

SPOTTED OWL MONITORING IN OLYMPIC NATIONAL PARK: 2009 ANNUAL REPORT



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Cover Photograph: Male northern spotted owl in the Lost River drainage, by Courtney Greiner, NPS.

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EXECUTIVE SUMMARY

This report summarizes progress on the northern spotted owl (*Strix occidentalis caurina*) monitoring program in Olympic National Park (ONP) in 2009. Monitored spotted owl territories in ONP, together with those visited by U.S. Forest Service Pacific Northwest Research Station (PNW) crews in the surrounding Olympic National Forest, make up the Olympic Peninsula Demographic Study Area. This is one of eight demographic study areas called for under the Effectiveness Monitoring Plan for the Northwest Forest Plan. The goal of these studies is to estimate spotted owl population trends from demographic data.

ONP personnel monitored and managed data on a sample of 52 spotted owl territories (hereafter “sites”) in 2009 to determine their occupancy and reproductive status. Nine sites were occupied by spotted owl pairs, and seven by single spotted owls, roughly 1/3 the level of occupancy in the early 1990’s. We documented no nesting attempts at any site, but this is not unusual in the Olympics following years when most NSO attempt to nest, as they did last year. We relocated 21 previously banded spotted owls, and located four that either had no bands or bands could not be confirmed. No new NSO were banded in 2009.

Data collected 1990-2008 was analyzed at a workshop in Corvallis, OR in January of 2009. These results are being peer reviewed and will be released this winter. The most recent analysis of trends in northern spotted owl populations, completed in January of 2004, indicated continuing declines, particularly in the northern parts of the subspecies’ range. The overall rate of decline was 4.1% a year, slightly less than the estimate for the Olympic Peninsula. Female fecundity appeared stable, but the more important estimate of adult survival was declining in several areas, including the Olympic Peninsula. All four study areas in Washington State had evidence of both declining adult survival and declining populations.

Barred owls (*Strix varia*) were first documented on the Olympic Peninsula in 1985, and competition with this species is now the primary threat to the conservation of spotted owls in protected areas such as ONP. In the course of spotted owl monitoring this year, we detected barred owls at 28 spotted owl sites and this species has now been detected at 87% of monitored spotted owl sites in ONP. Despite the presence of barred owls in the vicinity of most sites, 68% of occupied spotted owl sites remained more than 800 m from all previous barred owl locations. Occupancy of spotted owl sites has declined significantly following the first detection of barred owls in the area. Spotted owl territories which have remained occupied following detections of barred owls have both moved farther and increased in elevation relative to sites where barred owls have been absent. Extensive areas of ONP that formerly supported spotted owls, including much of the western Olympics, now appear to support only barred owls. Most remaining spotted owls are found on steep, well-drained sites above 2000’ elevation.

INTRODUCTION

Olympic National Park (ONP) is located on the Olympic Peninsula in northwest Washington State. The park consists of 922,653 acres, of which 755,820 acres are forested valleys naturally fragmented by high elevation peaks and ridges. Due to the lack of historic timber harvest or recent stand-replacing natural disturbance, most of the forested landscape is dominated by stands older than 100 years. There is a marked precipitation gradient from rainforest valleys in the southwest to rainshadow areas in the northeast, and it is convenient to refer to two very different strata (hereafter east- and west-side). Drier, east-side forests tend to be younger and are dominated by Douglas-fir (*Pseudotsuga menziesii*). West-side forests have a lower frequency of fire and contain more shade-tolerant species such as western red-cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and Pacific silver fir (*Abies amabilis*), with varying amounts of Douglas-fir.

The Olympic Peninsula demographic study area consists of 54 northern spotted owl (NSO) territories monitored by Park Service crews in Olympic National Park and 45 territories monitored by U.S. Forest Service Pacific Northwest Research Station (PNW) crews in the surrounding Olympic National Forest. Site selection for the ONP portion of the study was not strictly random. Initially, all known sites were monitored. As additional sites were located in the course of surveying randomly located inventory plots, these were added to the sample if they were within a one day hike of a site already being monitored. Forty percent of the current sample of sites were being monitored by 1990 and no sites were added or dropped after 1996. Funding and the logistics involved in monitoring sites as far as 24 miles from a trailhead determined the total number of sites that were feasible to monitor. We have continued to monitor sites regardless of their occupancy status and have also tried to keep them well distributed throughout the park, although we monitor fewer sites on the park's west side due to the lower density of spotted owls there. This study area, including both Park and Forest Service managed lands, is generally representative of habitat conditions on federal lands on the Olympic Peninsula, although the proportion of suitable habitat in the study area is somewhat higher than outside, owing to the higher proportion of National Park land (Appendix F, Anthony et al., 2006). It is not representative of state, private and tribal lands on the Olympic Peninsula, where there is little suitable habitat and few or no remaining spotted owls.

This report summarizes results of fieldwork, cooperative efforts and administration of National Park Service run portion of Olympic Peninsula Demographic Study during the 2009 breeding season. It is intended as a summary of results for administrators and cooperators, but does not present detailed methodologies or data analysis. Methods are described in Franklin et al. (1996).

Results from the PNW administered portion of the Olympic Peninsula study will be posted at: <http://www.fs.fed.us/pnw/olympia/wet/team-research/owl-res/index.shtml>

Reports from most cooperators in the Northwest Forest Plan's Northern Spotted Owl Effectiveness Monitoring Program are available at:
<http://www.reo.gov/monitoring/reports/northern-spotted-owl-reports-publications.shtml>

OBJECTIVES

The Olympic Peninsula demography study is one of eight areas where demographic rates are monitored to assess the effectiveness of the Northwest Forest Plan in preventing a further decline in spotted owl populations. ONP also provides a unique opportunity to understand the ecology of the northern spotted owl in a large area of suitable habitat with almost no history of timber harvest. The specific objectives of the study are to:

- 1) Document age-specific survival and fecundity to contribute to a range-wide assessment of spotted owl population trends, as required by the effectiveness monitoring component of the Northwest Forest Plan.
- 2) Monitor the effects of increasing barred owl populations on spotted owls.

2009 RESULTS

General Monitoring and Site Status

The project employed seven full-time biological technicians, two Student Conservation Association interns, and the project lead. ONP field crews made 225 visits (mean visits/site = 4.2, range 1-7) to 54 monitored spotted owl sites (Figure 1). Two of these sites were formerly monitored by PNW crews, and they will continue to manage those data. We report these site visits here, but the sample size for most analysis is 52 sites except where noted. Most visits (89%) were daytime searches, and crews focused search efforts on recently occupied activity centers, covering suitable habitat out to 2 km as time permitted. The full field crew (4-5 one or two-person teams) visited owl sites between March 30 and July 15.

Winter snow pack was just over 50% of normal at the beginning of the field season, but near or above normal precipitation prevailed in the months of April-June (NRCS data). There was some form of precipitation on 23% of site visits, in the form of heavy rain (5%), light rain (13%), snow (3%), and thunderstorms or hail (1%). The only major access issue was the continued closure of the Dosewallips Road, which added 5.5 miles to the approach hike to four sites.

The 52 spotted owl sites monitored in 2009 represented a sample of roughly 23% of the 229 spotted owl territories estimated to occur in ONP as of 1995 (Seaman et al., 1996). The mean

length of record was 17.4 years (range 14-18), not including years prior to 1992 when monitoring to current protocols began at most sites.

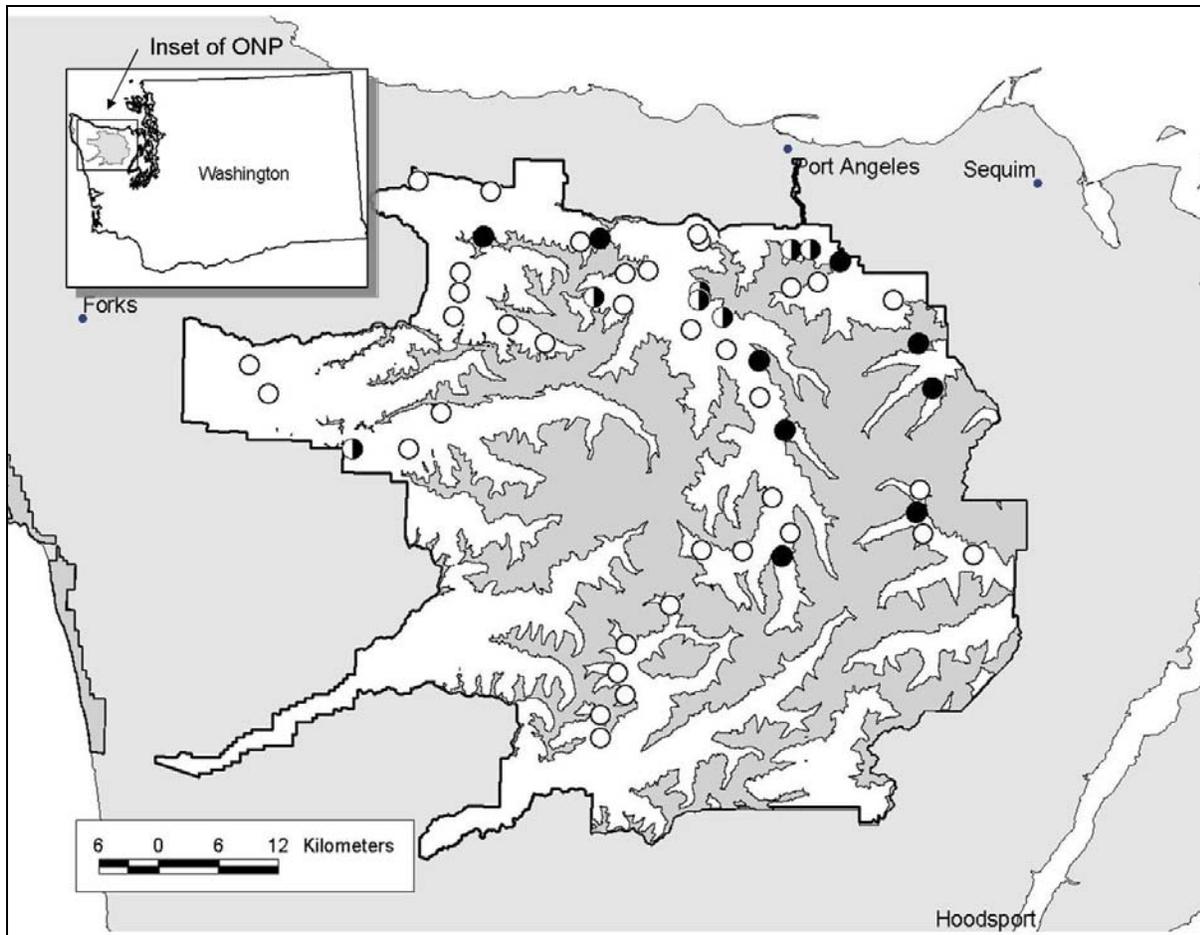


Figure 1. Location and occupancy status of 52 monitored spotted owl territories in Olympic National Park, 2009. Black dots are spotted owl pairs, half-filled circles are single owls and white circles are monitored sites with no response. Shaded area within the park boundary is high elevation non-habitat.

At least one spotted owl was detected at 16 (31%) of the monitored sites, and pairs were documented at 9 of these (Figure 2). We detected one or more spotted owls on only 13% of site visits. For the third year in a row we did not locate any spotted owl pairs at monitored sites on the west side of the park. We located a total of 25 spotted owls at monitored sites, of which 14 were males, 10 were females, and one was of unknown sex. These rates of occupancy are around 1/3 of that in the early 1990's, and represent the lowest annual count of NSO detected since this study began. All of the 23 territorial owls identified to age class were adults three years of age or older. Two spotted owls were of known age (3 and 15 years) as a result of initially being banded as juveniles or sub-adults.

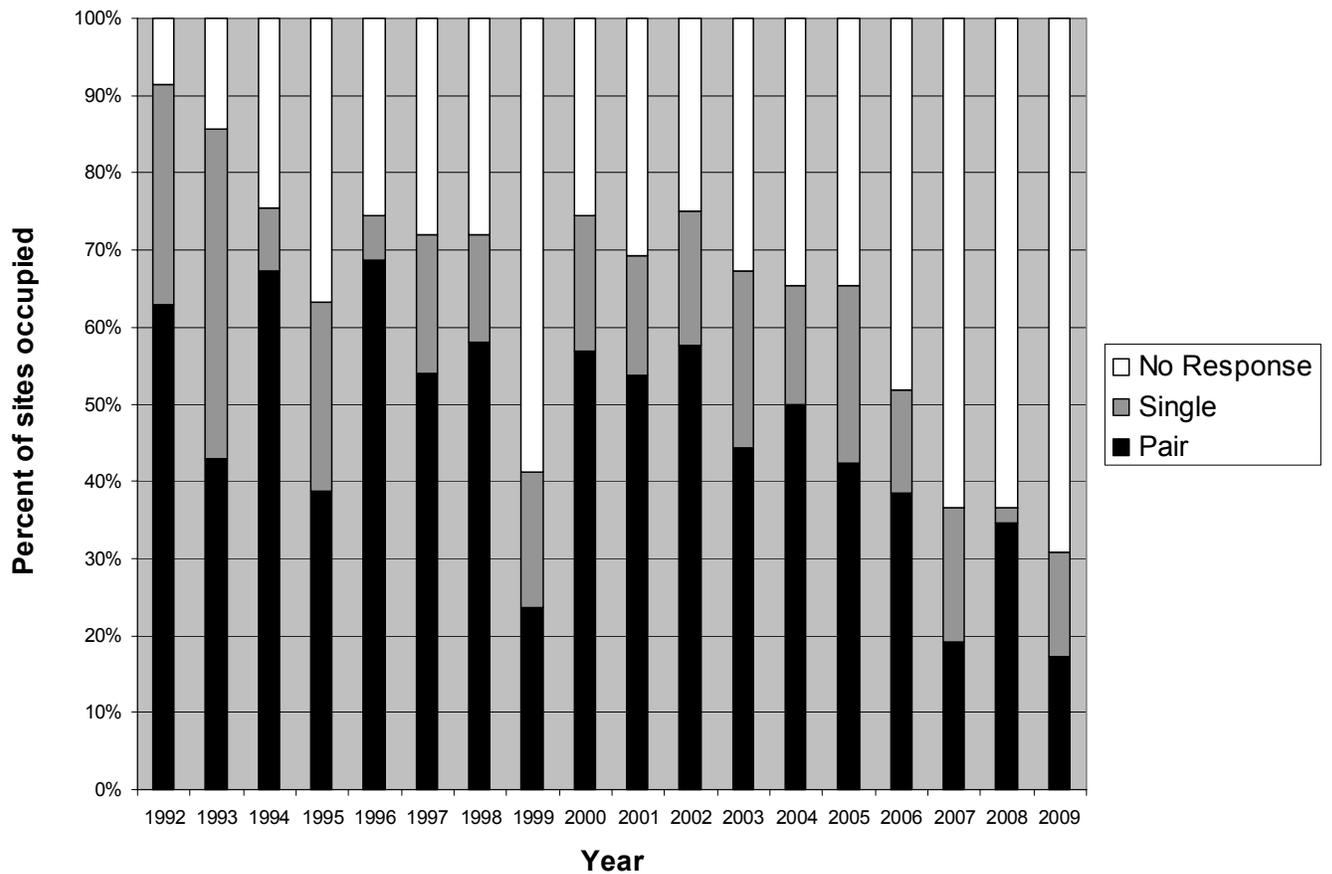


Figure 2. Percent of monitored spotted owl sites occupied by 0, 1, or 2 adult owls, Olympic National Park, 1992-2009.

When calculated for a fixed sample of NSO sites monitored from 1994-2009 (N = 49), the mean elevation of occupied sites has increased 628' over 16 years to 2753'. Only one occupied site, and no spotted owl pairs, was located below 2000' elevation this year. While there is clearly a relationship between elevation and the likelihood that a spotted owl site has remained occupied, models indicate that slope and topographic moisture explain more of the variance in occupancy than elevation alone (Gremel, 2005). However, in this landscape the steep, dry sites where spotted owls remain tend to occur at higher elevations. It is likely that all of these topographic variables are simply correlates for barred owl occupancy (see later section). Regardless of which factors are responsible, spotted owl distribution in the Olympics has changed radically over the course of this study. Remaining spotted owls are increasingly restricted to steep slopes and higher elevations, often in headwaters and side drainages, in the relatively dry northeast Olympics.

Nest and Reproductive Monitoring

We determined the reproductive status of 8 of 10 female spotted owls at monitored sites and none attempted to nest. Spotted owl productivity (fecundity) is calculated as the number of female young produced per territorial female, assuming a 50:50 sex ratio of offspring. Spotted owl fecundity in the Olympics has been highly variable, with years of high productivity often followed by years with little or no nesting, as happened this year (Figure 3).

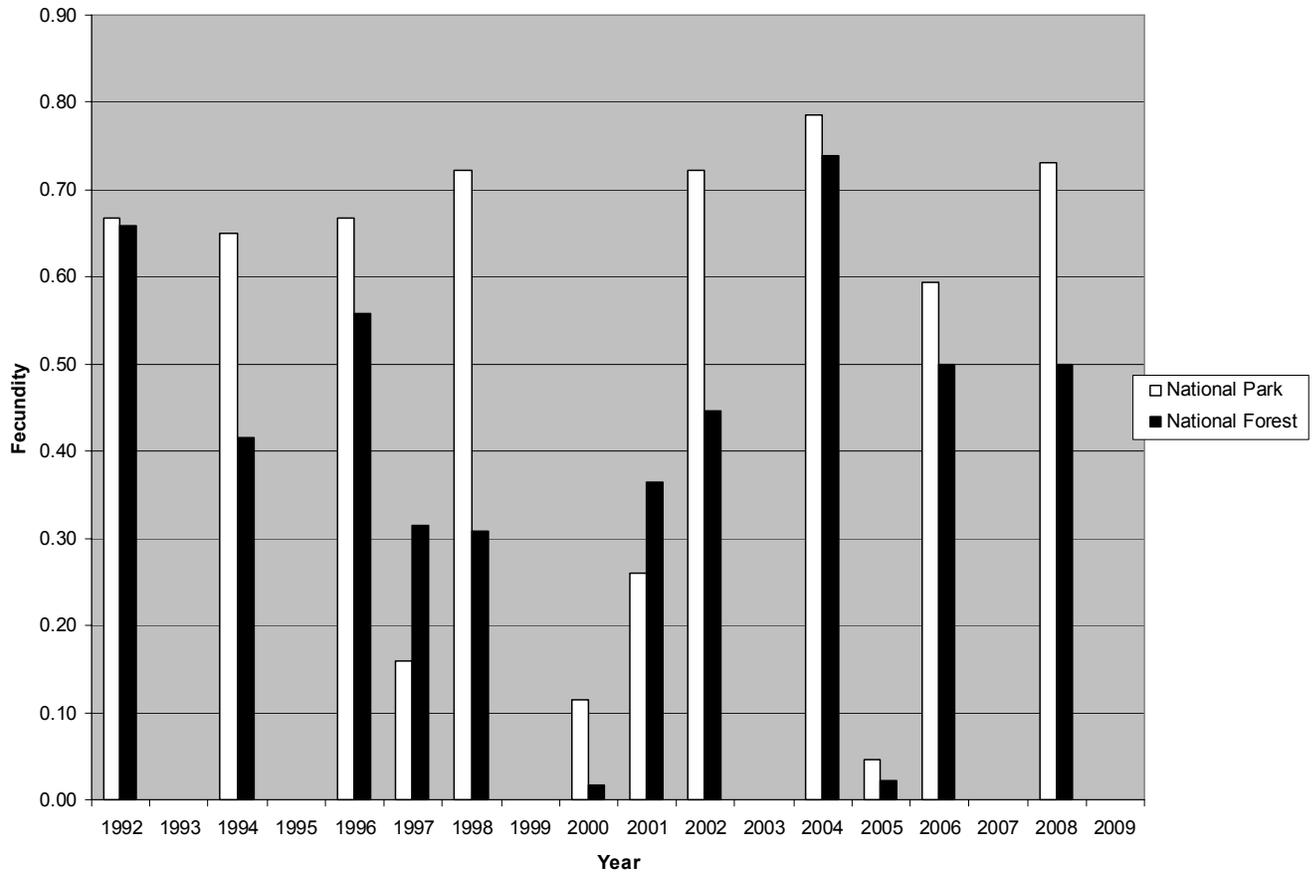


Figure 3. Olympic Peninsula adult spotted owl fecundity (mean # of female offspring/territorial female), 1992-2009. Includes both National Park (white bars) and National Forest (black bars).

This was the sixth year since 1992 when spotted owl fecundity in ONP was zero. In each of these years fecundity in the neighboring Olympic National Forest was also zero (Figure 3). The mean annual fecundity rate for adult female spotted owls in ONP ($N = 18$ years) was 0.34 (SE 0.079); the estimate for adult females over the range of the northern spotted owl was 0.37 (SE 0.029) (Anthony, et al., 2004).

The high year-to-year variation in female fecundity has been driven by the proportion of the population attempting to nest, and the productivity of those nests, rather than the rate of nest success, which averages 90% (Appendix 1). Of 195 nesting attempts with known outcomes since 1992, only 18 have failed.

Banding and Capture

Banding owls is necessary to identify individuals and estimate survival rates. All captured owls are fitted with a unique U.S. Fish and Wildlife Service number band. Adult and sub-adult owls are marked with a color band unique to a 16 km radius from the capture site, which enables field crews to identify these individuals without recapturing them. Juveniles receive a standard color band, which is changed if these birds are re-captured as adults on a new territory. We use standard capture techniques for spotted owls (Franklin et al., 1996), and emphasize owl safety during training.

ONP crews did not band any new spotted owls in 2009. We recaptured two spotted owls to identify a banded adult at a new site and to replace a lost color band. Of the 25 territorial spotted owls detected, we confirmed bands on 21 (84%). Single owls at two sites were only heard calling, and we were unable to capture an unbanded male (or males) found at two adjacent sites. Park crews have performed 483 captures and banded 364 spotted owls since 1988.

We captured and banded under ONP master station banding permit 22633 and U.S. Fish and Wildlife Service 10(a)(1)(a) "take" permit TE842449-3, expired February of 2009 with a renewal requested January of 2009.

Juvenile Dispersal

We did not relocate any juveniles banded in previous years. Eighteen of the 162 spotted owls banded as juveniles by ONP crews prior to 2009 have been recaptured as adults or sub-adults on the Olympic Peninsula. Five dispersed to Olympic National Forest, the rest were found within ONP. The median dispersal distance for this sample was 17.0 km, and the mean 19.4 km (SD 10.0, range 5.3-41.8 km). The mean dispersal distance of females was 42% greater than that of males, but this difference was not statistically significant. The greater dispersal distance for females is consistent with results reported by Forsman et al. (2002) for a large sample of juveniles in Washington and Oregon. The mean age at recapture was 2.9 years, implying that most spotted owls spend several years as non-territorial "floaters" or on territories outside of our study sites before being detected. To date, we have documented no dispersal of spotted owls between the Olympic Peninsula and Cascade provinces.

Barred Owls and Hybrids

Barred owls have recently expanded their range into the Pacific Northwest. The first documented occurrence on the Olympic Peninsula was on the west side of ONP in 1985 (Sharpe, 1989), and the number of sightings continues to increase. Barred owls are dominant in competitive interactions with spotted owls and evidence from many areas suggests that barred owls displace spotted owls from otherwise suitable habitat (Dark et al., 1998; Hamer, 1988; Kelly, 2001, Gremel, 2005).

Barred owls are generally more wary of humans and appear to be less responsive to our survey efforts than spotted owls. Most biases associated with our incidental data on barred owl occupancy, reproductive status and rate of increase likely lead to underestimates of these parameters. For example, although we attempt to revisit every past activity center at a spotted owl site, more of those visits cover where the spotted owls were most recently located. Since current locations are often a result of spotted owls moving to areas of lower barred owl activity, less of our monitoring is devoted to the areas where barred owls are most abundant. Also, as barred owl densities have increased, it has become more difficult to discern the number of adjacent territories. Barred owls are not banded and we conservatively lump clusters of sightings within several kilometers of each other as one territory ("site") until we get simultaneous evidence of multiple pairs. Many barred owl sites with single occupancy were not visited frequently enough to determine pair status, or at the proper time to document reproduction. Consequently, our estimates of barred owl pair and reproductive status should be considered minimum estimates of these values, and are useful only as indices for comparison among years.

We recorded barred owls on 55 separate occasions representing an estimated 38 barred owl territories during spotted owl surveys in 2009. We also detected barred owls on other occasions at these sites and two other territories while calling for or radio-tracking barred owls. These data are tracked separately from incidental detections on spotted owl surveys, so as not to bias comparisons of barred owl detections with previous years when these methods were not used. To standardize for variable survey effort between years, the annual count of occupied barred owl sites was divided by the number of days spotted owl survey teams were in the field (Fig. 4). The annual rate of increase in this index, calculated from the log of the slope from 1992-2009, was 13.9 % a year.

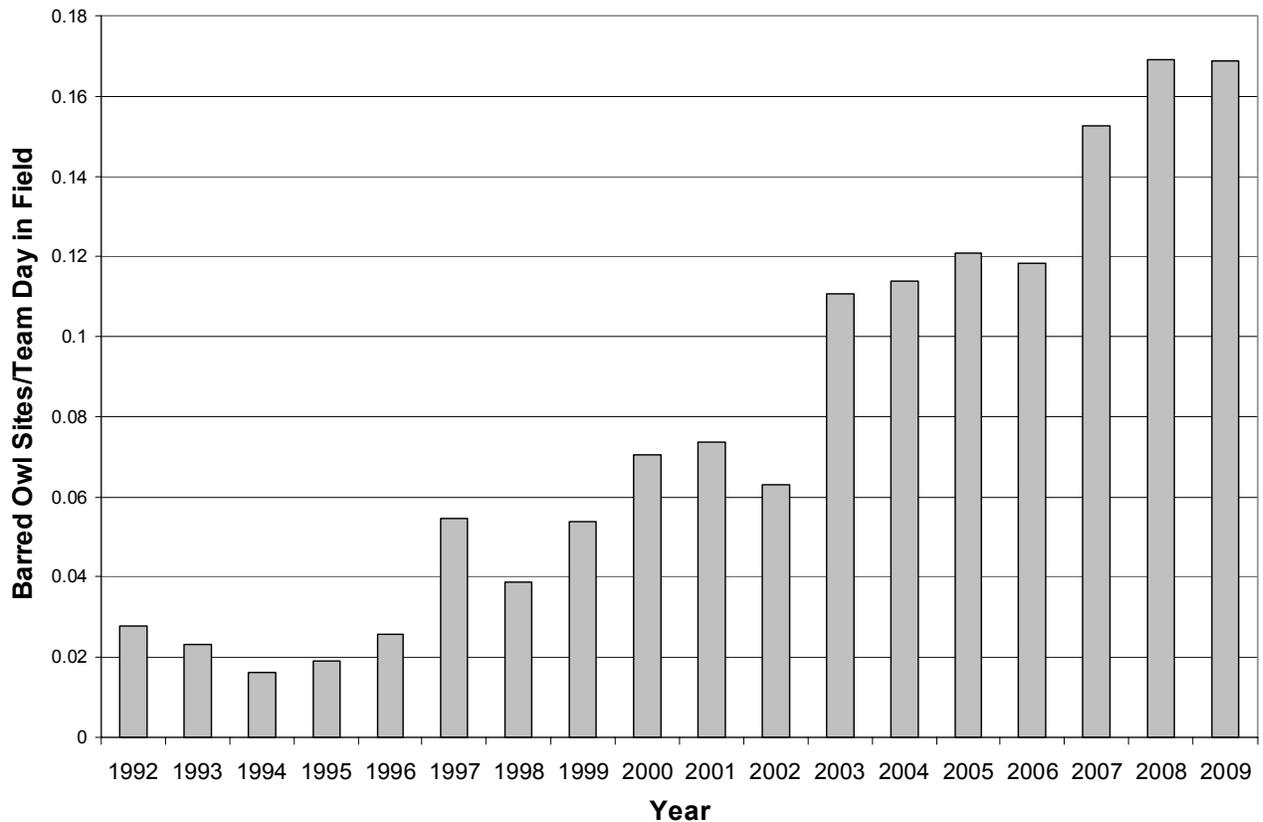


Figure 4. *Number of occupied barred owl sites standardized by survey effort, Olympic National Park, 1992-2009. Excludes sites detected as a result of using barred owl calls or radio-telemetry.*

Barred owl pairs were detected at 18 sites, and single barred owls at 22. Two of these were new territories, bringing the total number of known barred owl sites in ONP to 89. We documented nesting by barred owls at 7 sites, fledging a minimum of 8 juveniles. An index of barred owl reproduction (the number of juveniles detected/occupied barred owl site) correlated significantly with annual rates of spotted owl fecundity from 1992-2006 (Spearman's rho = 0.726, $p < 0.01$).

Hybridization between barred and spotted owls has been documented, but appears to be infrequent after the initial period of colonization (Hamer et al. 1994; Herter and Hicks, 2000; Kelly and Forsman, 2004). We know of two hybrids in the park, a male and a female, both paired with barred owls inhabiting former spotted owl activity centers. Neither hybrid was confirmed this season.

Morse Creek Barred Owl Study

We conducted a third season of work on a 7000 acre study area in the Morse Creek drainage, where we are monitoring density and space use by barred owls. The area was selected for its combination of both year-round road and trail access and the history of monitoring at all known spotted owl sites ($N = 5$). We did not receive funding to radio-mark both barred and spotted owls and continue landscape scale density surveys. We continued demographic monitoring of the spotted owls in the area and a pilot barred owl radio-telemetry project.

Surveyors located one pair of non-nesting spotted owls, and had multiple responses from a single spotted owl at two adjacent sites that were probably from the same unbanded bird. Surveys in previous years located five pairs of barred owls in this area and we have successfully installed backpack radios on one member of each of these pairs ($N = 4$ females and 1 male). We have had good success capturing barred owls using a barred owl decoy, taped calls and mist net in early spring (March 12- April 5), capturing at least one barred owl on seven of eight attempts where barred owls responded. We installed radios on four barred owls in the spring of 2008 and now have 62- 68 locations on three of these individuals. The fourth left her summer home range in October of 2008 and was killed by an avian predator, probably a great-horned owl, in a high elevation meadow/talus slope area after we recorded 34 locations. We installed a radio on a female barred owl this spring at the fifth territory and have collected 30 breeding season locations on this bird.

Effects of Barred Owls on Spotted Owls

In 2009, we detected barred owls within 800 m of 28 monitored spotted owl sites in the course of demographic monitoring, and at one additional site as a result of telemetry. We did not detect barred owls at any spotted owl sites where they were not found in previous years. Using a cumulative measure, barred owls have been detected at 45 (87%) monitored spotted owl sites. (Fig. 5). At ONP, rates of pair occupancy have declined at spotted owl sites following the first barred owl detection there. At sites where spotted owls have remained after barred owls were detected, they have both moved farther from their original location and shifted to higher elevations, relative to spotted owl sites without barred owls (Gremel, 2005).

We found barred owls and spotted owls within 800 meters of each other at only two of 16 occupied spotted owl sites. A single unbanded male spotted owl, probably the same individual, was found at adjacent sites in Morse Creek, both within 600 meters of a barred owl response. Spotted owls at three additional sites were found within 795, 750 and 400 meters of barred owls detected in previous years, and the remaining 11 active spotted owl site centers were more than 800 meters from any prior barred owl detection.

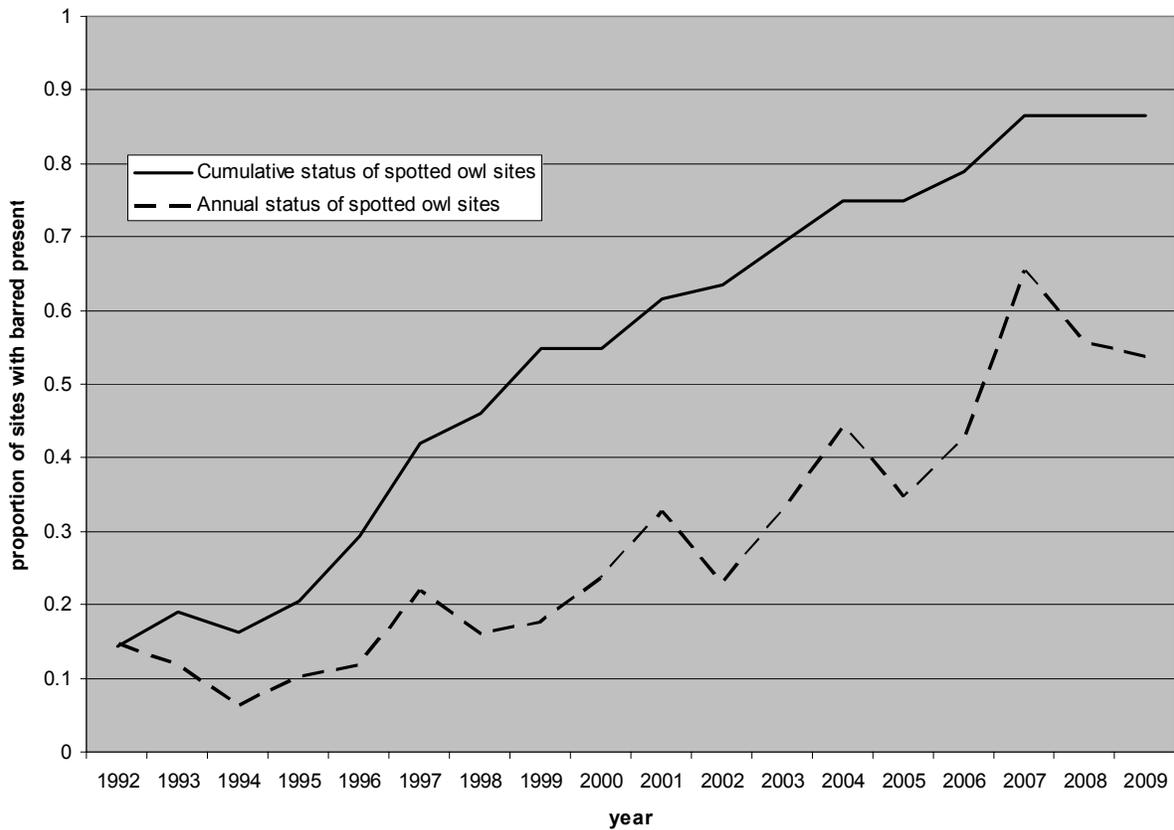


Figure 5. Presence of barred owls at monitored spotted owl sites (N=52), Olympic NP, 1992-2009. Spotted owl sites are defined as the area within 800m of any annual activity center through 2009. The solid line is the proportion of sites that have ever had a barred owl detected in this area, the broken line is the annual proportion of sites with barred owls.

Data from ONP suggest that spotted owls are avoiding areas occupied by barred owls rather than remaining and going undetected for many years. There has been no time trend in either annual spotted owl recapture probabilities, which have generally ranged between 0.6-0.8 (Anthony, et al., 2006), or per visit rates of spotted owl detection at occupied sites, which have fluctuated between 0.5 and 0.7 (ONP, unpub. data). While some data suggest that spotted owls are less vocal in the presence of barred owls (Crozier et al., 2006), we frequently detect owls on daytime visits whether or not they vocalize. Since we began recording the information in 2004, 39% of initial spotted owl detections have been visual, often as a result of owls flying in to surveyors, or surveyors investigating mobbing songbirds. We also locate spotted owl roosts by signs including pellets, whitewash, and feathers, all of which are either

absent in areas where we no longer detect spotted owls, or associated with barred owl activity centers.

Other Species

In addition to barred and spotted owls, we also record incidental responses by northern goshawks (*Accipiter gentilis*) and great-horned owls (*Bubo virginianus*). The number of occupied goshawk sites encountered during owl monitoring has ranged from 0-6 per year. This year we encountered goshawks at four sites, and found no active nests. We detected a pair of great-horned owls at one site. This species is rare in the dense, mid-elevation conifer forests of ONP where most of our monitoring takes place, and the pair found this year was located at the transition between montane forest and subalpine meadows at 3700' elevation.

COOPERATIVE EFFORTS

2004/2009 Spotted Owl Demography Workshops

We participated in the northern spotted owl demographic workshop, held January 2009 in Corvallis, OR. This was the fifth analysis to examine data from the spotted owl demography studies being conducted across the species range. Data from federal lands on the Olympic Peninsula (ONP and Olympic National Forest combined) were analyzed along with those from 10 other demographic studies to estimate age-specific rates of fecundity, survival and population trends across the range of the northern spotted owl. Results of this analysis are undergoing peer review and should be released this winter.

The previous analysis, completed in 2005, found that fecundity rates were stable, both on the Olympic demographic study area and when measured across the range of the northern spotted owl. Annual apparent survival estimates ranged from 0.75 to 0.89 for territorial non-juvenile spotted owls. Olympic was one of five study areas with evidence of a decline in survival rates over time; three of the five studies with declining survival were also located in Washington State.

Range-wide, the decline in numbers of territorial northern spotted owls was estimated to be 4.1% a year. Point estimates for 13 of 14 study areas fell below 1 (stable population), and there was evidence for a statistically significant population decline at 8 of these, including Olympic. The estimate of decline in the Olympic demographic study was 4.4% a year. The 95% confidence interval for this estimate barely included 1, indicating a strong probability, although slightly less than 95%, that NSO numbers were actually declining. Overall, it appeared that spotted owl populations in Washington were faring worse than those in Oregon and California. Population trends were more favorable on federal lands (declining 2.5% a year) than on all other study areas (declining 6.6% a year).

Northern Spotted Owl Presence/Absence Monitoring

The need for a more extensive survey method, designed to track both population trends and changes in distribution, was identified as a priority in a recent review. Beginning in 2006, we have implemented these surveys as part of the park's long-term landbird monitoring program. Crews from the Institute for Bird Populations survey randomly located 1.8 km-long transects, using protocols developed for a spotted owl inventory conducted at ONP in the early 1990's. After conducting point counts for songbirds at stations along these transects, surveyors call for spotted owls at five stations located 400 meters apart. Stations are called for 10 minutes and all stations in forested habitat are called, regardless of elevation. These surveys are providing an inexpensive test of the feasibility and statistical power of implementing a larger scale presence/absence survey.

Overall response rates by spotted owls have been quite low (Table 1). In 2009, only a single spotted owl was detected on 61 transects in Olympic, North Cascades and Mt. Rainier National Parks. Since 2005, surveys in these parks have detected 5 spotted owls and 18 barred owls on 234 transects

Table 1: Results of presence/absence owl surveys performed by Institute for Bird Populations landbird monitoring crews. Includes barred and spotted owls detected at or associated with owl calling stations, as well as incidental detections outside of formal survey.

Year	National Park	Transects Called	Stations Called	Barred Owl detections			Spotted owl detections		
				At Stations	Between Stations	Incidental	At Stations	Between Stations	Incidental
2005	Mt. Rainier	9	40	0	1	0	0	0	0
	N. Cascades	11	53	0	0	0	0	0	0
	Olympic	8	34	0	0	0	0	0	1
2006	N. Cascades	12	57	1	1	0	1	0	0
	Olympic	10	44	3	0	0	1	0	0
2007	Mt. Rainier	19	114	0	1	1	0	0	0
	N. Cascades	22	104	2	1	2	0	0	0
	Olympic	21	95	0	0	0	0	0	0
2008	Mt. Rainier	20	94	1	1	0	0	0	0
	N. Cascades	20	96	3	0	0	0	0	0
	Olympic	21	95	0	0	3	1	1	0
2009	Mt. Rainier	16	69	1	0	0	0	0	0
	N. Cascades	23	97	0	0	0	0	0	0
	Olympic	22	91	2	0	2	1	0	1

Other Interagency Activities

- Served as NPS representative on the Northern Spotted Owl Recovery Plan Implementation Team and Barred Owl Working Group (Gremel).
- Collaborated with Dr. Sam Wasser at the University of Washington, collecting spotted owl fecal samples for a study of corticosteroid stress hormone levels.
- Provided records of all field visits and annual site summary information to the Washington Department of Fish and Wildlife for a state-wide spotted owl database.
- Agreement technical representative for collaboration with Oregon State University on a study of interactions between barred and spotted owls (Happe). This study, which is underway near Eugene, OR, received \$145,000 of NPS funding through the Northwest Forest Plan's Regional Ecosystem Office.
- Supplied barred owl pellets collected in ONP to Scott Graham, Boise State University, for inclusion in a MS thesis on this species' diet within the range of the northern spotted owl.
- Collaborated with Amber Giroux and Dr. Tim Parker of Whitman College on an analysis of potential changes in spotted owl diet at ONP related to competition and displacement by barred owls. This manuscript is in preparation.
- Provided NSO pair location data to Ray Davis, BLM, for Northwest Forest Plan habitat modeling.
- Provided spotted owl occupancy data and barred owl covariate data to Dr. Katie Dugger, Oregon State University, for an analysis of the effects of barred owls on spotted owl site occupancy and probability of detection.
- Contributed a crew to conduct two weeks of spotted owl site visits on the Forest Service portion of the study area, following the injury of a member of the PNW Research Station's field crew.
- Resource advisor on the Heatwave Complex fires in ONP (Gremel). Completed three days of NSO inventory surveys and several days of monitoring at one historic NSO site prior to the fires reaching these areas.
- Supplied genetic samples of snowshoe hare (*Lepus americanus*) to Ellen Cheng, University of Montana, for a study of the species' genetics in the Olympics.

- Supplied northern goshawk feather and eggshell samples to Washington Department of Fish and Wildlife for a study of the genetics of that species in the Olympics.

BUDGET

All funding was provided by the NPS through the Regional Ecosystem Office of the Northwest Forest Plan. Funding for spotted owl monitoring was provided at the level of \$135,800 in FY 2009. An additional \$5000 was provided to support NPS participation in northern spotted owl recovery planning and the barred owl workgroup.

RECENT PUBLICATIONS

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This report is available online at:

<http://www.reo.gov/monitoring/reports/nso/Compiled-Report-091404.pdf>

ACKNOWLEDGEMENTS

The project is only possible due to the hard work, skill and dedication of the field crew. Declining spotted owl numbers have required an increasing number of all day no response searches in roadless wilderness and often difficult weather conditions. E.R. Burke, A.E. Farris, L.H. Graham, A.A. Green, C.M. Greiner, S.A. Gremel, K.M. Harrigan, T.J. Kay, and K.A. Williamson performed the fieldwork in 2009. Patti Happe, ONP Wildlife Branch Chief, provided overall project supervision and administration, T.J. Kay assisted with coordination and supervision of the field work, and R.A. Hoffman and K.F. Beirne provided GIS support and analysis. Liz Kelly, of the USFWS, generously provided the program used to map barred owl locations relative to spotted owl sites.

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APPENDIX 1

Nesting status and success rate of female spotted owls of all age classes, at monitored sites in Olympic National Park, 1992-2009.

	Non-nesting	Nesting	Unknown nest status	Total females	Proportion nest status known	Proportion females nesting	Nest success ¹
1992	1	15	7	23	0.70	0.94	0.93
1993	16		5	21	0.76	0	*
1994	3	24	7	34	0.79	0.89	0.92
1995	15		6	21	0.71	0	*
1996	5	28	3	36	0.92	0.85	0.92
1997	15	8	6	29	0.79	0.35	0.75
1998	1	24	5	30	0.83	0.96	0.91
1999	9		5	14	0.64	0	*
2000	17	10	4	31	0.87	0.37	0.56
2001	16	8	4	28	0.86	0.33	1.00
2002	3	27		30	1.00	0.90	0.92
2003	23		3	26	0.88	0	*
2004	2	22	4	28	0.86	0.92	0.95
2005	20	1	3	24	0.88	0.05	1.00
2006	1	17	2	20	0.90	0.94	0.94
2007	13		1	14	0.93	0	*
2008	1	16	2	19	0.89	0.94	0.94
2009	8		2	10	0.80	0	*
Total²	169	200	69	438	0.83	0.47	0.90

¹ Proportion of nest attempts that result in at least one fledgling, calculated on nests with known outcomes

² Where totals are calculated on proportions, they are the unweighted averages of the annual means

* No nesting attempts