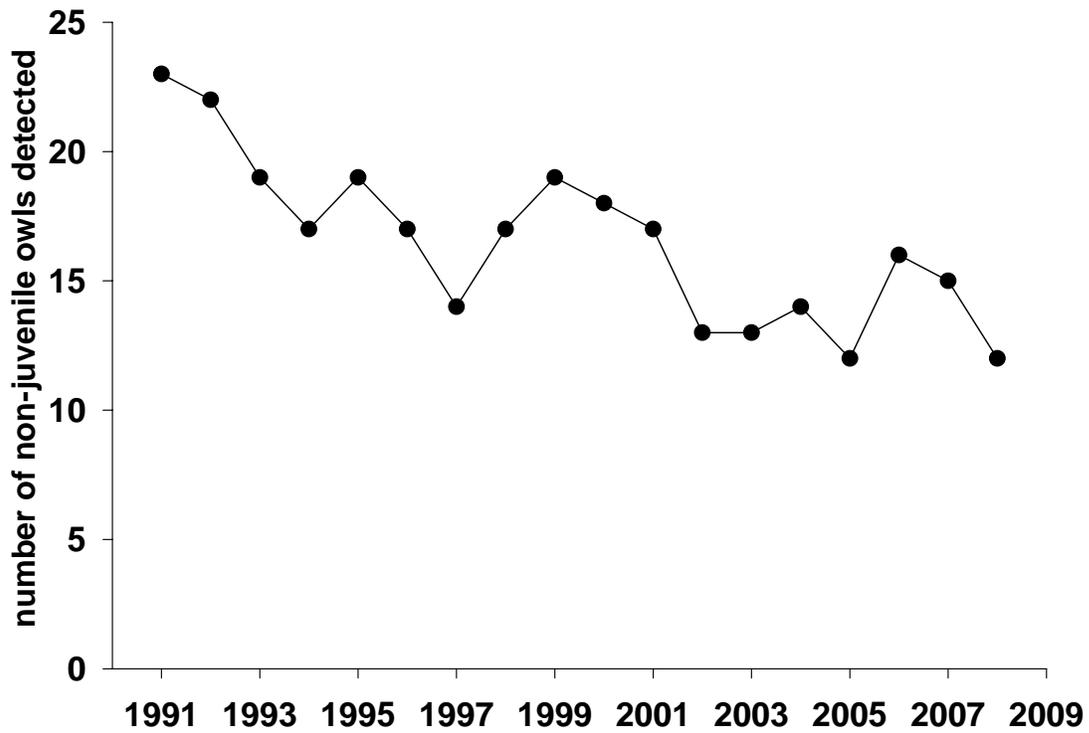


Figure 5. Number of non-juvenile owls detected on the 204 km² Cle Elum Density Study Area on the Okanogan-Wenatchee National Forest, Washington, 1991-2008. Points represent actual counts.

Barred owls and Spotted Owls

The range of the [Barred Owl](#) now overlaps the range of the Northern Spotted Owl, and the potential for the Barred Owl to negatively affect the Spotted Owl population has been a concern for many years (Taylor and Forsman 1976, Courtney et al. 2006). Kelly et al. (2003) found that site occupancy and reproduction of Spotted Owls were lower when barred owls were detected nearby. Thus, monitoring the number of occupied Barred Owl territories is an important index to measure the effect of Barred owls on Spotted Owl territory occupancy (Olson et al. 2005)



Barred owl (photo by Steve Sleep)

We recorded 24 Barred Owl responses in the General Study Area in 2008 during our Spotted Owl surveys. Based on how these responses were situated temporally and/or geographically, we believe the responses represent 17 Barred Owl territories. Due to limited resources, we did not attempt to determine whether the responses represented nesting pairs.

The apparent number of occupied Barred Owl territories in the DSA was substantially lower in 2004-2005 than in 1995-2003. This year, we detected the same number of occupied Barred owl territories (8) as in 2007 (Figure 6).



Spotted owl

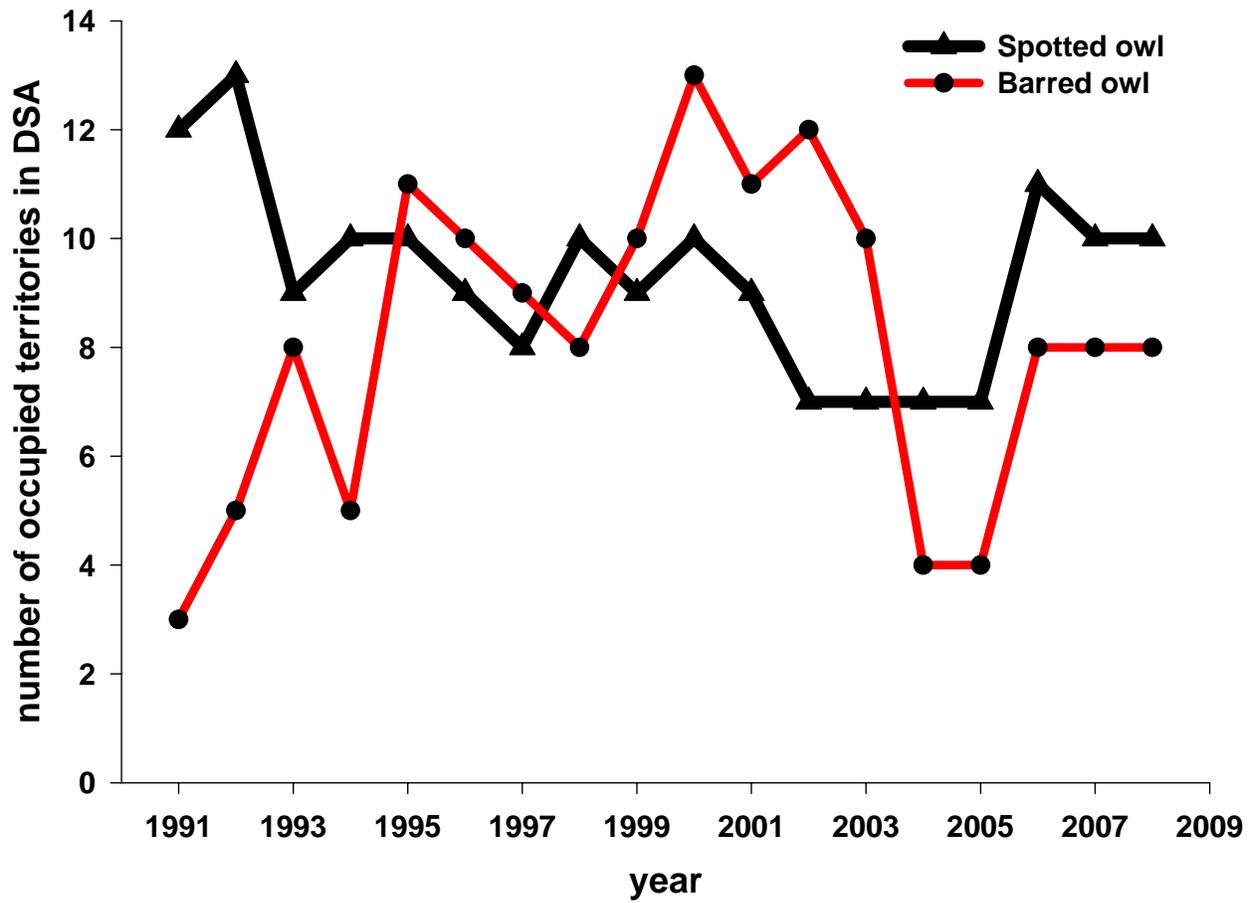
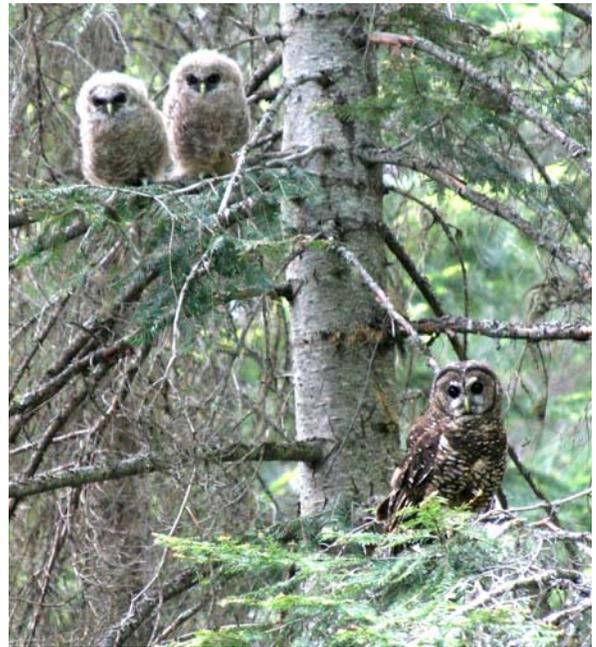


Figure 6. Number of occupied Spotted Owl territories and Barred Owl territories in the Swauk Cr. Density Study Area, Wenatchee National Forest, Washington, 1991-2008. Territories were considered occupied if an owl of either sex was detected at the territory.

Reproductive Rates

Of the 6 non-juvenile females for which we determined nesting status in 2008, 5 (83 %) attempted to nest, and 4 (67 %) produced young. Average fecundity (number of female young produced per female owl) was 0.45 (SE =0.16, Table 3). The proportion of females nesting in 2008 was above the average for all years while fecundity was below average (Figure 7, Table 4).

The pronounced odd-even year pattern of nesting and fecundity seen in 1989-1999—a pattern that was evident in many studies throughout the range of the Spotted Owl—has waned somewhat in the last 8 years (Figure 7, Table 3-4). Comparing a suite of models including the odd-even year effect, Anthony et al. (2006) noted that models that included a negative time trend in fecundity were a good fit to the data from the Cle Elum Study Area in 1989-2003. This indicates that fecundity has decreased during that time period. Since the Anthony et al. (2006) analysis, fecundity has shown less variation among years. During the years 1989-2008 there were 2 years (1993, 1997) with extremely low reproduction.



Female spotted owl and fledglings. Photo by Michael Frank

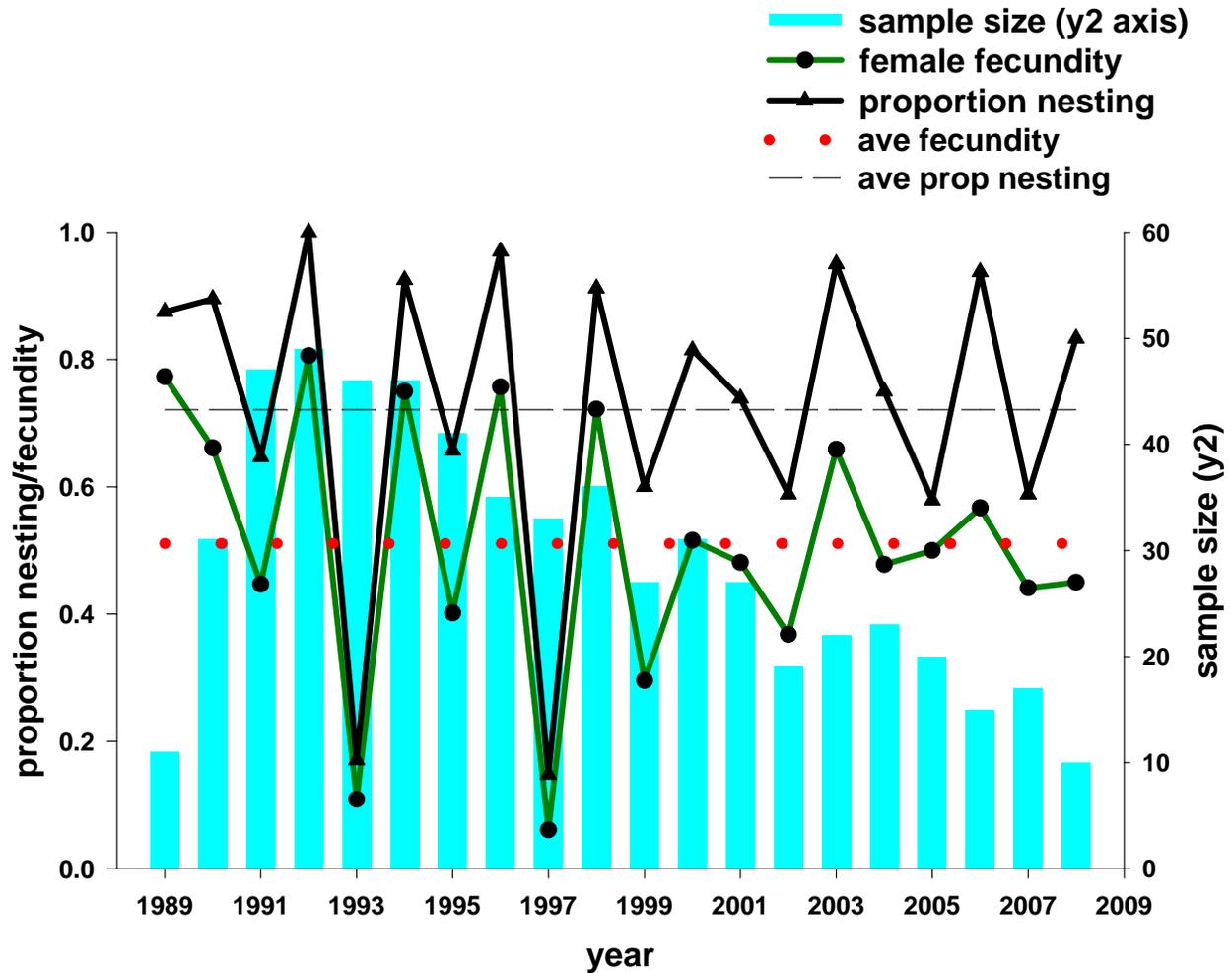


Figure 7. Reproductive indices of Northern Spotted Owls on the Cle Elum Study Area, Wenatchee National Forest, Washington, 1989-2008. Indices shown are: *proportion of females nesting* and *fecundity*. Sample size of females used for fecundity analysis for each year (bars) is plotted on axis Y2. Fecundity is the number of females produced per female owl, assuming a 50:50 sex ratio. The dotted and dashed lines show average (all years 1989-2008) for fecundity and proportion nesting, respectively.

The reproductive indices presented above are proportions that apply to a declining pool of reproductive owls. Thus, the reproductive potential of the spotted owl population on the Cle Elum Study Area has declined over time (Figure 8).

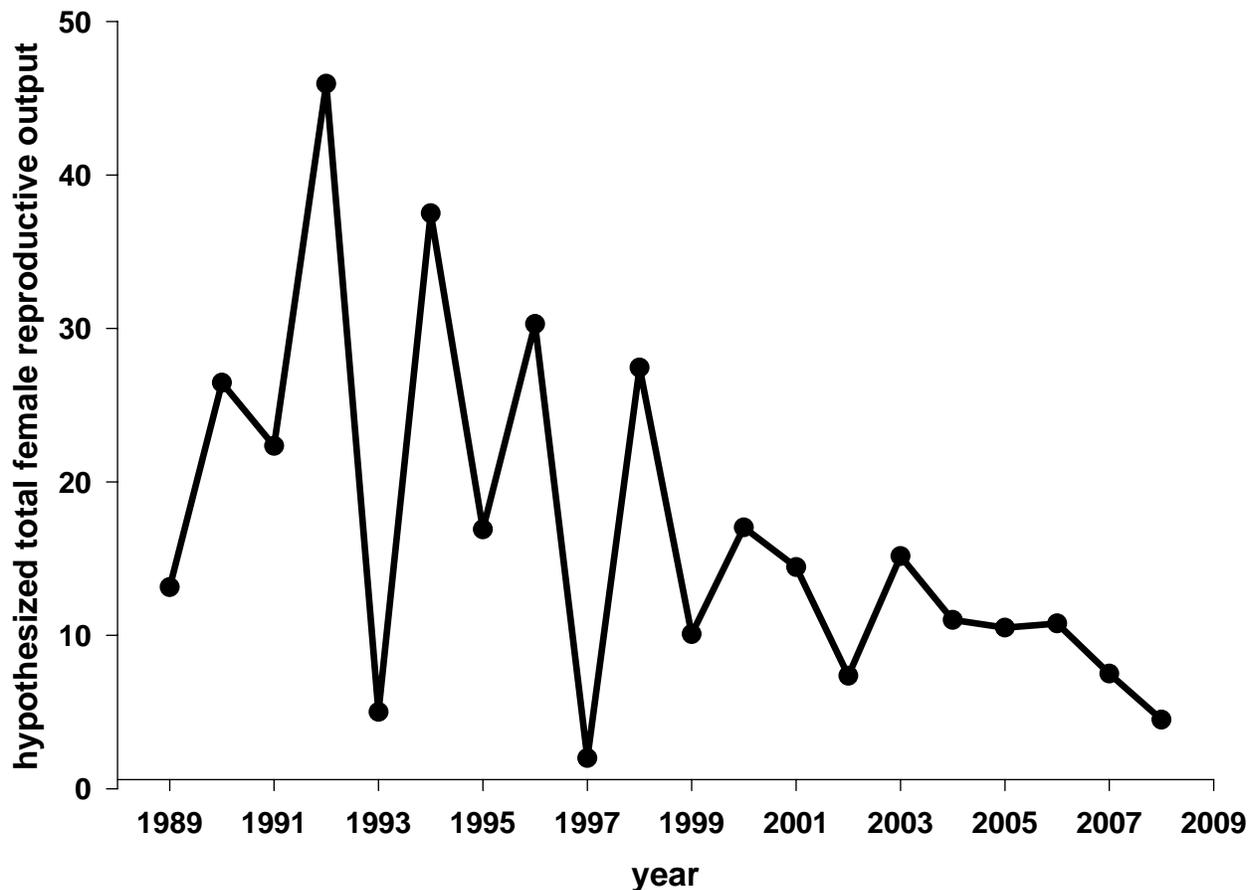
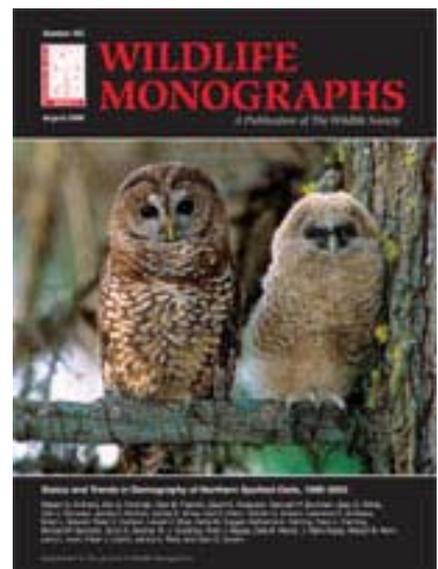


Figure 8. Hypothesized total female reproductive output (average yearly female fecundity * number of females detected each year), Cle Elum Study Area, Wenatchee National Forest, Washington, 1989-2008. Note in the years prior to 1992 the total sample of females monitored each year was increasing as we added new territories to the sample.

The 2004 Spotted Owl Demographic Workshop

A workshop to analyze data from Spotted Owl demography study areas was conducted in January 2004. This analysis included data from the Cle Elum Study Area 1989-2003, as well as 7 other Spotted Owl demography study areas funded under the Northwest Forest Plan. Six additional study areas also participated in the workshop (Figure 10). The results from the workshop were included in the U. S. Fish and Wildlife Service's 5-year review of the Spotted Owl (Courtney et al. 2004), and were also published as a Wildlife Monograph (Anthony et al. 2006). Data collected on the Cle



Elum Study Area will be included in the next Spotted Owl Demographic Workshop, scheduled for early 2009.

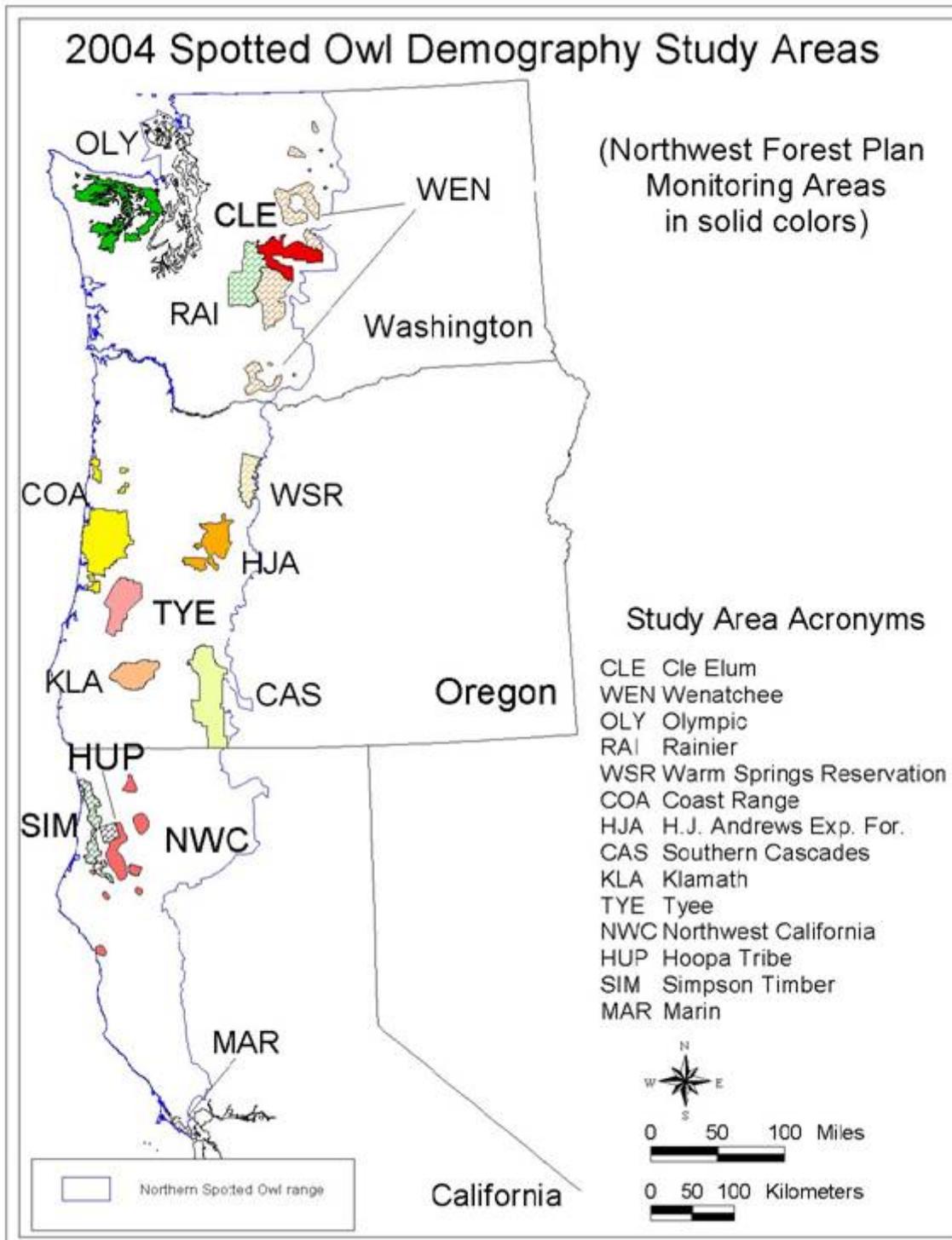


Figure 10. Northern Spotted Owl Demography Study Areas in the range of the Owl.

Problems encountered

We lost a total of 19 survey nights due to inclement weather or restricted access due to snow.

Literature cited

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Publications and presentations in Fiscal Year 2008

Dispersal habitat of Northern Spotted Owls in Washington. In prep.

Habitat use and home range of Northern Spotted Owls in Washington. In prep.

Associations between barred owls, landscape pattern and site occupancy of northern spotted owls in the eastern Cascades of Washington . In prep.

“All about Owls”. A powerpoint presentation, owl pellet examples, and a live Great horned owl provided by the Kittitas Animal Rehabilitation Group, presented at the Kittitas Environmental Education Network “Nature of Night” program, November 17, 2007, Central Washington University, Ellensburg, Washington.

For further reading

Franklin, A. B., Burnham, K. P., White, G. C., Anthony, R. G., Forsman, E. D., Schwartz, C., Nichols, J. D., and Hines, J. 1999. [Range-wide status and trends in northern Spotted Owl populations](#). Unpublished report. 71 pp.

Kelly, E. G., E. D. Forsman, and R. G. Anthony. 2003. Are Barred Owls displacing Spotted Owls? *Condor* 105:45-53.

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Table 1. Number of spotted owls banded each year on the Cle Elum Study Area, Okanagon-Wenatchee National forest, Washington, 1989-2008.

Year	Density study area			General Study Area			Total
	Adults (M,F)	Subadults (M,F)	Juveniles	Adults (M,F)	Subadults (M,F)	Juveniles	
1989	12 (7,5)	3 (1,2)	10	16 (10,6)	2 (0,2)	10	53
1990	5 (3,2)	2 (1,1)	12	39 (21,18)	3 (2,1)	28	89
1991	5 (4,1)	2 (2,0)	7	20 (11,9)	12 (3,9)	34	80
1992	0 (0,0)	2 (1,1)	16	16 (7,9)	2 (0,2)	60	96
1993	1 (0,1)	1 (1,0)	2	7 (1,6)	4 (1,3)	8	23
1994	0 (0,0)	1 (1,0)	14	4 (2,2)	2 (1,1)	52	73
1995	0 (0,0)	2 (2,0)	8	4 (3,1)	2 (2,0)	23	39
1996	0 (0,0)	1 (0,1)	12	2 (0,2)	0 (0,0)	39	54
1997	0 (0,0)	0 (0,0)	0	4 (2,2)	3 (2,1)	3	10
1998	0 (0,0)	1 (0,1)	9	2 (1,1)	2 (1,1)	43	57
1999	0 (0,0)	1 (0,1)	7	1 (0,1)	1 (1,0)	8	18
2000	0 (0,0)	2 (2,0)	11	1 (1,0)	3 (0,3)	18	35
2001	1 (1,0)	0 (0,0)	9	2 (1,1)	0 (0,0)	15	27
2002	0 (0,0)	0 (0,0)	5	1 (1,0)	1 (1,0)	11	18
2003	0 (0,0)	1 (1,0)	13	5 (3,2)	1 (1,0)	16	36
2004	0 (0,0)	1 (1,0)	5	2 (0,2)	1 (0,1)	14	23
2005	0 (0,0)	0 (0,0)	7	1 (0,1)	1 (1,0)	11	20
2006	0 (0,0)	1 (1,0)	5	1 (0,1)	0 (0,0)	11	18
2007	1 (1,0)	2 (1,1)	3	3 (3,0)	2 (1,1)	11	22
2008	0 (0,0)	1 (0,1)	3	0 (0,0)	0 (0,0)	6	10
Total	25 (16,9)	24 (15,9)	158	131 (67,64)	42 (17,25)	421	801

Table 2. Survey effort for the Cle Elum Study Area, Okanagon-Wenatchee National Forest, Washington, 1989-2008.

	territories surveyed to minimum protocol ¹	territories surveyed to protocol ²	new territories added	total owls detected	territories occupied ³
1989	0	19	19	36	19
1990	0	46	27	83	43
1991	0	71	27	109	59
1992	0	82	10	120	64
1993	0	80	3	101	54
1994	0	87	3	99	53
1995	0	86	1	93	51
1996	0	81	1	82	46
1997	0	86	1	68	40
1998	0	87	0	78	44
1999	0	82	1	76	45
2000	0	82	1	68	39
2001	0	80	0	56	33
2002	8	75	0	44	26
2003	10	75	2	50	28
2004	8	77	0	49	26
2005	8	77	0	46	26
2006	8	77	0	46	29
2007	8	77	0	40	23
2008	8	75	0	36	26

¹ Minimum protocol consisted of one visit to the territory.

² Territories surveyed to protocol as outlined in Lint et al. (1999)

³ A territory was considered occupied if one owl was detected during the survey period, March- August

Table 3. Reproductive indices of spotted owls on the Cle Elum Study Area, Okanagon-Wenatchee National Forest, Washington, 1989-2008.

Year	Fecundity of female owls ¹			Mean brood size of successful nests ²		
	n	mean	se	n	mean	se
1989	11	0.77	0.12	9	1.89	0.11
1990	31	0.66	0.08	23	1.78	0.09
1991	47	0.45	0.07	25	1.68	0.11
1992	49	0.81	0.06	42	1.88	0.09
1993	46	0.11	0.04	6	1.67	0.21
1994	46	0.75	0.08	32	2.16	0.11
1995	41	0.40	0.07	21	1.57	0.11
1996	35	0.76	0.07	30	1.77	0.09
1997	33	0.06	0.04	3	1.33	0.33
1998	36	0.72	0.09	27	1.93	0.13
1999	27	0.30	0.08	10	1.60	0.16
2000	31	0.52	0.08	20	1.60	0.11
2001	27	0.48	0.09	16	1.63	0.13
2002	19	0.37	0.11	9	1.78	0.15
2003	22	0.66	0.10	16	1.81	0.14
2004	23	0.48	0.10	13	1.69	0.13
2005	20	0.50	0.11	11	1.82	0.12
2006	15	0.57	0.12	10	1.70	0.15
2007	17	0.44	0.11	9	1.67	0.17
2008	10	0.45	0.16	5	1.80	0.20
Total	586	0.51	0.02	337	1.79	0.03

¹ Sample size (n) includes those females checked for reproductive status by August 31. Fecundity is the number of females fledged per female, assuming a 50:50 sex ratio.

² Mean brood size of nests that produced at least 1 young, and where the number of fledged young was determined by August 31

Table 4. Reproductive indices of spotted owls on the Cle Elum Study Area, Okanagon-Wenatchee National Forest, Washington, 1989-2008.

year	proportion (π) of females that nested ¹				proportion (π) of nesting females that fledged young ²				proportion (π) of all females that fledged young ³			
	n	π	95% CI ⁴		n	π	95% CI ⁴		n	π	95% CI ⁴	
1989	8	0.88	0.47	- 1.00	7	1.00	0.59	- 1.00	11	0.82	0.48	- 0.98
1990	20	0.90	0.68	- 0.99	17	0.94	0.71	- 1.00	31	0.74	0.55	- 0.88
1991	34	0.65	0.46	- 0.80	22	0.82	0.60	- 0.95	47	0.53	0.38	- 0.68
1992	47	1.00	0.92	- 1.00	43	0.88	0.75	- 0.96	49	0.86	0.73	- 0.94
1993	41	0.17	0.07	- 0.32	7	0.86	0.42	- 1.00	46	0.13	0.05	- 0.26
1994	40	0.93	0.80	- 0.98	37	0.78	0.62	- 0.90	46	0.70	0.54	- 0.82
1995	35	0.66	0.48	- 0.81	23	0.87	0.66	- 0.97	41	0.51	0.35	- 0.67
1996	34	0.97	0.85	- 1.00	33	0.91	0.76	- 0.98	35	0.86	0.70	- 0.95
1997	27	0.15	0.04	- 0.34	4	0.75	0.19	- 0.99	33	0.09	0.02	- 0.24
1998	34	0.91	0.76	- 0.98	31	0.84	0.66	- 0.95	36	0.75	0.58	- 0.88
1999	20	0.60	0.36	- 0.81	12	0.75	0.43	- 0.95	27	0.37	0.19	- 0.58
2000	27	0.81	0.62	- 0.94	22	0.91	0.71	- 0.99	31	0.65	0.45	- 0.81
2001	23	0.74	0.52	- 0.90	17	0.82	0.57	- 0.96	27	0.59	0.39	- 0.78
2002	17	0.59	0.33	- 0.82	10	0.80	0.44	- 0.97	19	0.47	0.24	- 0.71
2003	20	0.95	0.75	- 1.00	18	0.78	0.52	- 0.94	22	0.73	0.50	- 0.89
2004	20	0.75	0.51	- 0.91	15	0.80	0.52	- 0.96	23	0.57	0.34	- 0.77
2005	19	0.58	0.34	- 0.80	11	0.91	0.59	- 1.00	20	0.55	0.32	- 0.77
2006	16	0.94	0.70	- 1.00	12	0.67	0.35	- 0.90	15	0.67	0.38	- 0.88
2007	17	0.59	0.33	- 0.82	10	0.90	0.55	- 1.00	17	0.53	0.28	- 0.77
2008	6	0.83	0.36	- 1.00	5	0.80	0.28	- 0.99	10	0.50	0.19	- 0.81
Total	505	0.72	0.68	- 0.76	356	0.85	0.80	- 0.88	586	0.58	0.53	- 0.62

¹ Sample size (n) includes females that were checked for nesting status before June 15

² Sample size (n) includes nesting females that were checked for reproductive status by August 31

³ Sample size (n) includes all females that were checked for reproductive status by August 31

⁴ Exact confidence limits for the binomial proportion using the F distribution, Collett (1991)