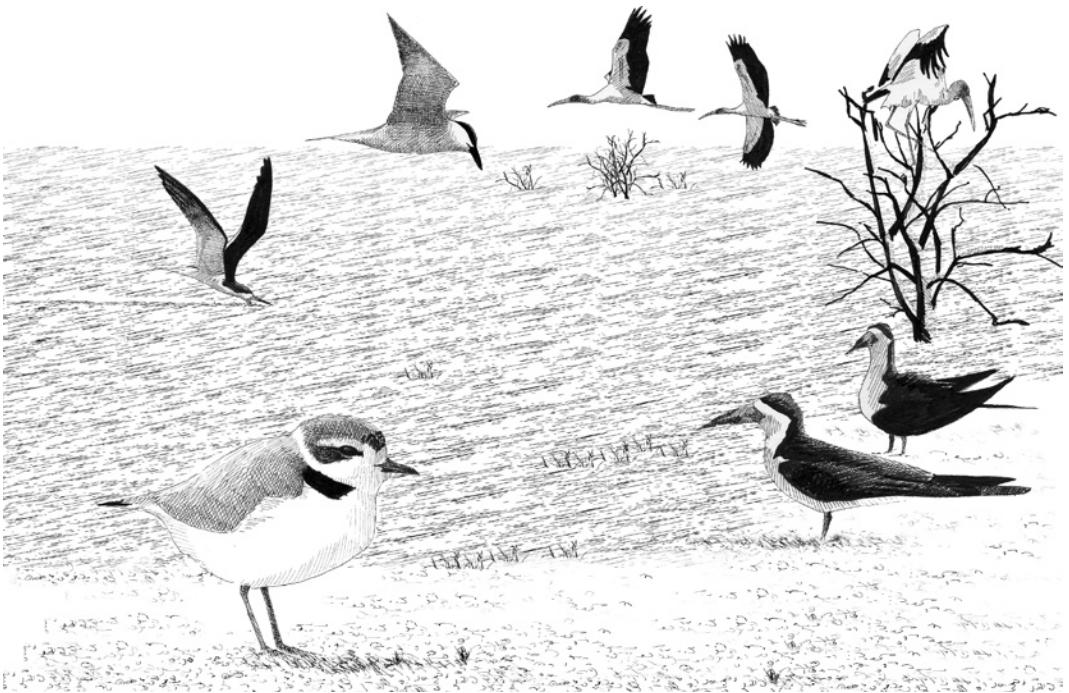


II

SPECIES ACCOUNTS



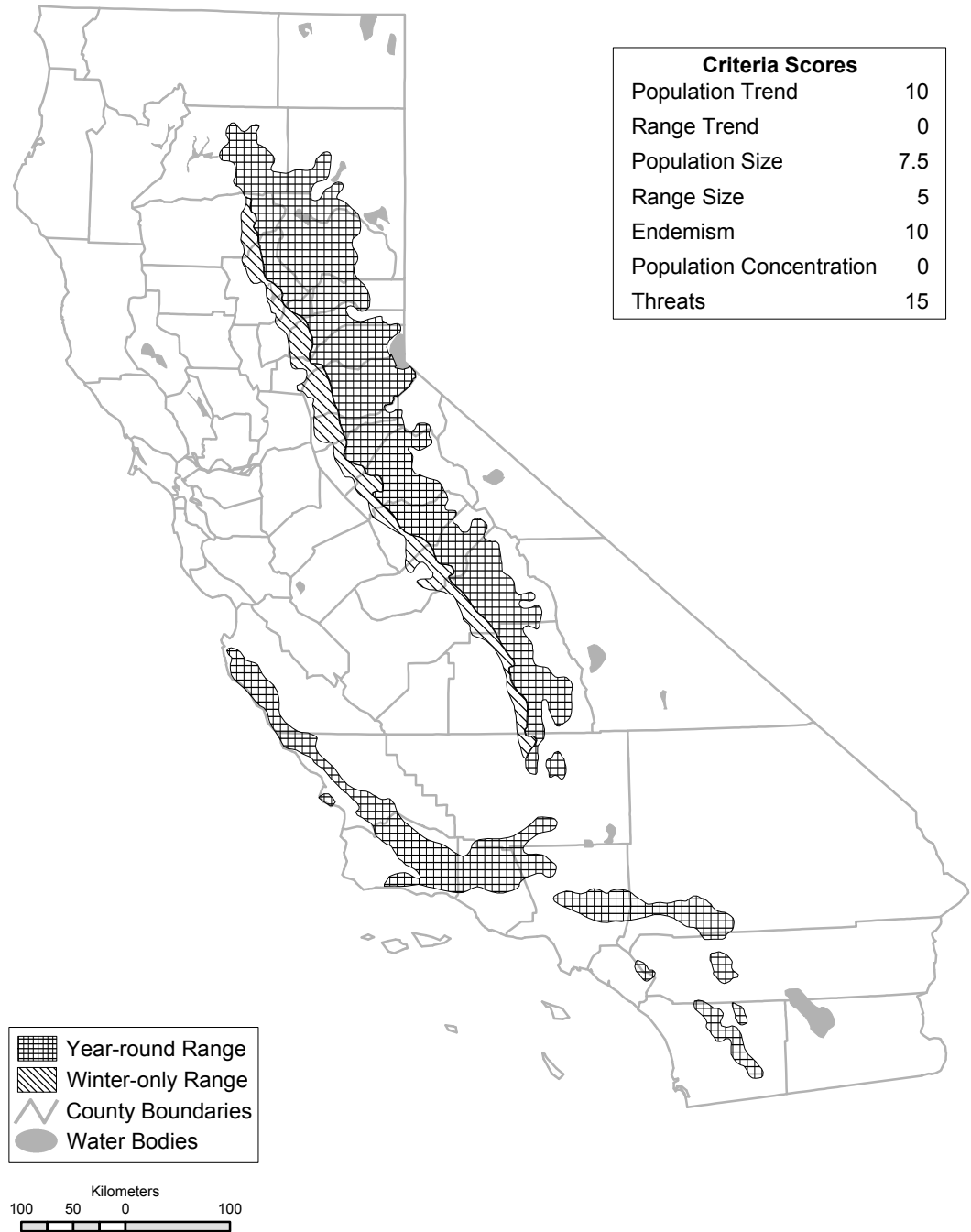
Andy Birch

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CALIFORNIA SPOTTED OWL (*Strix occidentalis occidentalis*)

JEFF N. DAVIS AND GORDON I. GOULD JR.



Year-round range of the California Spotted Owl in California. Essentially resident, though in winter some birds in the Sierra Nevada descend to lower elevations, where, at least to the south, small numbers of owls also occur year round. Outline of overall range stable but numbers have declined.

SPECIAL CONCERN PRIORITY

Currently considered a Bird Species of Special Concern (year round), priority 2. Included on the special concern list since its inception, either together with *S. o. caurina* (Remsen 1978, 2nd priority) or by itself (CDFG 1992).

BREEDING BIRD SURVEY STATISTICS FOR CALIFORNIA

Survey method unsuitable for this owl; no statistics available (Sauer et al. 2005).

GENERAL RANGE AND ABUNDANCE

The Spotted Owl (*Strix occidentalis*) includes three resident subspecies: the Northern Spotted Owl (*S. o. caurina*) in mountains of the Pacific coast from southwestern British Columbia south through western Washington and Oregon to San Francisco Bay, California; the Mexican Spotted Owl (*S. o. lucida*) in forested mountains from southern Utah and Colorado south to Michoacan, Mexico; and the California Spotted Owl (*S. o. occidentalis*) from the southern Cascade Range of northern California south along the west slope of the Sierra Nevada and in mountains of central and southern California nearly to the Mexican border, with three sight records from the Sierra San Pedro Mártir of northern Baja California (Gutiérrez et al. 1995, Unitt 2004). Minimum rangewide population estimates are 4779 Northern Spotted Owls, 1592 Mexican Spotted Owls, and 3050 California Spotted Owls, on the basis of surveys in 1987–1992, 1990–1993, and 1970–1992, respectively (Gutiérrez et al. 1995).

SEASONAL STATUS IN CALIFORNIA

Year-round resident within most of its range; breeds from mid-February to mid-September or early October (Verner et al. 1992a). Some birds breeding at mid- to high elevations in the Sierra Nevada winter 1342–5541 ft (405–1689 m) downslope from nest sites, a straight line distance of 15–58 km; they depart breeding areas from early October to mid-December and return from late February to late March (Laymon 1989, Verner et al. 1992a).

HISTORIC RANGE AND ABUNDANCE IN CALIFORNIA

Grinnell and Miller (1944) considered the California Spotted Owl to be “only fairly common.” They mapped and described two areas of

occurrence: one along the west slope of the Sierra Nevada from eastern Tehama County south to Tulare County, the other in the mountains of southern California from Santa Barbara, Ventura, and southwestern Kern counties southeast to central San Diego County. Elevations of known occurrence ranged from near sea level in San Diego County to 6600 ft (2012 m) in Tulare County.

RECENT RANGE AND ABUNDANCE IN CALIFORNIA

The outlines of the two areas of occurrence today extend farther north and south (see map), as described below by region, reflecting an extensive survey effort in the past three decades. Gutiérrez (1994) argued, however, that because of dramatic habitat losses from logging, urbanization, and other factors during the 19th and 20th centuries, the California Spotted Owl is less widespread and abundant today than it was before European settlement. Beardsley et al. (1999), for example, estimated that old-growth forest in the Sierra Nevada declined by about 76% from 1945 to 1993.

More than 25,000 observations of territorial owls, representing more than 2000 distinct locations, have been amassed since 1973 (CDFG unpubl. data/Spotted Owl Database). New sites continue to be added to the database, though at a much-reduced rate compared with the first 25 years of surveys. This suggests most sites with currently suitable habitat have been found. Survey effort, however, has probably declined since the early 1990s (T. Munton pers. comm.), muddying this conclusion.

Sierra Nevada. The recent range is similar, but the owl is now known to occur from northern Shasta County south to central Kern County (Verner et al. 1992a). Specifically, the recent range is a contiguous swath extending from the Pit River in the southern Cascades of northeastern Shasta County, where it meets the range of *S. o. caurina*, south along the west slope of the Sierra Nevada to the Greenhorn, Piute, and Tehachapi mountains of eastern Kern County. It also extends east of the Sierra axis in a few places, primarily where the mountains are lower, west-to-east topography is gradual, and there are pockets of “mixed-conifer” forest (e.g., Lake Tahoe Basin). As a breeder, the owl occurs at elevations ranging from about 1000 ft (305 m) in Fresno County to 7923 ft (2415 m) in Tulare County (Verner et al. 1992a, T. Munton pers. comm.).

The Spotted Owl Database (CDFG unpubl. data) includes >1700 activity centers in the Sierra Nevada. These are sites where an owl or a pair of owls was found nesting, roosting, or foraging. More than 80% are within the "mixed-conifer belt," which is about 3000–7000 ft (914–2134 m) elevation, and >90% are on federal, primarily Forest Service, lands (Verner et al. 1992b). The population was estimated to include at least 2500 owls (about 1000 pairs and 500 singles, Gutiérrez et al. 1995), which have been found in crude densities of 0.12–1.36 per km² (Gutiérrez et al. 1995, Noon et al. 1992).

Estimates of the finite rate of population change on four Sierra Nevada demographic studies did not detect statistically declining populations (Franklin et al. 2004). Estimates for three study areas, however, were below 1.0, suggesting that estimates may not have been "sufficiently precise to detect declines if they occurred" (Franklin et al. 2004). In the Sierra National Forest, the mean estimate of the finite rate of population change was very close to indicating a significant decline, based on the 95% confidence interval. Estimates of realized change in number of owls for this study area indicated that the 1999 population was only 70.9% of the initial 1993 population size (Franklin et al. 2004).

Southern California mountains. The recent range is more extensive and fragmented than the one Grinnell and Miller (1944) described. The owl is now known to occur in the southern Coast Ranges from Monterey County south through the Transverse and Peninsular ranges to southern San Diego County within 19 km of the Mexico border (Gutiérrez et al. 1995). Within this range there are at least 11 isolated subpopulations, each separated by 10–70 km of unsuitable habitat (Verner et al. 1992a). The owl occurs at sites that range in elevation from near sea level in Monterey County to 8530 ft (2600 m) in San Bernardino County (Gutiérrez et al. 1995, Smith et al. 2002).

The Spotted Owl has been detected several times in the Santa Cruz Mountains of San Mateo and Santa Cruz counties (e.g., Sequoia Audubon Society 2001), but the subspecies has not been identified and its status is poorly known.

The Spotted Owl Database (CDFG unpubl. data) includes >400 activity centers in southern California, about 85% of which are on federal, primarily Forest Service, lands (Verner et al. 1992b). The total population includes at least 600 birds (300–350 pairs; Noon and McKelvey 1992), which have been found in crude densities of 0.15–1.21 per km² (Smith et al. 2002).

An analysis of eight years of demographic data from the San Bernardino Mountains showed this subpopulation to be statistically stable from 1992 to 1998 (Franklin et al. 2004). In contrast, LaHaye et al. (2004), using a different analysis method and more years of data, determined the subpopulation had declined by approximately 9% per year from 1987 to 1998.

ECOLOGICAL REQUIREMENTS

This owl breeds and roosts in forests and woodlands with large old trees and snags, high basal areas of trees and snags, dense canopies ($\geq 70\%$ canopy closure), multiple canopy layers, and downed woody debris (Verner et al. 1992a). Large, old trees are the key component; they provide nest sites and cover from inclement weather and add structure to the forest canopy and woody debris to the forest floor. These characteristics typify old-growth or late-seral-stage habitats.

Blakesley (2003) found that site occupancy on a study area in the Lassen National Forest was associated with the amount of the nest area (a 203-ha circle around the nest) dominated by large trees (>61 cm diameter at breast height, dbh) and high canopy cover, and was negatively associated with the area dominated by medium-sized trees (30–61 cm dbh) with high canopy cover. Because the California Spotted Owl selects stands that have higher structural diversity and significantly more large trees than those generally available, it is considered a habitat specialist (Moen and Gutiérrez 1997).

In the Sierra Nevada, it predominantly uses Sierran mixed-conifer, White Fir (*Abies concolor*), montane hardwood-conifer, and montane hardwood forests at midelevations. These habitats are known generally and collectively as "mixed-conifer" forest. To a lesser extent, it inhabits California Red Fir (*Abies magnifica*) forests at high elevations and Pacific Ponderosa Pine (*Pinus ponderosa*) forests, Blue Oak (*Quercus douglassii*)–Gray Pine (*P. sabiniana*) woodlands, and valley foothill riparian forests at low elevations; a few birds use east-side pine forests (e.g., in Plumas and Sequoia national forests). Sites at lower elevations tend to have smaller-diameter trees, a lower basal area of live trees, higher shrub densities, and less downed wood than those at higher elevations (Verner et al. 1992a, Steger et al. 1997a). Downslope migrants winter mostly in Blue Oak–Gray Pine woodlands and valley foothill riparian forests.

In southern California, the owl principally occupies montane hardwood and montane hard-

wood-conifer forests—especially those with Canyon Live Oak (*Quercus chrysolepis*) and Bigcone Douglas-fir (*Pseudotsuga macrocarpa*)—at mid- to high elevations. At low elevations, it uses coastal oak woodland, valley foothill riparian, and Redwood (*Sequoia sempervirens*) forests (the latter in Monterey County only). A few owls use Singleleaf Pinyon Pine (*Pinus monophylla*)–Juniper (*Juniperus occidentalis*) and Lodgepole Pine (*P. contorta*) forests, especially where mixed with montane hardwood-conifer forest (Verner et al. 1992a).

Less heat tolerant than most birds (Weathers et al. 2001), this owl selects habitats with dense, multilayered canopies. The fact that it nests at low elevations in the southern Sierra Nevada, however, where ambient temperatures exceed 37° C, suggests it can tolerate high temperatures.

The Spotted Owl does not build its own nest but depends on finding suitable, naturally occurring sites in trees or, rarely and mostly historically, in cliffs (Gutiérrez et al. 1995). In Sierra Nevada conifer forests, nests are often (66%) in tree cavities or on broken-topped trees or snags (Verner et al. 1992a). Less often, they are on abandoned raptor or Common Raven (*Corvus corax*) nests, squirrel nests, dwarf mistletoe (*Arceuthobium* spp.) brooms, or debris accumulations in trees, but such platform nests predominate (59%) in oak woodlands. Nest trees in conifer forests are typically large (mean dbh of 118.5 cm, Steger et al. 1997b); those in oak woodlands are smaller (mean dbh of 61 cm, Steger et al. 1997a).

Platform nests also predominate (59%) in southern California (LaHaye et al. 1997). In the San Bernardino Mountains, such nests were in trees with an average dbh of 75 cm, whereas cavity nest trees and broken-top nest trees were significantly larger (mean dbh of 108.3 cm and 122.3 cm, respectively).

Foraging habitats are similar to breeding and roosting habitats, but this owl also hunts in more open stands, with canopy closures typically ≥40% (Call et al. 1992). Foraging habitat at lower elevations in the Sierra Nevada and in hardwood stands in southern California tend not to be multilayered and usually have less downed woody debris than those elsewhere (Verner et al. 1992a). Downed woody debris in higher-elevation forests of the Sierra Nevada is strongly associated with underground fungi, which are an important food for Spotted Owl prey species.

Small to medium-sized mammals, primarily rodents, are this owl's main foods. It mostly takes Northern Flying Squirrels (*Glaucomys sabrinus*)

at higher elevations (conifer forests) in the Sierra Nevada and Dusky-footed Woodrats (*Neotoma fuscipes*) at lower elevations (oak woodlands and riparian forests) and throughout southern California (Verner et al. 1992a).

This owl has unusually low energy requirements. When feeding young, it can satisfy its own energy demands by eating one Northern Flying Squirrel every 1.8 days or one Dusky-footed Woodrat every 3.7 days (Weathers et al. 2001).

The Spotted Owl seems to follow a bet-hedging life-history strategy, spreading the risk in reproductive investments over several breeding seasons (Noon and Franklin 2002). In any given year, 0%–95% of pairs in a study population will reproduce (Steger et al. 2002). Weather patterns appear to have a significant influence on this variation. In the San Bernardino Mountains of southern California, for example, a dry breeding season preceded by a wet year positively affected reproductive success (LaHaye et al. 2004), whereas precipitation in the early stages of nesting resulted in reduced fecundity. Also, North et al. (2000) found that reproduction was associated negatively with precipitation and positively with temperature during the nesting period in the southern Sierra Nevada. High adult survival may allow populations to persist through long periods of low reproduction. Thus, high adult survival is probably the most important characteristic for maintaining population stability (see Noon and Biles 1990).

THREATS

The primary threat to the California Spotted Owl is habitat loss and degradation. Its specialized habitat requirements, deferred reproductive maturity, low reproductive rate, and limited dispersal ability make it especially vulnerable to habitat changes. Loss of suitable habitat results from certain types of timber harvest, large stand-destroying wild-fires, and residential development. Habitat loss also contributes to habitat fragmentation, which impedes the dispersal of owls between suitable patches.

In the Sierra Nevada, catastrophic fires are occurring with greater frequency as a result of various human activities, especially fire suppression (Weatherspoon et al. 1992), and residential development is increasing in foothill areas (Stein et al. 2005), which reduces breeding habitat for some owls and winter habitat for downslope migrants.

Unlike the 2001 Sierra Nevada Forest Plan, the 2004 Sierra Nevada Forest Plan Amendment

does not adequately protect large trees and snags, high canopy closure, multiple canopy layers, and downed wood, and it does not provide limits on the proportion of areas that can be degraded through logging (Center for Biological Diversity 2004). These elements of the 2004 Amendment threaten California Spotted Owl habitat in this region.

Habitat fragmentation—both natural and anthropogenic—characterizes much of the owl's range in southern California. The urban, desert, and other nonforested areas that separate subpopulations appear to be formidable barriers to dispersing owls (LaHaye et al. 2001, Barrowclough et al. 2005). As the human occupation of this region increases, the extent of such barriers may increase to the point that owl dispersal is too restricted to allow adequate gene flow among subpopulations. Such small populations face decreased survival and reproductive success from inbreeding and an increased risk of extinction from stochastic events, such as broad-scale fires. For this reason, catastrophic fires are of particular concern in southern California. Five Spotted Owl territories in the mountains of San Diego County, for example, were completely burned in 2003, and nine owl territories in the San Gabriel Mountains were severely burned in 2002 and 2003 (USFWS 2005).

A new and rising threat to the California Spotted Owl is the recent invasion of its range by the Barred Owl (*Strix varia*). An increase in forest fragmentation, primarily from timber harvest, is thought to have facilitated this species' range expansion in the West (Dark et al. 1998). It was first detected in the Sierra Nevada in Nevada County in 1991 (Dark et al. 1998), and it reached Tulare County, at least 275 km to the south, by 2004 (Steger et al. 2006). Research on Northern Spotted Owls has shown that Barred Owls displace, physically attack, and possibly kill Spotted Owls as well as negatively affect their reproduction and survival (Center for Biological Diversity 2004). The two owls also hybridize, which may further reduce Spotted Owl survival and reproductive success. The small number of hybrids detected during extensive studies of the Northern Spotted Owl, however, suggest that isolating mechanisms that separate Spotted and Barred owls are normally sufficient to avoid hybridization (Kelly and Forsman 2004). Although the Barred Owl's dispersal potential appears to be greater than that of the Spotted Owl, the nonforested gaps between subpopulations in southern California may limit its range expansion into this region.

MANAGEMENT AND RESEARCH RECOMMENDATIONS

- Protect known activity centers from degradation; preserve suitable owl habitat by mixing silvicultural practices to maintain all age and structure classes; and, especially, retain and recruit large trees and snags ≥ 75 cm in diameter and retain downed woody debris ≥ 25 cm in diameter.
- Implement aggressive fuel management programs to reduce the likelihood of stand-destroying fires, thinning small-diameter trees to minimize fuel ladders and reducing the amount of downed wood < 25 cm in diameter to minimize fuel loads.
- Ensure that management guidelines are being implemented as directed and determine whether they are working; design landscape-scale experiments to assess the effects of controlled burning and current and alternative silvicultural treatments.
- Further evaluate the effects of weather, prey availability, and habitat structure and composition on the vital rates of the owl to understand the mechanisms that regulate its populations.
- Identify and inventory important regions for breeding and wintering owls in the Sierra Nevada foothills.
- Determine the status and subspecies of the Spotted Owl in the Santa Cruz Mountains.
- Study the effects of the Barred Owl on populations of the California Spotted Owl.

MONITORING NEEDS

The five demographic monitoring studies should be continued until the power of their tests on the finite rate of population change is greatly increased and the normal, long-term fluctuations in owl populations are determined. Achieving such goals may require two to three decades of intensive monitoring (LaHaye et al. 2004). In addition, new demographic monitoring studies should be initiated in southern California to broaden the sample and determine whether the various subpopulations act as a metapopulation. Density or demographic monitoring data also are needed from private lands throughout the owl's range. Adequate monitoring before and after various logging prescriptions will be required to assess the effects of habitat alteration on the foraging, roosting, and nesting activities of the owl.

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