ANNUAL REPORT, FY 2002 10 February 2003

1. Title:

Demographic Characteristics of Northern Spotted Owls (*Strix occidentalis caurina*) in the Klamath Mountain Province of Oregon, 1983-2002.

2. Principal Investigators and Organizations:

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3. Study Objectives:

The study objectives are to estimate the population parameters of northern spotted owls on the Klamath Study Area (KSA) within the Klamath Mountain Province. These parameters include occupancy, survival and reproductive success. The lands are administered by the Glendale and South River Field Office of the Medford and Roseburg Districts of the USDI Bureau of Land Management (BLM).

4. Potential Benefit or Utility of the Study:

The KSA is one of 8 long-term studies designed to assess trends in spotted owl populations and habitat as directed under the Northwest Forest Plan (USDA and USDI 1994). The survival and reproductive data will be used in population modeling to assess the long-term stability of the population (Franklin et al. 1999). Data from several study areas will be used in the development of habitat predictive models for the spotted owl (Lint et al. 1999, Anthony et al. 2000).

5. Study Area Description and Survey Design:

The study area is located within the Klamath Mountains Province in SW Oregon and is approximately 1377 km^2 (340,224 ac) in size. This province is characterized by mixed conifer forests dominated by Douglas-fir (*Pseudotsuga menziesii*) and incense cedar (*Calocedrus decurrens*). Other species common include pine (*Pinus* spp.), grand fir (*Abies grandis*), pacific madrone (*Arbutus menziesii*), golden chinquapin (*Castanopsis chrysophylla*), and oak (*Quercus* spp.) (Franklin and Dyrness 1973). Sites within the current boundaries of the KSA were systematically surveyed from 1997-present. A smaller study area (about 466 km^2; 115,138 ac) was intensively surveyed from 1990-1994 and is encompassed within the current boundaries.

The KSA includes portions of 2 BLM Districts (Medford and Roseburg), and much of the intervening areas of private and state lands. The federal lands are in an alternating "checkerboard" pattern of ownership with private lands. Of the 8 long-term studies, 2 of them (Klamath and Tyee) are composed almost entirely of this checkerboard pattern of ownership. The Northwest Forest Plan designates forestland into several Land Use

Allocations (LUA's). One is designated Late Successional Reserve (LSR) and is designed to provide a functional late-successional and old growth forest ecosystem. The study area includes part or all of 2 LSR's.

The checkerboard pattern makes analysis by ownership or LUA difficult since virtually all sites within an LSR designation have a portion of their home range in a non-LSR designation. For the purpose of this analysis, a line was drawn around each of the 2 LSR's in the study. If sites were located within these boundaries they was considered in LSR, even though the private land within these boundaries is not actually designated as LSR.

The study monitors demographic parameters such as survival rates, reproductive rates, and annual rate of population change. The protocol currently used to determine site occupancy, nesting, and reproductive status for this study follows the guidelines specified by the Northern Spotted Owl Effectiveness Monitoring Plan for the Northwest Forest Plan (Lint et al. 1999). An attempt is made to color band or reobserve all previously banded individuals within the study. The reobservation of banded owls will be used for the calculation of survival rates (Franklin et al. 1999, Burnham et al. 1996).

6. Results for FY 2002:

Survey Effort

There are currently 151 sites within the study area. Of the 150 sites surveyed during 2002, a pair occupied 97, a single male occupied 11, and one or 2 owls with social status unknown occupied 13 sites (Appendix A). We detected at least one owl at 121 (80.1%) of the sites. During 2002, 6 new sites were established within the study. A pair was present at 5 of the new sites and nesting was attempted at 3 of the new sites. Consistent occupancy by a territorial single or a pair is the usual criteria for designating a new site.

Owl Detections and Banding by Sex and Age

A total of 221 non-juvenile spotted owls were detected on the study area during 2002. We detected 118 males and 103 females resulting in a male: female sex ratio for non-juveniles of 1.15:1. Of the 202 non-juvenile owls identified on the study area, 155 (76.7%) were adults and 47 (23.3%) were subadults (Appendix B). The oldest known owl within the study area was a female that was at least 17 years old. A total of 96 owls were newly banded on the study area during 2002. Of these, 74 (77.1%) were fledglings, 13 (13.5%) were subadults, and 9 (9.4%) were adults.

There were 21 non-juvenile owls captured in 2002 that were initially banded as juveniles, but not previously captured or identified. Of the 43 non-juveniles encountered for the first time in 2002 (this includes banding and rebanding), the ages of 34 (79.1%) are known exactly or within 1 year. On the study area, one adult and 5 subadults were known immigrants and one adult and 5 subadults were known emigrants. A total of 20 owls originally banded as juveniles within the KSA were recaptured during 2002, 14 of them were recaptured within the KSA. One of the recoveries was located 119 km (74 miles) from the point of original banding. Of the 20 recaptures, 9 were originally banded in 2001

and 4 were originally banded in 2000.

There were 14 non-juvenile barred owls (*Strix varia*) detected on the study area during 2002. At 3 sites we detected a pair, nesting was confirmed at 2 of these sites, and at least 5 young were produced (1 of the sites produced triplets). There were no hybrid owls located within the study area during 2002.

Reproduction

Yearly reproductive data (1983-2002) (Appendix C) includes nest success, fecundity rate, and mean brood size. The proportion of females nesting is the number of females that attempted to nest from the sample where nest status was determined. Nest success is the proportion of nesting females that fledged young. The fecundity rate is the number of female young produced per female. The mean brood size is the average number of young produced per successfully reproducing pair. Where appropriate, the data is split into 4 female age classes; 1-year old, 2-year old, adult, and unknown age. The reproductive data is analyzed 2 ways: 1) the entire study area, and 2) divided into 2 groups (LSR and non-LSR) (Appendix D).

During 2002, there were a total of 93 sites where nesting status was determined, 61 nesting (65.6%) and 32 not nesting (34.4%). This compares to 2001 when there were a total of 76 sites where nesting status was determined, 53 nesting (69.7%) and 23 not nesting (30.3%). Of the sites where nesting occurred during 2002, 51 pairs successfully fledged young and 10 pairs nested and failed resulting in a nesting success rate of 83.6% (Appendix C).

The fecundity rate for 2002 was calculated at 0.428. This rate is slightly higher than the average for the years 1983-2002 (0.383). The fecundity rate for the years 1983-2002 was split into 4 female age classes. The rate for 1-year olds (0.073) was much lower than 2-year olds (0.337), adults (0.417), and unknown (0.288) (Table 1).

Table 1. Fecundity rate and mean brood size by age class within the KSA. Also included is the average fecundity rate for 15 studies across the range of the owl. Sites where backpack transmitters were attached to females during the nesting season were excluded from the calculation during the years of attachment. (a)

Age class	Mean fecundity, 15 studies 1985-1998	Mean fecundity (N), 1985-1998	Mean fecundity (N), 1983-2002	95% CI for fecundity	Mean brood size (N), 1983-2002	95% CI for brood size
1-yr	0.078	0.130 (30)	0.073 (55)	0.007-0.139	1.60 (5)	0.92-2.28
2-yr	0.161	0.273 (59)	0.337 (95)	0.254-0.420	1.49 (43)	1.33-1.64
Adult	0.321	0.394 (507)	0.417 (761)	0.385-0.448	1.61 (393)	1.56-1.66
Unk	NA	NA	0.288 (40)	0.174-0.401	1.28 (18)	1.05-1.51
Total			0.383 (951)	0.356-0.411	1.59 (459)	1.54-1.64

(a) Preliminary data, values may change.

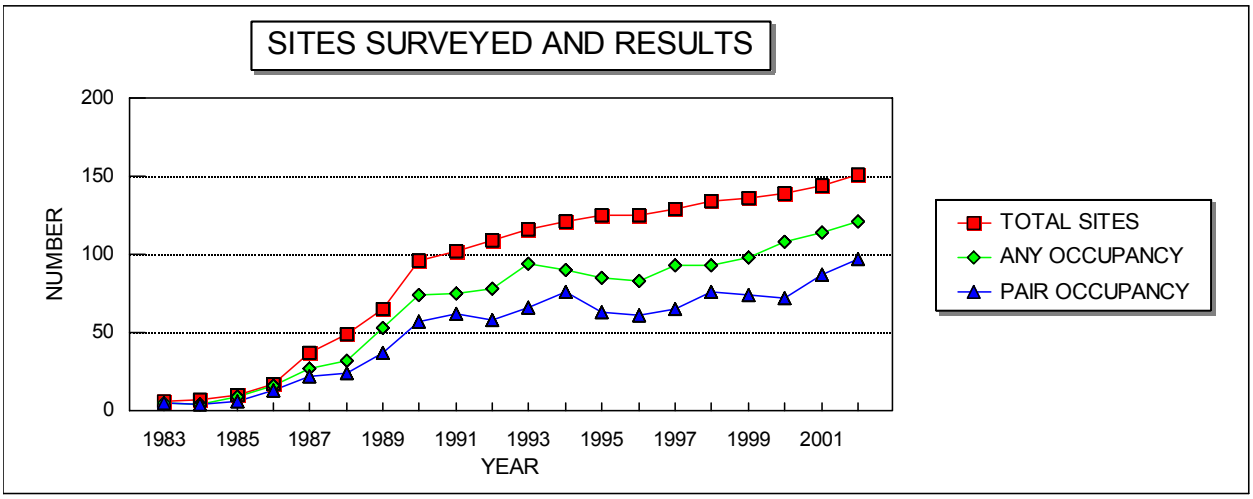
In 2002, the mean brood size (1.60) was almost identical to the average for the years 1983-2002 (1.59). The mean brood size for the years 1983-2002 was split into 4 female age classes, all resulted in similar values (Table 1).

7. Discussion for FY 2002:

Survey Effort

The survey effort within the study area has varied over the years, however the general trend has been an increase in the number of sites surveyed (Figure 1). Only one site (located between 2 surveyed sites) was not surveyed during 2002, this was the lowest number of sites with incomplete surveys since 1986 when only 17 sites were known. There has also been a concurrent increase in the number of sites occupied by at least one owl and occupied by a pair. The KSA boundaries were established in 1997 and the survey effort increased significantly at that time. Although most of the area within this boundary is surveyed well, it is not a density study and some areas are not surveyed. The addition of 6 new sites during 2002 is the largest increase since 1993 when 7 new sites were established. It is possible that some of these sites are actually newly established sites, while others were likely present but not previously located. At 3 of the sites; the individuals were adult age, 2 were known age and relatively old (10 and 11 years). Since juveniles tend to establish territories within 2-5 years old (Forsman et al. 2002), these sites may have been present but not located. The other 3 sites included owls 1-3 years old and may be newly established sites.

Figure 1. Occupancy status of sites in the KSA (1983-2002). Included are the number of sites in the study area, the number with at least 1 owl detection, and the number with a pair as defined by protocol.



Owl Detections

The number of non-juvenile owls detected in 2002 (221) was the largest for any year. This

increase in individuals corresponds with the increase in the number of sites on the study area. The number of owls detected should eventually level off as all possible owl sites become located. The large number of owls detected may also be related to the experience level of the crew. The entire crew from the 2001 season returned for the 2002 season. A majority of the non-juvenile owls encountered for the first time (79.1% in 2002, 82.4% in 2001) are of known age or known within 1 year. This is a result of banding juveniles or locating new owls while they are still subadult. Knowing the age structure of the population allows flexibility for current and future analysis.

The 14 non-juvenile barred owls detected on the study area was a slight increase from the 11 detected during 2001. If both spotted owl and barred owl detections are combined, there is an increase in barred owl detections from 5.1% during 2001 to 6.0% during 2002. There has been a rapid increase in barred owl detections at demographic study areas north of the KSA. It is probable that barred owls will continue their expansion south affecting spotted owl detections and population trends (Kelly 2001).

Demographics

The nest status was determined at 93 (95.9%) of the 97 sites where reproduction was determined. This was the highest proportion of any year, and compares with 92.7% of 82 sites during 2001, and 85.7% of 70 sites during 2000. Locating nesting pairs before 1 June is not required to determine reproduction, but it has several benefits. One benefit is a more accurate determination of nest success (84% during 2002), which is the number of pairs that attempted to nest and actually fledge young. Another benefit is a more accurate count of the number of young fledged. If the nest tree location is known, reproductive visits can be timed soon after fledging occurs to avoid the effects of early juvenile mortality.

The largest number of juveniles detected within the study area occurred during 2002, however the fecundity rate was equal or higher in the years 1983-1986, 1990, 1992, and 2001. This may be partially explained by the increase in survey effort and the number of sites surveyed, resulting in fewer undetected juveniles produced. In addition, the fecundity rate for the early years (1983-1986) was calculated from a small sample size and at a time when a well documented protocol did not exist. Of the 83 juveniles detected during 2002, only 74 were captured and banded. Some owls were detected as fledglings in early June, but we were unable to capture them at that time. The juveniles were not located on subsequent visits, and it is likely they were mortalities. Other juveniles that were not banded were confirmed mortalities consisting of remains found near the nest trees.

The age specific fecundity estimates for 15 study areas analyzed through 1998 show a gradually increasing rate from 1-year old to adult ages. The Klamath Study Area through 1998 (Franklin et al 1999) shows a similar gradual increasing rate from 1-year old to adult ages, but the fecundity rates are higher than the combined 15 study areas. Our most recent analysis shows a very low rate for 1-year olds, then a rate much closer to the adults for 2-year olds (Table 1). The sample sizes for the most recent analysis are much larger and are probably more accurate than the earlier estimates. Although fecundity rates varied by age class, the mean brood sizes did not appear to differ among age classes.

The fecundity rates for sites within an LSR compared to sites outside the LSR boundary are given by year in Appendix D. The NWFP became effective in the spring of 1994, therefore the data are also presented for the combined years before the effective date and for the combined years after the effective date. The combined years show a slightly higher fecundity in non-LSR sites before implementation and a slightly higher fecundity in LSR sites after implementation. The quantity of timber harvested on federal non-LSR forest is quite minimal. In addition, the private land harvest has occurred at about the same rate within the LSR boundary and outside of the boundary. The differences may be more meaningful as more timber is harvested from non-LSR federal land.

8. Acknowledgments:

Many people and organizations contributed to the success of this project. Without the dozens of dedicated people collecting the field data, none of this could have happened. In addition, biologists from surrounding areas have contributed information regarding owl movements. Several private timber companies have been gracious enough to allow access to sites on their property. The primary government agencies involved in the Klamath Study Area are the BLM and the State of Oregon. Funding for rangewide demographic studies comes from BLM, USDA Forest Service, and the National Park Service.

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Appendix A. Territories surveyed and occupancy results by year within the KSA (1983-2002). (a)

Year	Total sites	Sites w/ pair	Sites w/ single	Sites w/ undetermined status (b)	Total occupied sites	Sites w/ no occupation (c)	Sites w/ incomplete survey (d)
1983	6	5	0	0	5	1	0
1984	7	4	0	0	4	3	0
1985	10	6	1	2	9	1	0
1986	17	13	2	1	16	1	0
1987	37	22	4	1	27	3	3
1988	49	24	4	4	32	5	6
1989	65	37	7	9	53	4	3
1990	97	57	9	9	74	14	7
1991	103	62	11	2	75	19	7
1992	110	58	14	6	78	21	10
1993	117	66	17	12	94	12	10
1994	122	76	5	9	90	21	11
1995	126	63	13	9	85	18	22
1996	126	61	11	11	83	21	22
1997	130	65	16	12	93	24	13
1998	135	76	11	6	93	26	13
1999	137	74	9	15	98	31	6
2000	140	72	16	20	108	19	10
2001	145	87	13	14	114	25	2
2002	151	97	11	13	121	22	1

(a) Preliminary data, values may change.
(b) Undetermined status may include one or 2 owls, does not qualify as a pair or a resident single.
(c) No occupancy determined with at least 3 survey visits.
(d) Incomplete survey is 2 visits or less (usually no visits).

Appendix B. Sex and age composition of spotted owls located within the KSA (1983-2002). Non-juvenile owls where the sex could not be determined are not included. (a)

Year	Adult (M,F)	Subadult (M,F)	Age unk (M,F)	Total non-juvenile (M,F)	Juvenile
1983	0 (0,0)	0 (0,0)	10 (5,5)	10 (5,5)	5
1984	4 (2,2)	0 (0,0)	4 (2,2)	8 (4,4)	3
1985	12 (7,5)	0 (0,0)	3 (1,2)	15 (8,7)	6
1986	17 (10,7)	1 (1,0)	10 (4,6)	28 (15,13)	18
1987	32 (19,13)	9 (5,4)	16 (6,10)	57 (30,27)	8
1988	44 (26,18)	13 (4,9)	11 (7,4)	68 (37,31)	17
1989	77 (43,34)	5 (2,3)	17 (9,8)	97 (54,43)	18
1990	101 (57,44)	12 (6,6)	19 (10,9)	132 (73,59)	52
1991	113 (61,52)	16 (7,9)	12 (7,5)	141 (75,66)	40
1992	107 (61,46)	16 (6,10)	16 (10,6)	139 (77,62)	59
1993	117 (63,54)	24 (13,11)	19 (12,7)	160 (88,72)	22
1994	125 (67,58)	28 (13,15)	16 (9,7)	169 (89,80)	55
1995	121 (67,54)	9 (1,8)	19 (14,5)	149 (82,67)	18
1996	117 (63,54)	8 (3,5)	21 (13,8)	146 (79,67)	56
1997	117 (59,58)	23 (16,7)	23 (12,11)	162 (87,75)	52
1998	127 (69,58)	26 (13,13)	19 (9,10)	172 (91,81)	41
1999	130 (72,58)	17 (6,11)	33 (17,16)	180 (95,85)	44
2000	134 (75,59)	19 (8,11)	33 (20,13)	186 (103,83)	65
2001	151 (80,71)	36 (20,16)	17 (13,4)	204 (113,91)	82
2002	155 (84,71)	47 (21,26)	19 (13,6)	221 (118,103)	83

(a) Preliminary data, values may change.

Appendix C. Fecundity rate and mean brood size by year within the KSA (1983-2002). Years with an * represent years when backpack transmitters were attached to females during the nesting season, these sites are excluded from the calculation. (a)

Year	Nest success (N)	95% CI for Nest Success	Mean fecundity (N)	95% CI for fecundity	Mean brood size (N)	95% CI for brood size
1983	1.00 (4)	NA**	0.625 (4)	0.227-1.023	1.25 (4)	0.45-2.05
1984	1.00 (2)	NA**	0.500 (3)	0.000-1.742	1.50 (2)	0.00-7.85
1985	1.00 (4)	NA**	0.600 (5)	0.081-1.119	1.50 (4)	0.58-2.42
1986	1.00 (6)	NA**	0.786 (7)	0.422-1.150	1.83 (6)	1.40-2.26
1987*	1.00 (4)	NA**	0.250 (14)	0.003-0.497	1.75 (4)	0.95-2.55
1988*	1.00 (12)	NA**	0.425 (20)	0.235-0.615	1.42 (12)	1.09-1.74
1989*	0.92 (12)	0.73-1.00	0.250 (32)	0.113-0.387	1.45 (11)	1.10-1.81
1990*	0.82 (38)	0.69-0.94	0.521 (48)	0.394-0.648	1.61 (31)	1.43-1.79
1991*	0.75 (32)	0.59-0.91	0.345 (58)	0.226-0.463	1.67 (24)	1.43-1.91
1992*	0.90 (41)	0.81-1.00	0.528 (53)	0.409-0.647	1.51 (37)	1.31-1.72
1993	0.83 (18)	0.64-1.00	0.175 (63)	0.090-0.260	1.47 (15)	1.18-1.75
1994	0.84 (37)	0.71-0.96	0.387 (71)	0.276-0.499	1.77 (31)	1.59-1.96
1995	0.72 (18)	0.49-0.95	0.145 (62)	0.068-0.223	1.38 (13)	1.08-1.69
1996	0.95 (40)	0.88-1.00	0.475 (59)	0.368-0.581	1.47 (38)	1.31-1.64
1997	0.97 (31)	0.90-1.00	0.406 (64)	0.291-0.522	1.73 (30)	1.57-1.90
1998	0.79 (38)	0.65-0.93	0.281 (73)	0.194-0.368	1.37 (30)	1.18-1.55
1999	0.90 (29)	0.78-1.00	0.333 (66)	0.225-0.442	1.69 (26)	1.50-1.88
2000	0.88 (49)	0.78-0.97	0.464 (70)	0.364-0.564	1.51 (43)	1.36-1.67
2001	0.85 (54)	0.75-0.95	0.500 (82)	0.396-0.604	1.78 (46)	1.66-1.91
2002	0.84 (62)	0.74-0.93	0.428 (97)	0.339-0.516	1.60 (52)	1.46-1.73
1983-2002	0.86 (531)	0.84-0.89	0.383 (951)	0.356-0.411	1.59 (459)	1.54-1.64

(a) Preliminary data, values may change.

Appendix D. Fecundity rate and mean brood size by Land Use Allocation and year within the KSA. Years with an * represent years when backpack transmitters were attached to females during the nesting season, these sites are excluded from the calculation. (a)

Year	LSR, Mean fecundity (N)	LSR, 95% CI for fecundity	Non-LSR, Mean fecundity (N)	Non-LSR, 95% CI for fecundity
1983	0.667 (3)	0.000-1.384		
1984	0.500 (2)	0.000-6.853		
1985	0.500 (4)	0.000-1.150		
1986	0.625 (4)	0.000-1.387		
1987*	0.227 (11)	0.000-0.503	0.333 (3)	0.000-1.768
1988*	0.409 (11)	0.157-0.661	0.444 (9)	0.088-0.801
1989*	0.250 (22)	0.072-0.428	0.250 (10)	0.003-0.503
1990*	0.462 (26)	0.282-0.641	0.591 (22)	0.402-0.780
1991*	0.383 (30)	0.216-0.551	0.304 (28)	0.126-0.481
1992*	0.569 (29)	0.395-0.743	0.479 (24)	0.309-0.649
1993	0.194 (31)	0.062-0.325	0.156 (32)	0.040-0.272
1994	0.347 (36)	0.181-0.513	0.429 (35)	0.272-0.585
1995	0.129 (35)	0.024-0.233	0.167 (27)	0.044-0.289
1996	0.485 (33)	0.341-0.628	0.462 (26)	0.291-0.632
1997	0.471 (34)	0.310-0.631	0.333 (30)	0.161-0.506
1998	0.294 (34)	0.172-0.416	0.269 (39)	0.141-0.397
1999	0.333 (33)	0.169-0.497	0.344 (32)	0.189-0.499
2000	0.444 (36)	0.300-0.589	0.485 (34)	0.340-0.631
2001	0.500 (43)	0.358-0.642	0.500 (39)	0.342-0.658
2002	0.489 (46)	0.355-0.624	0.373 (51)	0.254-0.491
1983-1994	0.376 (209)	0.315-0.436	0.388 (169)	0.321-0.454
1995-2002	0.400 (294)	0.350-0.450	0.371 (278)	0.320-0.421
1983-2002	0.390 (503)	0.351-0.428	0.377 (447)	0.337-0.417

(a) Preliminary data, values may change.