

# ALTITUDINAL MIGRATION MOVEMENTS OF SPOTTED OWLS IN THE SIERRA NEVADA, CALIFORNIA<sup>1</sup>

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**Abstract.** In this study, I documented a previously unknown, downslope, fall migration in 10 adult Spotted Owls (*Strix occidentalis*) in the central Sierra Nevada, California. The owls began to migrate in mid-October and all had migrated by mid-November. They moved an average of 31 km to the southwest and dropped an average of 754 m in elevation. This migratory movement enabled the owls to establish disjunct winter home ranges below the level of heavy and persistent snow. This seasonal movement complicates the task faced by land management agencies attempting to manage a viable population.

**Key words:** Spotted Owl; *Strix occidentalis*; migration; radiotelemetry; California.

## INTRODUCTION

Until recently, the behavior and ecology of the Spotted Owl (*Strix occidentalis*) were poorly known. Interest in these topics has intensified since 1980 because of controversy regarding old-growth forest management and the owl's use of this habitat (Dawson et al. 1987). The owls were believed to be permanent residents throughout their extensive range (Bent 1938, Grinnell and Miller 1944, Phillips et al. 1964, Gabrielson and Jewett 1970, Godfrey 1979). Radiotelemetry studies in Oregon and northwestern California supported this conclusion (Solis 1983; Forsman et al. 1984; Sisco, pers. comm.), while Laymon (1985) presented preliminary data showing that some Spotted Owls moved downslope in winter.

Here I present data obtained using radiotelemetry in the central Sierra Nevada, California, during 1983 and 1984, showing a previously undocumented downslope fall migration. I examine this migratory behavior and discuss its possible origin and implications to the survival and management of the species.

## STUDY AREA AND METHODS

The study area included the Georgetown District of the Eldorado National Forest and private lands downslope to the west in El Dorado and Placer counties, California. The area encompassed 3,315 km<sup>2</sup> and ranged in elevation from 154–1,785 m. The habitats present in this area were red fir (*Abies magnifica*) forest, mixed-conifer forest,

ponderosa pine (*Pinus ponderosa*) forest, chaparral, and pine-oak woodlands.

I captured paired adult Spotted Owls in late spring and early summer and attached 31-g, RB-5 radio transmitters (Telonics, Mesa, Arizona) with harnesses made of teflon tubing. I captured and radio tagged four pairs in 1983 and two pairs in 1984; 10 of these 12 owls survived until fall. I present data on eight owls that I located at least twice a week from 15 June to 1 January and two owls that could not be located in winter. If the owls could not be found on their normal summer home ranges, I attempted to locate them using radiotelemetry from prominent locations. When these attempts failed, I searched from a light airplane.

## RESULTS

Owls began to disappear from their summer home ranges beginning on 18 October and continued to leave until 18 November (Table 1). I was locating the Ramsey female daily when it began to move downslope to the southwest on 25 October 1983. The bird moved from 1.6–9.7 km nightly, and covered the 33.8 km to its wintering site over seven nights. Using the general distance and direction of this bird as a guide, I was able to locate wintering sites of four additional owls in 1983 and three additional owls in 1984 (Table 1, Fig. 1). The wintering sites of two radio-tagged owls were not found. These owls either had transmitters that failed or they moved outside the area I searched.

Six owls moved directly from breeding to wintering sites without backtracking or repeated upslope and downslope movements. Two birds,

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TABLE 1. Migration distance, direction, elevation change, and timing of eight adult Spotted Owls in the central Sierra Nevada.

Individual owl	Distance (km)	Direction (degrees)	Average elevation (m)		First movement
			Nest	Winter	
Bacchi female	23	185	1,325	710	27 Oct 1983
Gaddis female	23	250	1,325	615	8 Nov 1983
Gaddis male	16	240	1,325	770	6 Nov 1983
McCulloh female	24	194	1,480	1,075	18 Oct 1984
Pigeon male	34	226	1,230	460	25 Oct 1983
Ramsey female	34	245	1,230	770	26 Oct 1983
Wallace female	40	250	1,600	370	7 Nov 1984
Wallace male	58	234	1,600	310	12 Nov 1984
Mean	31	228	1,389	635	1 Nov

however, made anomalous movements. The McCulloh female moved 11 km south on 18 October 1984 and 5 km southwest on 19 October, but returned to the nest site on 21 October. On 28 October she moved 16 km south and crossed the South Fork of the American River. The next night she moved the remaining 8 km to her ultimate wintering site. The Gaddis male moved 16 km downslope on 6 November 1983, returned

upslope to the nesting area on 12 November, then moved down again on 15 November. He returned upslope to the nest site on 16 December, where he died on 28 December. This owl moved the shortest distance between summer and winter home ranges, a flight it was able to make in one night.

The fall downslope movement did not correspond to any obvious major weather events. In

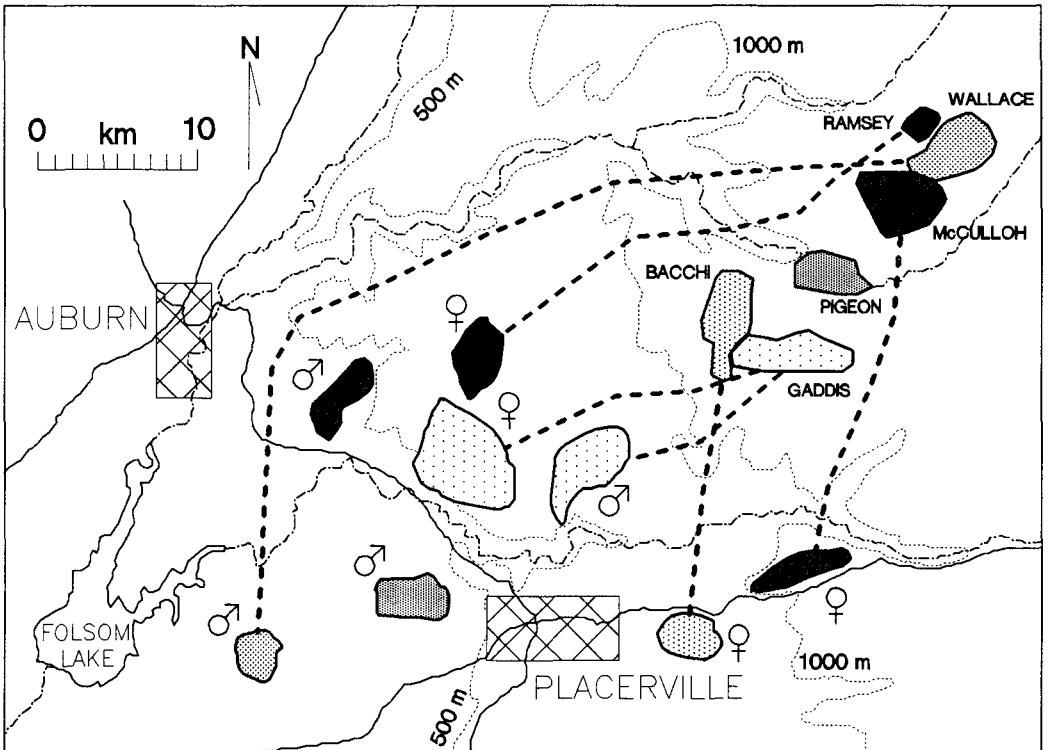


FIGURE 1. Summer and winter home ranges of eight adult Spotted Owls in Sierra Nevada, California, 1983 and 1984. Migration routes (dotted lines) are shown where known.

1983 all of the owls had migrated prior to the first major storm in mid-November. In 1984 there was a snow storm in early October, but the birds did not move until late October and early November.

The owls traveled an average distance of 31 km from the nest site to the center of the winter range and moved towards the southwest (Table 1). The two owls that were not found may have moved even farther or in an unexpected direction or may have died. The six pairs of owls bred at elevations between 1,231 and 1,600 m in mixed-conifer forests (Table 2). The owls that were followed downslope dropped an average of 754 m in elevation and wintered between 308 and 1,077 m in pine-oak woodlands (Table 2). The breeding sites were characterized by mature, closed-canopy forests dominated by Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), and incense cedar (*Calocedrus decurrens*). The wintering sites were characterized by dense patches of interior liveoak (*Quercus wislizenii*) mixed with open stands of gray pine (*Pinus sabiniana*), ponderosa pine, chaparral, and grasslands.

Upon arrival in the foothills, each owl began to circulate through a discrete area that I consider to be a winter home range. The timing of the upslope movement was not determined, since the transmitters had failed by spring, however the owls were back on their breeding territories by mid-April when the nest sites were first rechecked.

DISCUSSION

The downslope fall movement found in this study was previously unknown for Spotted Owls, although similar movements are known for many other species of wildlife in the Sierra Nevada (e.g., the Mountain Quail [*Oreortyx pictus*] and Dark-eyed Junco [*Junco hyemalis*]). The movements of quail and juncos are thought to be caused by the onset of extremely heavy average winter snowpack in this area. Studies of Spotted Owls in Oregon (Forsman et al. 1984) and northwestern California (Solis 1983; Sisco, pers. comm.) were done at low elevations or at sites with large within-home-range elevational differences. The "BLM" site of Forsman et al. ranged from 151 to 595 m elevation, while his "H. J. Andrews" site varied from 380 to 1,630 m. Solis (1983) and Sisco (pers. comm.) had sites that ranged from 242 to 1,342 m. Persistent snow would not occur on the low-elevation sites, and owls at the sites

TABLE 2. Minimum and maximum elevation within winter and summer home ranges of five Spotted Owls in the central Sierra Nevada.

Pair	Winter elevation (m)		Summer elevation (m)	
	Minimum	Maximum	Minimum	Maximum
Bacchi female	650	900	1,169	1,477
Gaddis female	400	700	1,292	1,354
McCulloh female	1,000	1,300	1,354	1,600
Pigeon male	270	400	615	1,415
Ramsey female	650	800	1,169	1,410

with great variation in elevation could simply move to the lower portions of their home range during heavy snowfall.

The owls in this study bred at relatively high elevations. In addition, all breeding home ranges had narrow elevational ranges (Table 2). Only the Pigeon Roost pair contained habitat below 1,100 m, the lower limit of heavy snowfall and persistent snow. The lower portion of their home range in the Rubicon River canyon, was very rocky and contained few trees, making it poor habitat for Spotted Owls. The owls in this study did not have the option of expanding their home ranges into wooded canyon bottoms at lower elevations during heavy snows. They either had to find sufficient food in the areas of heavy snowpack or migrate to lower elevations.

Recent studies of Spotted Owls in Washington and Oregon suggest a potential to develop a seasonal movement pattern. Several adult owls in northern Washington moved to disjunct winter locations, but showed no downslope pattern of movement (Brewer and Allen 1985). An adult female in southern Oregon moved to a disjunct winter home range, but also stayed at the same elevation (Janice Reid, pers. comm.). These isolated cases suggest sufficient behavioral plasticity so that migratory behavior could be invoked rather quickly if needed for survival.

Several hypotheses are possible regarding the extent of downslope movement: (1) It may be a characteristic of this subspecies (*S. o. occidentalis*); (2) It may be a characteristic of only the owls found in the central Sierra Nevada where heavy winter snows accumulate; (3) It may be a characteristic derived only by certain individual owls or populations of owls to deal with local effects of elevation or habitat disturbance; or (4) It may be a characteristic of all owls but only manifest in the ones that need it to survive. Little

evidence supports any of these hypotheses at this time.

Some evidence suggests that other populations of this subspecies migrate, even in areas where persistent snow is absent. Winter surveys done in breeding home ranges in the San Bernardino Mountains between 1,800 and 2,800 m have failed to locate Spotted Owls (Linda Saunders, pers. comm.). However, they have been found during the Claremont Christmas Bird Count at the southern edge of these mountains at elevations between 200 and 600 m, where they do not breed (*American Birds* 1978, 1979, and 1980; Kennon Corey, pers. comm.). They have also been recorded on the Ventura (in 1984 and 1986), Morro Bay (in 1983), and Santa Barbara (in 1977 and 1978) Christmas Bird Counts (*American Birds* 1978, 1979, 1984, 1985, and 1987) away from areas where they breed. Some of these records may be of dispersing juveniles, while others may be adults migrating downslope.

My study area has been heavily impacted by timber harvest since 1850. The harvest, until recently, has been done primarily by single-tree selection, which opens the forest canopy. This change in forest structure reduces the numbers of prey dependent on mature, closed-canopy forest (e.g., flying squirrels, *Glaucomys sabrinus*). This may have led to a recent development of migration.

The USDA Forest Service, in developing their land management plans, has assumed that Spotted Owls are not migratory. This belief has led to management plans that provide for a set area for each pair of owls. Downslope movement and disjunct winter home ranges cause added problems for the agencies attempting to manage this species in the Sierra Nevada. While it may be possible for the Forest Service to provide nesting habitat, it will be used for only about 7 months each year; the wintering habitat, which may be as critical, will go unprotected. Only one of the eight owls in this study wintered on Forest Service land. The remainder wintered on private land and land managed by the USDI Bureau of Land Management. Management is made more difficult since the members of each pair of Spotted Owls winter separately. Also it is impossible to predict the exact winter location based on the location of breeding sites, since all owls move different distances and directions.

Much of the private land in this area has been

managed for livestock production. This foothill zone is, however, increasingly being used for home sites and firewood production. Both of these practices are of concern since they remove or disturb valuable wintering habitat for Spotted Owls. The human population in the foothill zone of the west slope of the Sierra Nevada is growing rapidly. The demand for firewood is increasing in California due to high electricity and natural gas costs. Oaks, especially, are being cut at an increasing rate. The need to involve all land-use planning agencies that control both breeding and wintering sites of Spotted Owls is critical if the species is to survive in the Sierra Nevada.

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