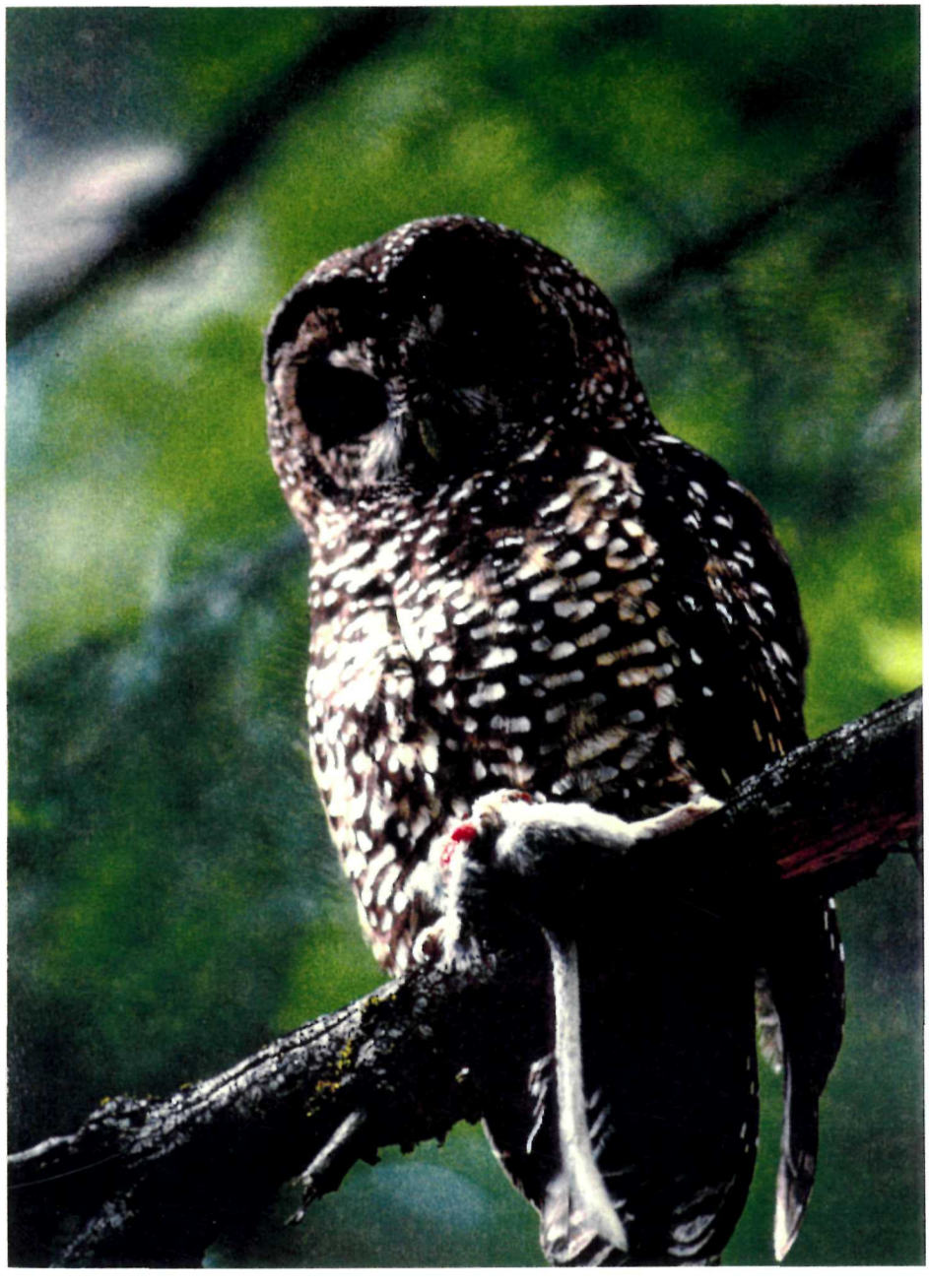
A Survey of Northern Spotted Owls in North Cascades National Park Service Complex, Washington

Robert C. Kuntz II and Roger G. Christophersen



December, 1996

A Survey of Northern Spotted Owls in North Cascades National Park Service Complex, Washington

Robert C. Kuntz II and Roger G. Christophersen

Technical Report NPS/CCSONOCA/NRTR-96/05

North Cascades National Park Service Complex
2105 State Route 20
Sedro Woolley, WA 98274

December, 1996

United States Department of Interior - National Park Service - Pacific West Region

North Cascades National Park Service Complex, comprising North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area, was established in October, 1968 and is located in northwestern Washington. North Cascades National Park was established to preserve certain majestic mountain scenery, snow fields, glaciers, alpine meadows, and other unique natural features in the North Cascade Mountains for the benefit, use, and inspiration of present and future generations. Ross Lake and Lake Chelan National Recreation Areas were established to provide for outdoor recreation use and enjoyment and to conserve scenic, scientific, historic, and other values contributing to public enjoyment of these lands and waters.

The National Park Service disseminates results of biological, physical, or social science research through the Natural Resources Technical Report Series. Natural resources inventories and monitoring activities, scientific literature reviews, bibliographies, and proceedings of technical workshops or conferences are also disseminated through this series. Documents in this series usually contain information of a preliminary nature and are prepared primarily for internal use within the National Park Service. This information is not intended for use in open literature.

Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

Copies are available from the following:

Denver Service Center
Technical Information Center
P.O. Box 25287
Denver, Colorado 80225-0287

(303) 969-2130

ABSTRACT

The northern Spotted Owl (*Strix occidentalis caurina*) was listed by U.S. Fish and Wildlife Service as a threatened species in June, 1990. Logging and urbanization of mature and old-growth forests (~~*Strix varia*~~) have been identified as major causes for declines in Spotted Owl habitat and populations. The status of the northern Spotted Owl in North Cascades National Park Service Complex (NOCA) had not been well documented. In 1993, National Park Service biologists initiated a program to inventory and monitor Spotted Owl populations in NOCA. All potential Spotted Owl habitat was identified and surveyed to locate activity sites used by Spotted Owls. This initial survey took 4 years and was completed in 1996. Additionally, all known Spotted Owl activity sites were monitored each year to determine occupancy and productivity.

A total of 133,094 ha of potential Spotted Owl habitat was identified within NOCA. However, survey efforts were concentrated in the 76,473 ha of potential habitat at elevations below 1,220 m (4,000 ft) because recent studies in southwestern British Columbia and northern Washington outside NOCA have documented little Spotted Owl activity above this elevation. Approximately 42.5% of this low elevation potential habitat (32,471 ha) was surveyed during the four-year project period. Through this effort, 1,580 point counts were conducted representing a linear distance of 753.4 km surveyed.

We identified 11 Spotted Owl activity sites during the 4-year survey. Pair occupancy was documented at 6 activity sites. Single Spotted Owls were found at the other 5 activity sites. All activity sites were located in closed-canopy coniferous forests dominated by Douglas-fir (*Pseudotsuga menziesii*) and Western Hemlock (*Tsuga heterophylla*). Mean elevation of these 11 Spotted Owl activity sites was 608 m (1,996 ft) and ranged from 317 m (1,040 ft) to 878 m (2,880 ft). An average of 8.5 (range 6-11) Spotted Owl activity sites were monitored for occupancy and productivity each year. Mean occupancy at pair activity sites was 0.52 and ranged from 0.33 (1996) to 0.75 (1993). Mean annual fecundity was 0.30 female young per paired adult female. In 1995, we documented a male Spotted X Barred Owl (*Strix varia*) hybrid paired with a female Barred Owl. This is only the fourth documented record of hybridization between these 2 species in Washington. To date, we have found no evidence this pair has successfully bred.

The Spotted Owl is an uncommon resident in the North Cascades. This species prefers old-growth conifer forests below 1,220 m elevation. Productivity varies greatly from year-to-year. In some years nesting does not occur. It appears Spotted Owl populations in the North Cascades are continuing to decline. Competition with Barred Owls for suitable habitat may be influencing the Spotted Owl's distribution and abundance in NOCA.

Detections of other owl species were common during this study. We identified 42 Barred Owl activity sites, representing 18 pairs and 24 singles. We documented an additional 38 individual owls of 4 other species. The Northern Pygmy-Owl (*Glaucidium gnoma*) was the most commonly (19) detected species. Thirteen Northern Saw-whet Owls (*Aegolius acadicus*), 5 Great Horned Owls (*Bubo virginianus*), and 1 Western Screech-Owl (*Otis kennicotti*) were also documented during the 4-year survey period.

North Cascades National Park Service Complex represents a large area of pristine habitat and is an excellent study area to monitor trends in wildlife populations. NOCA's unique location at the northern edge of the Spotted Owl's range makes it an outstanding area for monitoring expansion or contraction of this species range. We recommend the following for future study of NOCA's Spotted Owl populations:

* Continue demographic monitoring of Spotted Owls in NOCA on a long-term basis, as required by the President's Forest Plan, the Endangered Species Act, and the Spotted Owl Recovery Plan.

* Initiate a program to determine the effects of Barred Owl populations on Spotted Owl populations in the North Cascades. Documenting displacement of Spotted Owls by Barred Owls and quantifying habitat use differences between the two species in NOCA will enable us to better understand ecological relationships between these two owl species.

ACKNOWLEDGMENTS

We wish to thank the members of our field crews for their hard work and dedication: biological technicians, E.J. Bindseil, S.L. Bottoms, A.M. Gillesburg, R. E. Holmes, E.D. Miller, L.L. Spahr, P.L. Walcott, L.M. Westgard, P.J. Wharton, and A.D. Zitkovick; volunteers, S.M. Bagley, M. M. Lazaro, K. E. McEvoy, M. Nill, J.D. Stamp, B.A. Timm, and E.M. Wells. A. M. Braaten provided GIS support and analysis. R. E. Holmes provided graphics support. We thank the entire staff at North Cascades National Park Service Complex, especially B. Foss, P. Blunt, V. Tisdale, and S. Glesne, for their administrative support. We especially thank J. Larson for helping obtain funding. This project was funded by the National Park Service and the U.S. Geological Survey's Biological Research Division (a.k.a. National Biological Service).

For his support and technical assistance, we thank D.E. Seaman, wildlife biologist with the U.S. Geological Survey's Biological Research Division. D. E. Seaman provided the master banding permit for marking studies at North Cascades National Park Service Complex. National Council for the Paper Industry for Air and Stream Improvement, Incorporated biologists T. Fleming and R. Estes provided support and technical assistance east of the Cascades crest. D. E. Seaman and R. Glesne provided valuable comments on the manuscript.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The northern Spotted Owl (*Strix occidentalis caurina*) was listed by U.S. Fish and Wildlife Service (USFWS) as a threatened species in June, 1990 (USDI 1990). Northern Spotted Owl populations are thought to have declined over the last century due to habitat loss (Gutierrez 1994). Logging and urbanization of mature and old-growth forests have been identified as major causes for declines in Spotted Owl habitat (Thomas et al. 1990). In southern British Columbia and the North Cascades Range of Washington, the invasion of Barred Owls (*Strix varia*) over the last 40 years may also have contributed to declines in Spotted Owl abundance (Hamer 1988, Dunbar et al. 1991, Kuntz et al. 1993, Kuntz and Christophersen 1994, and Christophersen and Kuntz 1995). Since listing, Anderson and Burham (1992 and 1994) have indicated that northern Spotted Owl populations are continuing to decline throughout their range and this decline may be accelerating.

The status of the northern Spotted Owl has not been well documented in the North Cascades of Washington and southwestern British Columbia. Past efforts to assess the status of Spotted Owls within North Cascades National Park Service Complex (NOCA) began in the early 1980's when random calling surveys were initiated by the Washington Department of Fish and Wildlife (WDFW). Only a few of the random survey transects actually entered NOCA boundaries and no Spotted Owls were detected in NOCA from these surveys (A. Potter, pers. comm. 1996). In 1987, NOCA biologists conducted a calling survey in the Ross Lake basin and found no Spotted Owls (Wasem 1987, unpubl. data). Other surveys conducted by NOCA biologists were done in conjunction with environmental assessments of NPS operations (USDI 1989). No Spotted Owls were detected from these surveys either. Biologists from the National Council of the Paper Industry for Air and Stream Improvement, Incorporated (NCASI), have helped complete reconnaissance-level surveys in the Stehekin Valley while conducting spotted owl investigations on U.S. Forest Service (USFS) lands adjacent to NOCA. Since the mid-1980's, park biologists and NCASI have visited 2 "historic" nest sites found in the Stehekin Valley to monitor productivity and survivorship. NCASI has banded adults and juveniles at these 2 "historic" sites and on adjacent USFS lands (Fleming 1990, unpubl. data). British Columbia biologists have conducted limited surveys near the international border within the Chilliwack and Upper Skagit River drainages (Forsman and Booth 1986, C. Leniham, pers. comm.1996). Additionally, 4 years of extensive Spotted Owl surveys were completed between 1988 and 1992 on the Mount Baker Ranger District (west of NOCA) of the Mount Baker-Snoqualmie National Forest (Utzinger 1992, unpubl. data).

Two recent conservation plans direct federal land management agencies to inventory and monitor Spotted Owls and their associated habitats (USDI 1992a, USDA 1994). The National Park Service (NPS) requires that all parks have a resource management plan identifying priority issues needing immediate action. NOCA's Resource Management Plan (1994) identifies implementation of an inventory and monitoring program for Spotted Owls as Priority # 2. In 1993, NOCA resource management staff initiated a 4-year effort to meet these directives. Objectives of this study were to survey potential Spotted Owl habitat within NOCA and locate

Spotted Owl activity sites, to estimate Spotted Owl relative abundance, and to monitor Spotted Owl activity site occupancy and productivity.

STUDY AREA

The North Cascades National Park Service Complex (NOCA) includes North Cascades National Park, Lake Chelan National Recreation Area, and Ross Lake National Recreation Area. NOCA is located in the North Cascades physiographic province in northwestern Washington. Spanning the crest of the Cascade Range, NOCA lies within 2 major biogeographic zones: the temperate marine west slope and semi-arid continental east slope (Franklin and Dyrness 1973). The park includes lands from low elevation forested valleys to high elevation glaciated mountain peaks with a total area of 276,815 ha. Elevations range from 119 m to 2,806 m. Approximately 93% of NOCA is designated as wilderness.

The region west of the Cascade crest is characterized by a wet maritime climate. Summers are relatively cool and dry with mild wet winters. The Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) cover types dominate west-side forested habitat below 1,220 m (Agee and Kertis 1986). Depending on specific site conditions, western red cedar (*Thuja plicata*) is also well represented in these cover types. Above 1,220 m, forested habitat west of the crest is dominated by the Pacific silver fir (*Abies amabilis*) cover type (Agee and Kertis 1986). Other tree species well represented in this cover type include mountain hemlock (*Tsuga mertensiana*), Alaska yellow-cedar *(Chamaecyparis nootkatensis*), Douglas-fir, western hemlock, and western red cedar.

East of the Cascade crest a rainshadow effect exists creating cool winters and warm dry summers. Below 1,220 m, forested habitat is dominated by the Douglas-fir cover type with western red cedar, lodgepole pine (*Pinus contorta*), western white pine (*Pinus monticola*), and Ponderosa pine (*Pinus ponderosa*) commonly found as minor components (Agee and Kertis 1986). Above the 1,220 m elevation line, forested habitat is dominated by the subalpine fir (*Abies lasiocarpa*) cover type (Agee and Kertis 1986). Other tree species that are common in this cover type include mountain hemlock and Englemann spruce (*Picea engelmannii*). Although less common, the Pacific silver fir cover type is also found on the east side above 1,220 m, most notably in the Bridge Creek section of the Stehekin River drainage. Both western hemlock and mountain hemlock were commonly found in this cover type.

METHODS

Inventory:

A vegetation map, developed from Landsat multispectral scanner satellite data (Almack et al. 1993), was used to identify areas of potentially suitable Spotted Owl habitat. Based on the Spotted Owl habitat definition used by the Interagency Scientific Committee (Thomas et al. 1990), habitat use in the Wenatchee National Forest (Buchanan 1991), and the North Cascades Grizzly Bear Ecosystem vegetation map (Almack et al. 1993), we developed a Geographical Information System (GIS) map showing potential Spotted Owl habitat within NOCA. Appendix 1 gives the classes and class definitions used to identify Spotted Owl habitat surveyed. Overlaying U.S. Geological Survey (USGS) 1:24,000 scale topographic maps onto this GIS Spotted Owl habitat map, transects of point-count stations were delineated along trails and in off-trail wilderness to maximize coverage in potential habitat.

Point-count transects were surveyed to locate Spotted Owl activity sites. These transects generally consisted of 8 to 12 point-count stations placed in areas of suitable habitat at all elevations. Point-count stations were placed along trails and at off-trail locations. Whenever possible, stations were placed along ridges and away from streams to maximize coverage by enhancing sound transmission. Surveys were conducted each year from late March through early July. After our first year (1993) of sampling, we discontinued surveying at elevations above 1,220 m. Surveys conducted in 1994-96 concentrated on potential habitat below 1,220 m to maximize our efficiency with the limited resources available. An attempt was made to survey all transects once. A few transects were omitted because they were unreasonably hazardous due to terrain or weather conditions. A subset of these transects were randomly selected and surveyed an additional two times.

Most agencies conducting Spotted Owl surveys in the Pacific Northwest use the minimum standard 6 survey protocol to determine pair occupancy and reproductive status within a defined geographical location (USDI 1992b). This standard was mainly developed for use in determining spotted owl presence/absence in areas where forest manipulations (e.g. logging, road construction) are planned. Since our objective was to find as many activity sites as possible, we chose to deviate from the standard protocol in order to maximize our coverage of potential habitat in the park. We realize this may have caused us to miss detections of some occupied activity sites. However, results from surveys conducted at Olympic National Park showed there was a high probability of detecting at least one member of a resident pair during the first three visits and most owl pairs were detected on the first visit (Seaman et al. 1992).

Current protocols recommend conducting surveys at night when owls are more active and are thought to be more responsive to standard survey techniques (USDI 1992b). Because much of our study area was in inaccessible, rugged backcountry, the location of transects influenced the time-of-day they were conducted. Off-trail transects were sampled during daylight hours to provide a safe working environment for field crews. Trail, road, and boat transects were sampled

at night. Subsets of transects being sampled three times were randomly selected from each day/night category.

Teams of two technicians conducted a series of ten-minute point counts placed every 400 m along a transect. Two-minute point counts were conducted at the mid-point (200 m) between ten-minute stations. We used standard methods for locating Spotted Owls (Forsman 1983). Using a series of vocal imitations of various Spotted Owl calls, usually the three-note or four-note location calls, and series calls, technicians hooted at the point-count stations and mid-point stations. When a Spotted Owl was detected, observers attempted to locate the owl to determine its sex, age, and if the owl was banded, band colors and band positions.

Using standard mousing techniques (Forsman 1983), owls were followed to determine pair status and locate nests and juveniles. An attempt was made to capture and mark all Spotted Owls in the study area. Marking consisted of placing a U.S. Fish and Wildlife Service metal band with a unique number on one leg and a color band on the other leg. One-color bands were used to mark adult owls, while a multi-colored band (e.g. RED/WHITE/RED) was placed on juvenile owls.

Monitoring:

Throughout the four-year study, we monitored Spotted Owl activity sites found during current and previous inventory field seasons. Monitoring was conducted to determine owl occupancy and productivity. These data also provide information on nest site fidelity, pair fidelity, and survival rates. As many activity sites as possible were sampled each year. However, when all activity sites could not be visited in a given year, we gave priority to sites where pair activity had been identified in previous years.

Protocol standards for monitoring historic sites are similar but less rigid than standards for inventory surveys. Most monitoring visits were conducted during daylight hours. However, when owls were unresponsive to daytime efforts, occasional dawn and/or dusk visits were utilized. Visits were appropriately spaced throughout the breeding season to account for variation in owl activity site use and detectibility.

Once owls were relocated at an activity site, color bands (if banded) were visually examined to confirm identification of individually marked birds. Using the same methods described in the survey banding protocol, an attempt was made to capture and mark any adult owls or juveniles not previously marked. Follow-up visits were made to determine if successful reproduction occurred.

Data Analysis:

To determine how much potential Spotted Owl habitat was sampled, we digitized all point-count stations onto our GIS habitat map. Each station was given a conservative buffer of 400 m to insure the maximum effective coverage of the survey areas. Many federal, state, and private

agencies have used 800 m when surveying along roads (Forsman 1983, USDI 1992b). However, at Olympic National Park, a 200 m buffer was used (Fredrickson et al. 1992, Seaman et al. 1992). To make this buffer, a computer generated circle was created with a radius of 400 m centered on each point-count station. Because the point-count stations were only 400 m apart, the buffer circles overlapped. This effectively created a fairly linear buffer along the survey route. We then calculated the amount of potential habitat falling within the total buffer area.

We defined occupancy as confirmed if both members of a Spotted Owl pair were seen and/or heard on territory or if nesting was confirmed (eggs or young seen in the nest). Productivity was calculated as the number of young fledged divided by the number of pairs producing at least one fledgling. We assumed a juvenile sex ratio of 1:1 when calculating fecundity (the number of female young per paired adult female).

RESULTS

Spotted Owl Inventory:

A total of 133,094 ha of potential spotted owl habitat was identified in 2 strata within the park complex (Figure 1). The 2 strata comprise forests east and west of the Cascades crest. Surveys were concentrated in, but not confined to, forests below 1,220 m. A total of 32,471 ha (42.5%) of the potential habitat below 1,220 m was surveyed during the 4 year project period (Table 1).

We surveyed 1,580 point count stations at least once during the 4-year inventory. This coverage represented a linear distance of 753.4 km. An additional 1,203 (557 km) point counts were completed as second and third-time survey visits to these stations. We detected Spotted Owls at 9 point-count stations (Table 1). Eight of the 9 detections were found on first-visit surveys of the point-count stations. One detection occurred on the third visit to that point-count station. Four detections occurred in 1993, while surveying the east-side forests. The other five Spotted Owls detected were found in the west-side forests during 1994 through 1996 (Table 1). An estimate of response rate, based on actual linear distance, is 0.013 spotted owls per km surveyed throughout the park (76.1 km/owl). The response rates for the east-side and west-side strata equaled 0.019 owls per km surveyed (52.1 km/owl) and 0.010 owls per km surveyed (95.3 km/owl) respectively.

During our 4-year inventory effort, we identified 11 Spotted Owl activity sites (Figure 2, Appendix 2). Nine of these activity sites were new sites found as a direct result of our survey effort. Fourteen Spotted Owls, consisting of 5 pairs and 4 singles, were located at these activity sites (Table 2).

Two additional sites were found incidental to our survey effort. Of these 2 sites, 1 was a new site containing a single owl of unknown status. The other site had a history of Spotted Owl pair occupancy with both birds color-banded prior to our study.

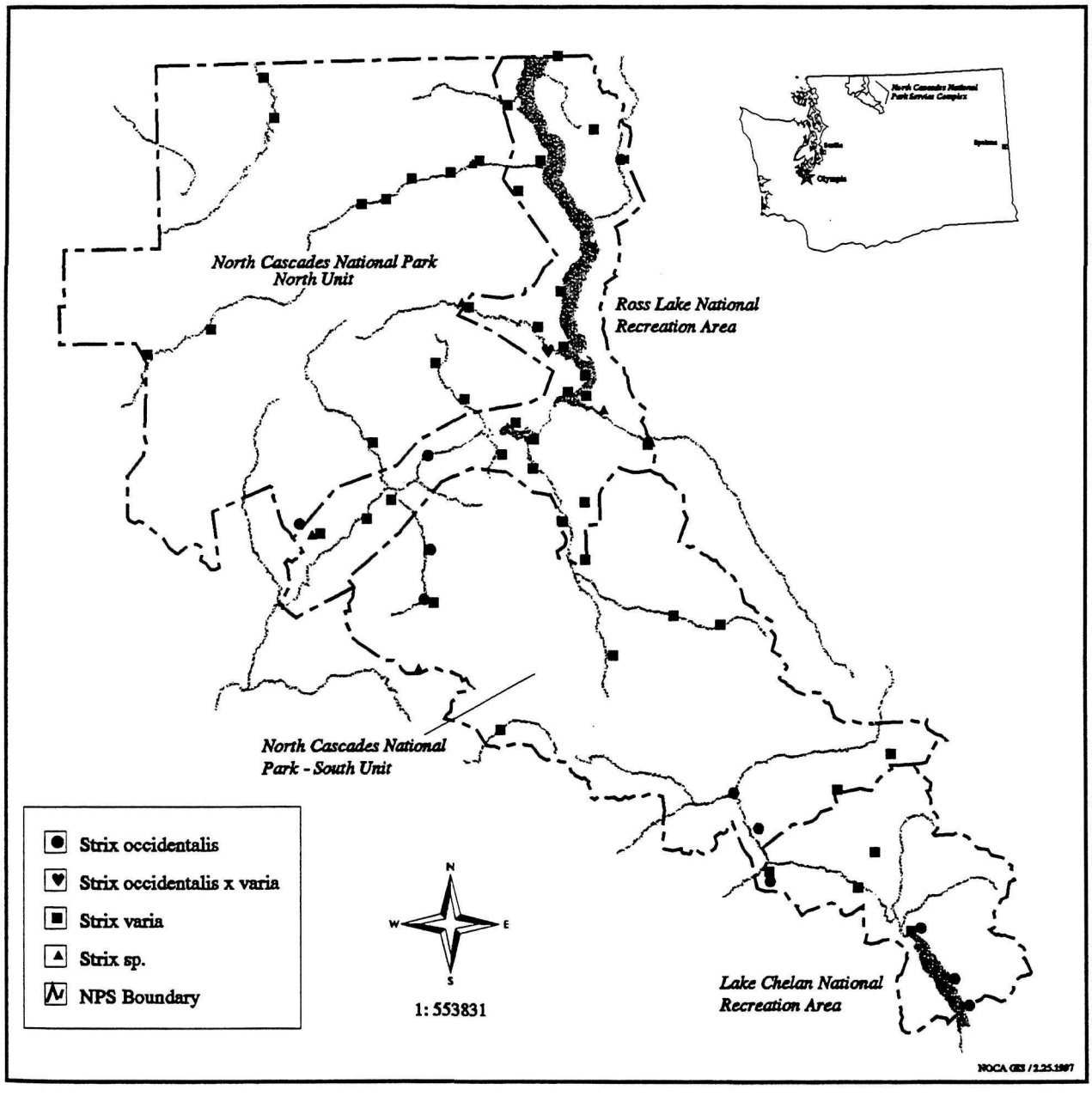


Figure 2. *Strix* spp. detected in North Cascades National Park Service Complex, Washington (1993 - 1996).

Table 1. Summary of potential Spotted Owl habitat surveyed and Spotted Owls detected in North Cascades National Park Service Complex, Washington (1993-1996).

STRATUM	POTENTIAL SUITABLE HABITAT (ha)	HABITAT SURVEYED (ha)	% COVERED	POINT COUNT STATIONS	LINE TRANSECT DISTANCE (km)	SPOTTED OWL DETECTIONS
East slope < 1,220 m	11,451	7,270	63.5	397	208.3	4
West slope < 1,220 m	65,022	25,201	38.7	992	476.4	5
High elev. >1,220 m	56,621	5,767	10.2	191	68.7	0
Total	133,094	38,238	28.7	1,580	753.4	9

Mean elevation of Spotted Owl activity sites used during the 4-year survey period was 608 m and ranged from 317 m to 878 m (Figure 3, Appendix 2). All activity sites were located in closed-canopy coniferous forests (Classes 1,2, and 4; see Appendix 1). Dominant tree species at these activity sites included Douglas-fir, western hemlock, and Pacific silver fir in the west-side strata and Douglas-fir, western hemlock, and ponderosa pine in the east-side forests (Appendix l).

We documented 1 male Spotted X Barred Owl hybrid paired with a female Barred Owl in the Ross Lake watershed (Figure 2). Identification was verified by its unique plumage, unusual vocalizations, and morphological measurements as described by Hamer et al. (1994). To date, we have found no evidence this pair has successfully bred.

Barred Owls:

We identified 42 Barred Owl activity sites during the 4-year inventory period (Figure 2). Eighteen 18 pairs and 24 singles were detected at those sites (Appendix 3). An estimate of the detection rate for barred owls was 0.056 owls per km surveyed (17.9 km/owl). The Barred Owl response rate for east-side and west-side forests was 0.019 owls per km surveyed (52.1 km/owl) and 0.080 owls per km surveyed (11.3 km/owl) respectively. In addition, four incidental detections (2 pairs, 2 singles) occurred while en route to a survey point-count stations. Mean elevation of Barred Owl activity sites was 708 m and ranged from 183 m to 1520 m (Figure 3).

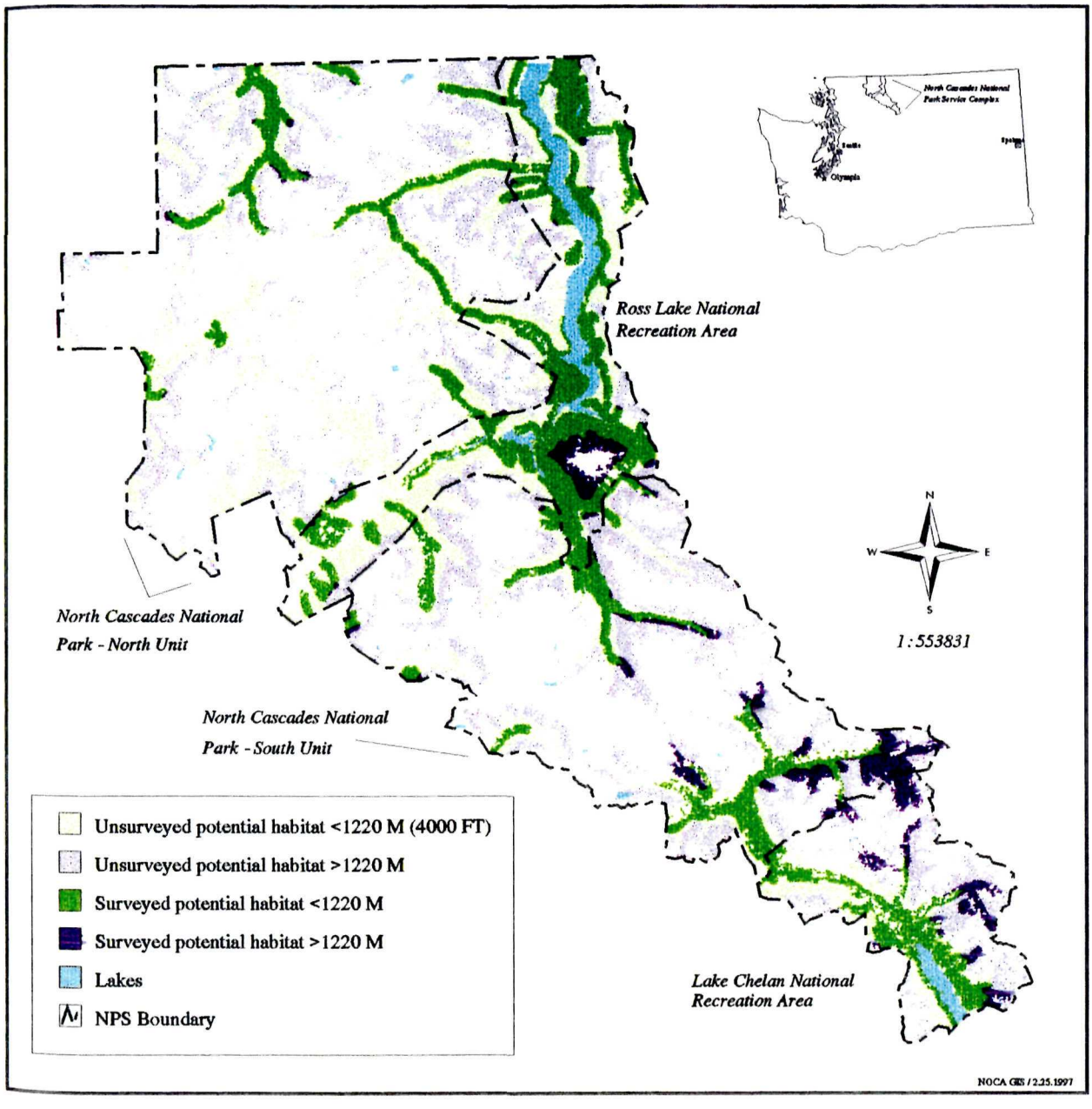


Figure 1. Potential Spotted Owl habitat in North Cascades National Park Service Complex, Washington.

Table 2. Summary of Spotted Owl inventory and monitoring efforts in North Cascades National Park Service Complex, Washington (1993-1996).

YEAR	OWL PAIRS NESTING[1]	OWL PAIRS NOT NESTING OR NEST UNK[2]	1 OWL STATUS UNK[3]	TOTAL INDIVID. ADULTS[4]	# OF NESTS WITH JUVS[5]	JUVS[6]	NEWLY BANDED ADULTS AND JUVS[7]	% OF BANDED OWLS RESIGHTED[8]	OWL SITES VISITED[9]
1993	3[10]	1	1[10]	9	3	4	6	75	6
1994	1	1	1	5	1	2	3	33	8
1995		2		4	0	0	1	29	9
1996	1	1	2	6	1	2	4	14	11

[1] Number of sites occupied by confirmed nesting owl pairs, includes successful and unsuccessful nests.
[2] Number of sites occupied by confirmed owl pairs who are not nesting or nesting could not be determined.
[3] Number of sites at which a single owl responded to survey attempts, but there is not sufficient data to determine whether it was a resident single.
[4] Total number of individual owls; sum of all above categories, including both members of pairs and unknown status sites.
[5] Number of nests found on historic sites that were successful at fledging juveniles in that year.
[6] Number of juvenile owls located within that specified year. In 1993, a juvenile perished before fledging.
[7] Number of owls newly banded in that year, includes adults and juveniles.
[8] % of previously banded adult spotted owls that were resighted (bands were identified) in a specified year out of the pool of possible banded owls in NOCA. Does not include any juveniles.
[9] Number of historically occupied owl sites visited in that specified year.
[10] Includes a non-survey detection.

Other Owl Species:

An additional 38 individual owls of 4 other species responded to our calling surveys (Figure 4, Appendix 4). The Northern Pygmy-Owl (*Glaucidium gnoma*) was the most commonly (19) detected species. Thirteen Northern Saw-whet Owls (*Aegolius acadicus*), 5 Great Horned Owls (*Bubo virginianus*), and 1 Western Screech-Owl (*Otis kennicotti*) also were documented during the 4-year survey effort. Five additional individual owls could not be identified to species.

Spotted Owl Monitoring:

We monitored occupancy and productivity at Spotted Owl activity sites from 1993 through 1996. An average of 8.5 (range: 6-11) activity sites were monitored each year (Table 2). An activity site was labeled "pair site" if a pair occupied the site in at least 1 year of the 4-year study. We detected Spotted Owl pair activity at 6 sites and found only single individuals at the other 5 activity sites. Mean occupancy at pair activity sites was 0.52 and ranged from 0.33 (1996, n=6) to 0.75 (1993, n=4). Three of six (50%) Spotted Owl pairs successfully fledged at least 1 young during the 4-year study. A total of 7 young fledged during the study period (Table 2). Young

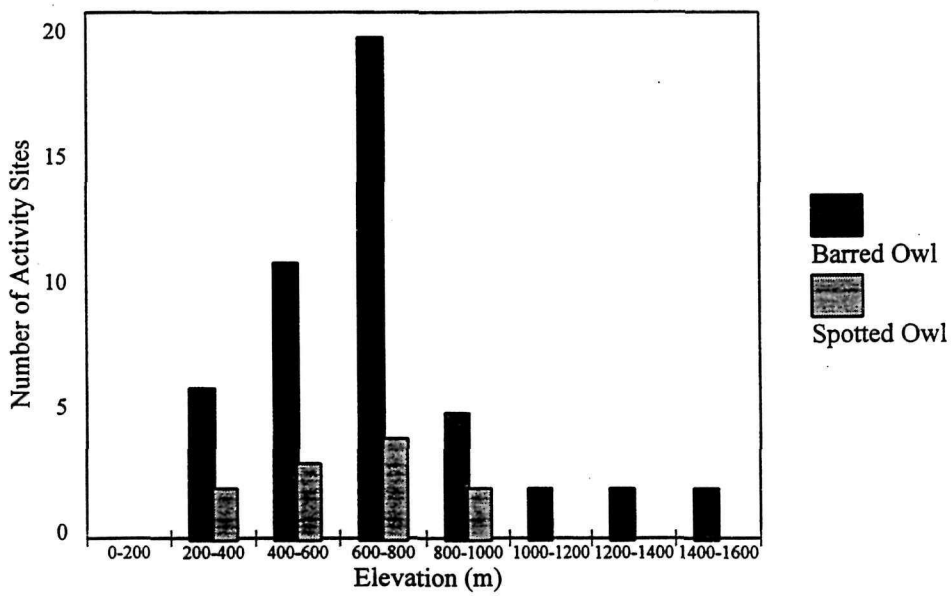


Figure 3. Elevation distribution of Spotted Owl and Barred Owl activity sites in North Cascades National Park Service Complex, Washington.

fledged in all years except 1995. Mean annual productivity equaled 1.25 young per successful pair. Mean annual fecundity was 0.30 female young per paired adult female.

Of the 14 adult Spotted Owls detected during the 4-year study, 7 were captured and banded (Appendix 5). An additional 3 adult owls had been banded previously by NCASI (Flemming, pers. comm.). Seven of the 8 juvenile Spotted Owls detected while monitoring activity sites were also banded (Appendix 5). We observed the eighth juvenile on the nest, but were not able to determine if it fledged. Four adult owls were resighted in one or more years (Table 2).

DISCUSSION

Response rates of Spotted Owls in our study were very low compared to response rates from other Pacific Northwest studies (Forsman et al. 1977 [0.36 pairs/km], Banci unpubl. rpt. 1989 [0.04 owls/km], Dunbar et al. 1991 [0.04 owls/km]). Our surveys, as well as surveys in British Columbia, were conducted at the northern edge of the range of the Spotted Owl in North America (AOU 1983, Dunbar et al. 1991). The Forsman et al. (1977) surveys, conducted in Oregon, lie in the center of the range of the Spotted Owl. This could account for some of the detection rate differences, as a species' abundance is normally assumed to be lower at the edge of its range. This would not, however, account for our lower survey detection rates compared to those in British Columbia. It is believed that Spotted Owl populations are continuing to decline throughout their range (Anderson and Burham 1992, Gutierrez 1994). Our studies used similar

detection techniques, but were completed from 5 to 9 years after surveys conducted in British Columbia. Several factors may have influenced our lower response rates.

First, since the 1940s, Barred Owls have been expanding their range into western North America (Grant 1966, Taylor and Forsman 1976, Hamer 1988). Barred Owls are now common in southwestern British Columbia and northern Washington (Hamer 1988, Dunbar et al. 1991), and have nearly complete overlap with the range of the northern Spotted Owl (Hamer 1988, Gutierrez 1994). Dunbar et al. (1991) speculated that Barred Owl range expansion may be having a negative impact on Spotted Owl populations. Secondly, Barred Owls respond aggressively to broadcast playbacks of Spotted Owl calls (Hamer 1988, Dunbar et al. 1991) and may respond more quickly than Spotted Owls. Recently, surveyors in British Columbia found that if they continued to broadcast playbacks of Spotted Owl calls after Barred Owls responded they occasionally elicited responses from a Spotted Owl (Carla Lenihan, B. C. Parks, pers. comm. 1996). When we elicited responses from Barred Owls, we suspended calling at that station and moved on. This may have caused us to miss some Spotted Owls that were present in the survey area but did not make their presence known as quickly as did Barred Owls. Lastly, our lower detections rates may represent continued declines in Spotted Owl populations. In any case, our results concur with those of southwestern British Columbia that the Spotted Owl is an uncommon resident in the North Cascades.

Within NOCA, Spotted Owl response rates from east-side forests were approximately twice that of west-side forests. Several factors may have influenced these different response rates. First, east-side detection rates were determined using only 1 year (1993) of data collection, whereas 3 years (1994-1996) of data were collected for west-side forests. Reproductive success of Spotted Owls can vary greatly from year to year (McKelvey et al. 1992, Seaman et al. 1996). A study conducted at Olympic National Park found response rates were correlated with reproductive success (D.E. Seaman, pers. comm. 1996). In 1993, we found more nesting pairs and fledged young than in any other year during our study (Table 2). Had we surveyed east-side habitat any other year, our detection rates may have been similar to west-side rates. Secondly, we detected approximately 8 times as many Barred Owls as Spotted Owls in west-side forests. Detection rates in east-side habitats were similar between the two species. If Barred Owls do respond more quickly to playback calls, then it could account for differences in our detection rates between east-side and west-side forests.

Mean annual fecundity of Spotted Owl pairs at NOCA was similar to that found in Olympic National Park during the same time frame (Seaman et al. 1996). We failed to document reproductive success in 1995 as did many areas of Washington. Factors influencing Spotted Owl productivity are not known. However, it is likely that prey base resources and weather contribute to the success or failure of Spotted Owl nesting attempts.

Records of adult Spotted Owl/Barred Owl hybrids are rare. Four records have previously been reported in Washington (Hamer et al. 1994, T. Flemming unpubl. data, Seaman et al. 1996).

Our decision to concentrate our survey effort below 1,220 m was based on several factors. First, while surveying 4,785 ha of potential habitat above 1,220 in 1993, we found no evidence of Spotted Owl activity. Recent studies in southwestern British Columbia and northern Washington have documented little Spotted Owl activity above 1,220 m (Banci unpubl. rpt. 1989, Dunbar et al. 1991, D. Utzinger pers. comm. 1996). Only Banci's unpublished report (1989) provided occurrence data above 1,220 m. They found birds at 1,435 m, the highest elevation Spotted Owls have been recorded in British Columbia. During our study, the highest elevation we detected Spotted Owls was 878 m (2,880 ft), though we surveyed much habitat between the elevations of 878 m and 1,220 m. Based on the Spotted Owl habitat definition used by the Interagency Scientific Committee (Thomas et al. 1990) and our subjective assessment of the high-elevation stratum (>1,220 m), we feel this stratum comprises marginal quality habitat with small, patchy distributions. With limited resources, we decided to concentrate survey efforts on the highest quality, low-elevation habitat.

CONCLUSIONS AND RECOMMENDATIONS

The Spotted Owl is an uncommon resident in the North Cascades. This species prefers old-growth conifer forests below 1,220 m elevation. Productivity varies greatly from year-to-year. In some years nesting does not occur. Spotted Owl populations in the North Cascades may be continuing to decline. Competition with Barred Owls for suitable habitat may be influencing the Spotted Owl's decline.

North Cascades National Park Service Complex represents a large area of pristine habitat and is an excellent study area to monitor trends in wildlife populations. NOCA's unique location at the northern edge of the Spotted Owl's range makes it an outstanding area for monitoring expansion or contraction of this species range. We recommend the following for future study of NOCA's Spotted Owl populations:

* Continue demographic monitoring of Spotted Owls in NOCA on a long-term basis, as required by the President's Forest Plan, the Endangered Species Act, and the Spotted Owl Recovery Plan.

* Initiate a program to determine the effects of Barred Owl populations on Spotted Owl populations in the North Cascades. Documenting displacement of Spotted Owls by Barred Owls and quantifying habitat use differences between the two species in NOCA will enable us to better understand ecological relationships between these two owl species.

LITERATURE CITED

Agee, J.K., and J. Kertis. 1986. Vegetation cover types of the North Cascades. National Park Service Cooperative Park Studies Unit, College of Forest Resources, Univ. of Washington, Seattle. 64 pp. + map.

Almack, J.A., W.L. Gaines, R.H. Naney, P.H. Morrison, J.R. Eby, G.F. Wooten, M.C. Snyder, S.H. Fitkin, and E.R. Garcia. 1993. North Cascades Grizzly Bear Ecosystem evaluation; final report. Interagency Grizzly Bear Committee, Denver, CO. 156 pp.

Anderson, D.R., and K.P. Burnham. 1992. Model building and statistical inferences for adult female northern Spotted Owls. Paper presented at 62nd Cooper Ornithological Society meeting, June 22-28, 1992. Seattle, WA.

Banci, V. 1989. A survey of the Spotted Owl in southwestern British Columbia, 1989. Unpubl. progress rpt. B.C. Conservation Foundation in association with B.C. Ministry of Environment. Surrey, B.C. 16 pp.

Buchanan, J.B. 1991. Spotted Owl nest site characteristics in mixed conifer forests of the eastern Cascade Mountains, Washington. M.S. thesis. Univ. of Washington, Seattle.

Burnham, K.P., D.R. Anderson, and G.C. White. 1994. Estimation of vital rates of the northern spotted owl. Pp. 1-26 *in* Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern Spotted Owl. Vol II, Appendix J. USDA, Forest service and USDI, Bureau of Land Management, Portland, OR.

Christophersen, R.G. and R.C. Kuntz II. 1995. North Cascades National Park Service Complex Northern Spotted Owl Inventory and Monitoring Program - 1995 Progress Report. Unpubl. progress rpt. National Park Service, North Cascades National Park Service Complex, Sedro Woolley, WA. 22 pp.

Dunbar, D.L., B.P. Booth, E. D. Forsman, A. E. Hetherington, and D. J. Wilson. 1991. Status of the Spotted Owl, *Strix occidentalis*, and Barred Owl, *Strix varia*, in southwestern British Columbia. Canadian Field-Naturalist 105:464-468.

Forsman, E. D. 1976. A preliminary investigation of the Spotted Owl in Oregon. M.S. Thesis. Oregon State University, Corvallis. 127pp.

Forsman, E.D. 1983. Methods and materials for locating and studying Spotted Owls. USDA, Forest Service, Gen. Tech. Rpt. PNW-162. 8 pp.

Forsman, E.D. and B. Booth. 1986. A survey of the Spotted Owl in the Skagit River Region of British Columbia. Unpubl. rpt. 9 pp.

Forsman, E. D., E.C. Meslow, and M.J. Strub. 1977. Spotted Owl abundance in young versus old-growth forests, Oregon. Wildlife Society Bulletin 5: 43-47.

Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Report PNW-8. USDA, Forest Service, Pacific Northwest Forest and Range Exp. Stn., Portland, OR. 417 pp.

Fredrickson, R.J., D.E. Seaman, B.B. Moorhead, and D.B. Houston. 1992. Northern Spotted Owl inventory and monitoring in Olympic National Park - 1992 progress report. Unpubl. Progress rpt. National Park Service, Olympic National Park. 14 pp.

Grant, J. 1966. The Barred Owl in British Columbia. Murrelet 47: 39-45.

Gutierrez, R.J. 1994. Changes in the distribution and abundance of Spotted Owls during the past century. Pp. 293-300 *in* J. R. Jehl, Jr. and N. K. Johnson, eds. A century of avifaunal change in western North America. Studies in Avian Biology No. 15.

Hamer, T.E. 1988. Home range size of the northern Barred Owl and northern Spotted Owl in Western Washington. M.S. Thesis. Western Washington University, Bellingham, WA. 86 pp.

Hamer, T.E., E.D. Forsman, A.D. Fuchs, and M.L. Walters. 1994. Hybridization between Barred and Spotted Owls. The Auk 111: 487-492.

Kuntz, R.C. II, R.G. Christophersen, and R.E. Holmes. 1993. North Cascades National Park Service Complex Northern Spotted Owl Inventory and Monitoring Program - 1993 Progress Report. Unpubl. progress rpt. National Park Service, North Cascades National Park Service Complex, Sedro Woolley, WA.

Kuntz R.C. II, and R.G. Christophersen. 1994. North Cascades National Park Service Complex Northern Spotted Owl Inventory and Monitoring Program - 1994 Progress Report. Unpubl. progress rpt. National Park Service, North Cascades National Park Service Complex, Sedro Woolley, WA. 22 pp.

Lechleitner, R., M. Cookson, and E. Miller. 1996. Mount Rainier National Park northern Spotted Owl inventory and monitoring program - 1995 progress report. Unpubl. Progress rpt. National Park Service, Mount Rainier National Park. 12 pp.

McKelvey, K., B.R. Noon, and R.H. Lamberson. 1992. Conservation planning for species occupying fragmented landscapes: the case of the northern Spotted Owl. Pp. 424-450 *in* P.M. Kareiva, J.G. Kingsolver, and R.B. Huey, eds. Biotic interactions and global change. Sunderlund, MA: Sinauer Associates, Inc.

North Cascades National Park Service Complex. 1994. Resource Management Plan. 209 pp.

Seaman, D.E., R.J. Fredrickson, D.B. Houston, B.B. Moorhead, and R.A. Hoffman. 1992. Northern Spotted Owl inventory - Olympic National Park. Unpubl. progress rpt. National Park Service, Olympic National Park. 42 pp.

Seaman, D.E., S.A. Gremel, S.L. Roberts, and D.W. Smith. 1996. Spotted Owl inventory-monitoring in Olympic National Park - Final Report. Unpubl. Progress rpt. National Park Service, Olympic National Park. 31 pp.

Taylor, A.L. and E.D. Forsman. 1976. Recent range expansion of the Barred Owl in western North America, including the first records for Oregon. Condor 78: 560-561.

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern Spotted Owl. Report of the Interagency Scientific Committee to address the conservation of the northern Spotted Owl. U.S. Government Printing Office 1990:791-171/20026. 427 pp.

U.S. Dept. of Agriculture, Forest Service. 1994. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern Spotted Owl. Vol. I, 322 pp.

U.S. Dept. of Interior (USDI), Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; determination of threatened status for the northern Spotted Owl, final rule. Washington D.C. Federal Register 55 (123):26114-26194.

U.S. Dept. of Interior (USDI), Fish and Wildlife Service. 1992a. Recovery plan for the northern Spotted Owl - draft. Washington, D.C. 662 pp.

U.S. Department of the Interior, Fish and Wildlife Service.1992b. Protocol for surveying proposed management activities that may impact northern Spotted Owls. Unpubl. rpt. 20 pp

U.S. Dept. of the Interior, National Park Service. 1989. Environmental assessment: North Cascades visitor center, environmental learning center, and Ross Lake/Happy Flats overlook, North Cascades National Park, Washington. NPS, Denver Service Center, Denver, CO. 33 pp.

APPENDICES

APPENDIX 1. Vegetation classes and class definitions of potential spotted owl habitat (from: Almack et al. 1993, by permission of the authors).

---

1 - CONIFER 70+ - Conifer forest of trees over 10 ft tall with greater than 70% canopy closure. In the upper ecological zone this class is restricted to stands greater than 50 years old.

2 - CONIFER 50% TO 70% - Conifer forest of trees over 10 ft tall with 50% to 70% canopy closure. In the upper ecological zones all forests with this canopy closure are included. In the PSME (*Pseudotsuga menziesii*) and PIPO (*Pinus ponderosa*) zones only those forests with 50% to 70% conifer canopy cover and total tree, shrub, and herb cover less than 130% are included.

3 - CONIFER 30% TO 50% - Conifer forest of trees over 10 ft tall with 30% to 50% canopy closure. Herbaceous or shrubby vegetation may be greater than tree cover.

4 - CONIFER 50% TO 70% IN PSME AND PIPO ZONES - Conifer forests with 50% to 70% canopy closure and lush shrub and/or herbaceous occurring in PIPO or PSME zones. Total tree, plus shrub and herbaceous vegetation must be greater than 130%.

5 - RIPARIAN CONIFER OVER 70% CANOPY COVER - Same as 1, except in the riparian zone. Includes forest with over 70% conifer cover in the upper ecological zone.

6 - RIPARIAN CONIFER 50% TO 70% CANOPY CLOSURE - Same as 2 and 4, except in the riparian zone.

7 - RIPARIAN CONIFER 30% TO 50% CANOPY CLOSURE - Same as 3, except in the riparian zone.

APPENDIX 2. Summary of Spotted Owl detections in North Cascades National Park Service Complex, Washington (1993-1996).

SITE NAME	STATUS[1]	ELEVATION (m)	YEAR FOUND[2]	YEARS ACTIVE (%)[3]
Flick Ck	Male	355	1993	1 (25)
Agnes Ck	Pair	690	1993	4 (100)
Buzzard Ck	Pair	730	1993	4 (100)
Theis Ck	Pair	670	1993	1 (25)
Imus Ck	Unk	605	1993	1 (25)
Four Mile Ck	Pair	430	1993	4 (100)
Upper Newhalem	Male	435	1994	1 (33)
Little Devil	Pair	810	1994	1 (33)
Deer Lick	Pair	591	1995	2 (100)
Damnation Ck	Unk	878	1996	1 (100)
Gorge Ck	Male	317	1996	1 (100)

[1] Site was given pair occupancy status if a pair was located in 1 of 4 years.
[2] Includes only first-time detections.
[3] Site was considered active for that year if a response was solicited in that year.

APPENDIX 3. Summary of Barred Owl detections in North Cascades National Park Service Complex, Washington (1993-1996).

SITE NAME	DATE[1]	STATUS	ELEVATION (m)[1]
Stehekin R Rd I	4/21/93	Pair	335
Rainbow Lk Tr I	6/16/93	Male	1510
Company Ck	7/30/93	Pair [2]	380
Kettling Ck	8/11/93	Pair	1275
Rainbow Lk Tr M	8/16/93	Male	1345
Colonial Cmpgnd	3/14/94	Pair	380
N'halem Ck Tr L	3/22/94	Unk	230
Ruby Arm	3/24/94	Male	550
Panther Ck Tr I	3/28/94	Unk	1030
Pyramid Lk	3/29/94	Unk	725
Ruby Boundary	3/31/94	Unk	755
Neve Ck	4/20/94	Male	660
Green Pt	4/21/94	Pair [2]	750
Hwy 20 II	4/26/94	Unk	630
Fisher Ck Tr U	5/3/94	Unk	1450
Thunder Ck Tr V	5/4/94	Male	975
Fisher Ck Bound	5/26/94	Pair	865
Little Devil	6/8/94	Male [2]	991
Fisher Ck Tr M	6/21/94	Pair	1145
Fisher Ck	6/21/94	Unk [3]	381
East Bank Tr IV	3/21/95	Unk	658
Big Beaver Ck Tr I	3/22/95	Pair	585
Lightning Ck Tr II	4/4/95	Male	890
Picket Fence West	4/8/95	Unk	549
L Beaver Ck Tr I	4/19/95	Unk	658
Ross Dam Tr L	4/22/95	Pair	628
Big Beaver Wet	5/4/95	Pair [4]	536
L Beaver Ck Tr II	5/6/95	Pair	582
Canadian Border E	5/17/95	Pair	524
Silver Ck L	5/18/95	Male	719
Ross Dam Tr U	5/20/95	Pair	597
Arctic Ck	5/21/95	Female	853
L Beaver Ck Tr III	6/1/95	Pair	658

[1] Includes only first-time detections.
[2] Not detected by survey.
[3] Viewed as an "uncertain" activity site.
[4] Identified as a male Spotted X Barred Owl hybrid paired with a female Barred Owl.

APPENDIX 3. (continued)

SITE NAME	DATE[1]	STATUS	ELEVATION (m)
B Beaver Ck Tr III	6/1/95	Pair	567
B Beaver Cmpgnd	6/4/95	Pair	512
Lightning Ck Tr III	6/15/95	Unk [3]	695
L Beaver Ck Tr IV	6/27/95	Unk [3]	670
L Beaver Ck Tr IV	6/28/95	Pair	732
L Beaver Ck Tr V	6/29/95	Pair	792
Damnation Ck Tr	4/3/96	Unk	780
Diablo Lk Tr	4/6/96	Male	427
Chilliwack R Tr I	4/16/96	Pair	646
Chilliwack R	4/16/96	Unk	665
Chilliwack R Tr III	4/19/96	Unk [3]	707
Baker R Boundary	5/2/96	Male	305
Stetattle Ck Tr U	5/3/96	Male	500
Terror Ck	5/6/96	Male[2]	305
Cascade R Rd	5/18/96	Male	634
Stetattle Ck	5/31/96	Pair	720
Skagit R Ag Ponds	6/13/96	Pair	183
Bald Eagle Ck	7/1/96	Unk	354

[1] Includes only first-time detections.
[2] Not detected by survey.
[3] Viewed as an "uncertain" activity site.

APPENDIX 4. Summary of "other" owl detections in North Cascades National Park Service Complex, Washington (1993-1996).

SPECIES	DATE[1]	STATUS	ELEVATION (m)[1]
Northern Pygmy-Owl	6/18/93	Unk	459
Northern Pygmy-Owl	7/12/93	Unk	1215
Northern Pygmy-Owl	3/17/94	Unk	466
Northern Pygmy-Owl	3/23/94	Unk	482
Northern Pygmy-Owl	4/21/94	Unk	664
Northern Pygmy-Owl	4/28/94	Unk	393
Northern Pygmy-Owl	5/18/94	Unk	725
Northern Pygmy-Owl	5/19/94	Unk	555
Northern Pygmy-Owl	5/24/94	Unk	1018
Northern Pygmy-Owl	5/25/94	Unk	1146
Northern Pygmy-Owl	6/21/94	Unk	1329
Northern Pygmy-Owl	3/26/95	Unk	655
Northern Pygmy-Owl	4/9/95	Unk	738
Northern Pygmy-Owl	4/20/95	Unk	671
Northern Pygmy-Owl	6/27/95	Unk	634
Northern Pygmy-Owl	4/16/96	Pair	744
Northern Pygmy-Owl	5/4/96	Unk	1024
Northern Pygmy-Owl	6/12/96	Unk	963
Northern Saw-whet Owl	4/8/93	Unk	410
Northern Saw-whet Owl	5/26/93	Unk	715
Northern Saw-whet Owl	3/21/94	Unk	475
Northern Saw-whet Owl	4/21/94	Unk	573
Northern Saw-whet Owl	5/16/94	Unk	579
Northern Saw-whet Owl	6/7/94	Unk	460
Northern Saw-whet Owl	6/8/94	Unk	747
Northern Saw-whet Owl	4/3/95	Unk	774
Northern Saw-whet Owl	4/4/95	Unk	847
Northern Saw-whet Owl	5/7/95	Unk	1170
Northern Saw-whet Owl	4/4/96	Unk	976
Northern Saw-whet Owl	4/6/96	Unk	451
Northern Saw-whet Owl	4/16/96	Unk	707

[1] Includes only first-time detections.

APPENDIX 4. (continued)

SPECIES	DATE[1]	STATUS	ELEVATION (m)[1]
Great Horned Owl	4/9/93	Pair	420
Great Horned Owl	6/18/93	Unk	960
Great Horned Owl	7/2/93	Unk	745
Great Horned Owl	4/9/95	Unk	701
Western Screech Owl	7/12/93	Unk	335
Unknown owl sp.	3/21/94	Unk	680
Unknown owl sp.	5/4/94	Unk	664
Unknown owl sp.	4/9/95	Unk	509
Unknown owl sp.	4/22/95	Unk	579
Unknown owl sp.	5/30/96	Unk	1183

[1] Includes only first-time detections.

APPENDIX 5. Summary of Spotted Owls banded in North Cascades National Park Service Complex, Washington (1990-1996).

BAND NUMBER[1]	LEG[2]	COLOR BAND[3]	LEG[2]	AGE[4]	SEX[5]	DATE BANDED
877-63237[6]	R	GREEN	L	A	M	21/JUN/90
877-63236[6]	R	ORANGE	L	A	F	21/JUN/90
1387-74204[7]	L	RED/WHITE/RED	R	J	M	23/JUN/93
1387-64924[7]	R	RED/WHITE/RED	L	J	F	30/JUN/93
1387-79407[7]	R	RED/WHITE/RED	L	J	U	21/JUL/94
1387-79408[7]	L	RED/WHITE/RED	R	J	U	21/JUL/94
1387-74210[8]	R	RED	L	A	M	19/AUG/93
1387-74209[8]	R	BLUE	L	A	F	19/AUG/93
1387-79403[7]	R	YELL/BLK/YELL	L	S	F	03/JUN/95
877-63232[6]	R	BLACK	L	A	M	20/JUN/90
1387-64923[6]	L	YELLOW	R	A	F	28/JUN/93
1387-64975[7]	R	RED/WHITE/RED	L	J	M	02/JUL/93
1387-79401[8]	L	ORANGE	R	S	F	17/MAY/94
1387-79411[7]	L	GREEN	R	A	M	14/JUN/96
1387-79412[7]	R	YELLOW	L	A	F	14/JUN/96
1387-79413[7]	L	RED/WHITE/RED	R	J	U	03/JUL/96
1387-79414[7]	R	RED/WHITE/RED	L	J	U	03/JUL/96
1387-79402[9]	R	ORANGE	L	A	M	09/MAY/95

[1] U.S. Fish and Wildlife Service issued band number.
[2] Leg band is on: R = right, L = left.
[3] Color band is unique band used to mark individual adults and juveniles.
[4] A = adult; J = juvenile; S = subadult.
[5] M = male; F = female; U = unknown
[6] Bird banded by NCASI biologists as part of Wenatchee National Forest Spotted Owl demographic study.
[7] Bird banded at a Spotted Owl "historic" activity site.
[8] Bird banded at a new Spotted Owl activity site.
[9] Bird banded was identified as a male Spotted X Barred Owl hybrid.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their developement is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaing by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

(NPS D 224) (December 1996)