

SCIENTIFIC EVALUATION OF THE STATUS OF THE NORTHERN SPOTTED OWL

CHAPTER TWO

Northern Spotted Owl Biology

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1 INTRODUCTION

The Spotted Owl (*Strix occidentalis*) occurs in western North America from southwestern British Columbia, Canada, to central Mexico (Gutiérrez et al. 1995). Throughout its range it is primarily associated with older age forests having relatively closed canopies (Forsman et al. 1984, Ganey and Balda 1989, Bart and Forsman 1992, Bias and Gutiérrez 1992, Call et al. 1992, Gutiérrez et al. 1995, Seamans and Gutiérrez 1995, Moen and Gutiérrez 1997, LaHaye and Gutiérrez 1999, Peery et al. 1999). The only major exceptions to this generalization are in the southwestern United States, where it sometimes occupies deep, steep-walled canyons (Rinkevich and Gutiérrez 1996), and in some portions of the Pacific Northwest, where it occurs in relatively young forests (Irwin et al. 1991, Anderson and Farnum 1993, Diller and Thome 1999, Thome et al. 1999, Folliard et al. 2000).

For more than a century since this species was described, the Northern Spotted Owl (*S. o. caurina*) was considered a rare, seldom-seen resident of the vast, virgin forests of the Pacific Northwest (Bent 1938). By the mid 1970s, new research in this region indicated a more widespread distribution, a higher population density, and a strong association between this species and late-successional stage forests (Forsman 1976, 1977, 1980; Gould 1977; Forsman et al. 1984). This new information, coupled with rapid logging of virgin forests following World War II, resulted in concern for the conservation status of this owl (USDI Fish and Wildlife Service 1973, 1982, 1987, 1989, 1990, Dawson et al. 1985, Anderson et al. 1990, Gutiérrez 1994).

When continuing research indicated that this species probably required many hectares of old-growth forest of high commercial value, much controversy ensued over proper management of this species. This controversy centered on the conservation needs of the owl and economic and social needs of the timber industry. This controversy made Spotted Owls one of the most studied birds in the world (Dixon and Juelson 1987, Lohmus 2003). The political controversy that evolved (Simberloff 1987, Doak 1989, Wilcove and Murphy 1991) spawned numerous management plans for this species (e.g., Marcot et al. 1986, USDA-PNW 1988, Thomas et al. 1990, Noon and Murphy 1997, USDI 1993, Noon and McKelvey 1996, Marcot and Thomas 1997, *Washington Department of Natural Resources 1997*). These developments highlighted the complexities of managing a rare, but currently wide-spread species which appeared to require large tracts of older forest for its continued existence (Gutiérrez et al. 1995). Over time, it became clear a solution to this complex problem would require advances in population analysis, forest-wildlife relationships, forestry, as well as adaptability of the timber industry and federal, state, and local governments (Salwasser 1987, Gutiérrez et al. 1995, Noon and Murphy 1997).

2 PHYSICAL CHARACTERISTICS

The Northern Spotted Owl is a medium-sized owl about 0.5 m in length with a wing span around 1.0 m (Dawson 1923, Gutiérrez et al. 1995). It has dark eyes, chocolate-brown plumage with white spots, and no ear tufts (Gutiérrez et al. 1995). The sexes have similar plumage, but are sexually dimorphic in size (Johnsgard 2002, Blakesley et al. 1990). Females are typically 10-20% larger in mass than males (540-850 g versus 490-690 g, respectively).

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The Barred Owl is similar in appearance, but can be distinguished from Spotted Owls by its slightly larger size, ashy-gray coloration, horizontal bars on its breast, and vertical streaks on its abdomen (Gutiérrez et al. 1995, Mazur and James 2000). During the last several decades, the Barred Owl has expanded its range into the Pacific Northwest (Campbell 1973, Hamer et al. 1994, 2001, Dark et al. 1998, Herter and Hicks 2000, Pearson and Livezey 2003) where it is known to displace (Dunbar et al. 1991, Iverson 1993, Kelly et al. 2003), hybridize with (Hamer et al. 1994, Herter and Hicks 2001, Peterson and Robins 2003), and possibly kill Northern Spotted Owls (Leskiw and Gutiérrez 1998). Hybrids generally appear like large, light-colored Spotted Owls. The head and tail feathers are most similar to those of Barred Owls and the breast and abdomen appear intermediate with white patches separated by brown streaks and bars (Gutiérrez et al. 1995).

3 DISTRIBUTION

The Northern Spotted Owl is found from southwestern British Columbia, western Washington and Oregon, into northwestern California south to Marin County (*American Ornithological Union 1957, Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995*). The range of the Northern Spotted Owl does contact the range of the California Spotted Owl (*S. o. occidentalis*) in northern California near the southern end of the Cascade Range (Thomas et al. 1990, USDI 1992, Barrowclough et al. 1999, Haig et al. 2001).

4 VOCALIZATIONS

Vocalizations of the Spotted Owl include an array of hoots, whistles, and barks (*Forsman 1976, Forsman et al. 1984, Fitton 1991, Gutiérrez et al. 1995*). Thirteen different calls have been described and are used by both sexes. Female and male calls can be identified by the pitch of the call. Females have distinctively higher-pitched calls than males for all vocalizations. The following is a brief description of the most common vocalizations used by this species, including comments on the perceived use of each call. For a thorough discussion of Spotted Owl vocalizations, see *Forsman (1976), Forsman et al. (1984), Fitton (1991), Gutiérrez et al. (1995), Waldo (2002), and VanGelder (2003)*.

The *four-note location call* is used to announce territoriality, locate a mate, or announce prey deliveries. Phonetically it is described as *hoo—hoo-hoo—hooo*. Other commonly used hoots are *agitated location calls (hoo—hoo-hoo-ow)* and *series location calls* which are extended versions of the four-note location call lasting 7-15 notes and are most often used for territorial defense. Both agitation and series location calls are used to convey aggression and males tend to use them more often than females.

Contact calls are hollow whistles ending in an upward inflection (*cooo-weep*) and are typically used by females to announce their locations to mates. Males use this call infrequently except when presenting prey to their mate or young. Agitated contact calls are a louder, shriller form of the contact call and are most often used by females during territorial defense.

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Bark series calls are 3-7 note calls (*ow!-ow!-ow!-ow!-ow!*) used primarily during territorial disputes and most commonly by females. *Begging calls* are employed by young of the year and sounds like a raspy contact call. Phonetically, it is a gravelly *cooo-weep* or *sweeet*. Females may exhibit similar behavior and calling patterns during the nesting season using a soft contact call to stimulate delivery of prey from their mate.

5 BEHAVIOR

5.1 LOCOMOTION

The Spotted Owl spends virtually its entire existence beneath the forest canopy. Thus, its flight pattern shows adaptations to maneuverability rather than strong, sustained flight (Gutiérrez et al. 1995). Most daily movements are accomplished by numerous short flights, using a series of wing-beats followed by gliding (Gutiérrez et al. 1995). Upslope flight appears labored and unhurried.

5.1.1 NON-FLIGHT MOVEMENTS

Occasionally, Spotted Owls will walk along limbs or on the ground for short distances to chase prey, cache prey, or change roost locations (Gutiérrez et al. 1995). This owl walks with an ambling, rolling gait occasionally flapping its wings to maintain balance when running. Before juvenile owls are capable of flight, they can walk or climb using their feet and bill (Kristan et al. 1996).

Spotted Owls forage by moving from perch to perch through the forest. They are classified as perch and pounce predators because once on perch they sit, look and listen for prey activity and then attack the located prey (*Forsman 1976, Forsman 1980, Forsman et al. 1984, Gutiérrez et al. 1995*). Prey can be detected by sound as prey species move among branches or through forest litter. Spotted Owls have the morphological characteristics associated with owls that hunt primarily using sound localization: a well-developed facial disk, asymmetrical positioning of ear openings and large preaural folds (Norberg 1977, Volman and Konishi 1990). Prey can also be detected by sight.

Upon satiation, Spotted Owls will cache surplus food for later use (*Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995*). The majority of the time, this involves placing the remaining portion of the prey item in a partially concealed location on the limb of a tree. However, other suitable locations include cavities in trees, broken tree stubs, on the ground at the base of a tree, and on the ground near logs. Alternatively, owls may simply roost with surplus prey in their talons or placed immediately beside them on the branch where they are roosting. Concealment of cached prey may have evolved in response to kleptoparasitism by other species, particularly birds (Hunter et al. 1993).

5.2 SELF-MAINTENANCE

5.2.1 PREENING, SCRATCHING, CLEANING

Spotted Owls often preen themselves while they are roosting. Spotted Owl pairs are very social and often allopreen with their mates when roosting together. They also preen their young regularly.

5.2.2 ROOSTING AND THERMOREGULATION

Spotted Owls select sheltered roosts to avoid inclement weather, summer heat, and predation (Forsman 1976, 1980, Barrows and Barrows 1978, Barrows 1981, Forsman et al. 1984, Ting 1998). This owl has a narrow thermal neutral zone (Ganey et al. 1993, Weathers et al. 2001) and during summer months selects cool, shady roosts to minimize exposure to warm temperatures (Forsman 1976, 1980, Barrows and Barrows 1978, Barrows 1981, Forsman et al. 1984, Solis 1983, Ting 1998). During warm weather, Spotted Owls seek roosts in shady recesses of understory trees and occasionally will even roost on the ground (Barrows and Barrows 1978, Forsman et al. 1984, Gutiérrez et al. 1995). In winter, they roost relatively high near the bole of canopy trees with overhanging branches to shelter themselves from precipitation. On sunny winter days they occasionally seek roosts with sun exposure (Sisco 1984). During the course of a day, Spotted Owls may move short distances in response to temperature changes or to avoid direct sunlight (Ting 1998). Once an owl becomes overheated, it will gular-flutter, followed by standing erect, exposing its legs, and partially spreading its wings (Ting 1998). Both adult and juvenile Spotted Owls have been observed drinking. Drinking has been observed primarily during summer and is possibly associated with thermoregulation (Gutiérrez et al. 1995). However, Weathers et al. (2001) suggested that this owl requires more water than most birds and may obtain nearly 40% of its required water by drinking.

5.2.3 PELLETT DEPOSITION

Spotted Owls usually swallow an entire prey animal whole if it is small, or a sizeable portion if it is a large prey. On occasion they may remove viscera of larger small mammals, but they generally eat prey whole. As a consequence, the undigested portions of prey (e.g., claws, hair, bones) are regurgitated as a compact pellet. Little is known about the frequency or timing of pellet regurgitation (Smith et al. 1999). However, pellets are regularly found near roosts during the breeding season, but less so during the winter. In spring and summer, pellets are most commonly cast in the late afternoon or evening (Gutiérrez et al. 1995). However, they often regurgitate pellets to make room for recently captured prey and may commonly regurgitate pellets while foraging.

5.2.4 GENERAL DAILY ACTIVITY PATTERN

Spotted Owls are primarily nocturnal (Forsman et al. 1984). They forage between dawn and dusk and sleep during the day. Peak activity occurs during the two hours after sunset and the two hours prior to sunrise (Forsman et al. 1984, Gutiérrez et al. 1995, Delaney et al. 1999).

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However, this owl will readily take advantage of opportunities to capture vulnerable prey near their roosts during daylight hours (Laymon 1991, Sovern et al. 1994).

5.2.5 AGONISTIC BEHAVIOR

Spotted Owls become alert when roosting whenever large birds fly over the canopy or when potential predators enter nest or roost stands (*Forsman 1976, Gutiérrez et al. 1995*). They will actively defend their nests and young from avian and mammalian predators, including biologists (*Forsman 1976, Gutiérrez et al. 1995*). Defensive behavior includes agitated calling, posturing, flying, and if sufficiently provoked, physical attack. Attacks involve repeated strikes where the owl attempts to talon the head and upper body of the intruder (*Gutiérrez et al. 1995*).

5.3 TERRITORIALITY

Spotted Owls are highly territorial and regularly confront conspecifics with aggressive vocal displays (*Forsman 1976, 1980; Forsman et al. 1984, Gutiérrez et al. 1995, Franklin et al. 1996*). In extreme cases, physical confrontations may occur but are thought to be rare and of short duration. They apparently learn to recognize their neighbor's voices and calling patterns and respond to them much less vigorously (*Fitton 1991, Waldo 2002*). Because of their strong territoriality, survey protocols have been developed for this species (*Forsman 1983*). In the past decade, it has been noted that Spotted Owls seem to respond less when Barred Owls are present and several incidences of Barred Owls replacing Spotted Owls have been recorded (*Iverson 1993, Hamer et al. 1994, Gutiérrez et al. 1995, Dark et al. 1998, Kelly et al. 2003*). It is possible that Spotted Owls exhibit reduced response rates when Barred Owls reside nearby (*Gutiérrez et al. 1995*).

5.4 SEXUAL BEHAVIOR

5.4.1 MATING SYSTEM

Spotted Owls are generally monogamous and primarily mate for life. While divorce does occur (*Forsman et al. 2002*), the majority of Spotted Owls exist with a single mate throughout their lives (*Gutiérrez et al. 1995*). Pair bonds can last a decade or longer.

5.4.2 PAIR ACTIVITIES

Pairs begin roosting together 4-6 weeks prior to egg-laying in late February or early March (*Forsman 1976, Gutiérrez et al. 1995*). Pairs commonly roost together from March to June and less frequently the remainder of the year. Spotted Owls regularly roost side-by-side during the breeding season and often allopreen (*Gutiérrez et al. 1995, Forsman et al. 1984*). Copulation begins 2-3 weeks before egg-laying and becomes more frequent immediately prior to laying (*Forsman 1976, Forsman et al. 1984*).

6 INTERSPECIFIC INTERACTIONS

6.1 NONPREDATORY

Spotted Owls are regularly mobbed by smaller birds (Gutiérrez et al. 1995). Mobbing is primarily done by social corvids, such as Steller's Jays. However, numerous diurnal bird species may also participate. Most species that mob Spotted Owls have been recorded in this owl's diet and this may partially explain mobbing. Red-tailed Hawks (*Buteo jamaicensis*) and ravens (*Corvus corax*) have been documented kleptoparasitising Spotted Owls (Hunter et al. 1994), and Barred Owls will displace Spotted Owls (Hamer 1988).

6.2 PREDATION

Predation on Spotted Owls has not been directly observed. However, Northern Goshawks (*Accipiter gentiles*), Cooper's Hawks (*Accipiter cooperi*), Red-tailed Hawks, and Great Horned Owls (*Bubo virginianus*) have been implicated as potential avian predators (Johnson 1992). Leskiw and Gutiérrez (1998) may have recorded predation of a Spotted Owl by a Barred Owl (*Strix varia*). Fisher (*Martes pennanti*) have been seen climbing in Spotted Owl nest trees and may eat Spotted Owl eggs and young (Gutiérrez et al. 1995).

7 BREEDING

7.1 PHENOLOGY

7.1.1 PRENESTING BEHAVIOR AND NEST SELECTION

Pairs begin to roost together from February to early March and regularly call to each other and interact at dawn and dusk (Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). Similar to most owls, Spotted Owls do not construct their nests. Suitable nesting platforms are selected and the owls do little except minor reshaping of the nest surface. Eggs are typically laid between the middle of March and the middle of April (Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). Occasionally, clutches are initiated later than mid-April (inferred by late fledging and estimated age of juveniles). However, it is unknown whether these are late-starting first clutches or attempts to renest after an initial failure. Although renesting has been reported (Lewis and Wales 1993, Forsman et al. 1995) it is rare, and production of a second brood has not been documented for this species.

7.1.2 INCUBATION, BROODING, AND FLEDGING

Incubation lasts about 30 days and is performed exclusively by the female (Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). Brooding is also done exclusively by the female and she provides constant attention to the young until they are 8-10 days old (Forsman 1976). At this time, the female begins to leave the nest for short periods of time to forage. During

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incubation and the first 10 days of brooding, the male provides all food for himself, his mate, and their young (Forsman et al. 1984).

Brooding continues until the nestlings are around 35 days old (Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). The female spends less time in the nest as the young grow and develop. However, she can almost always be found in close proximity to the nest during this time and regularly roosts on the closest available perch, often within a couple meters. At about 35 days old, the young fledge but are incapable of flight (Forsman 1976). They either hop out of the nest to nearby branches or jump to branches below the nest or to the ground. The growth rate of juvenile bills and feet far exceeds that of other body structures and appears to be adapted to handling prey and climbing to safe perches (Kristan et al. 1996).

7.1.3 FLEDGLINGS

Once they have left the nest, fledglings spend the remainder of spring and summer moving from branch to branch gaining mass and developing their flight feathers (Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). By August, parents spend substantially less time attending their young, while fledglings begin to forage opportunistically but clumsily (Gutiérrez et al. 1995). By September, parents feed their young irregularly and some juveniles begin to disperse. Most young have dispersed by early November (Gutiérrez et al. 1985, Forsman et al. 2002).

8 PLUMAGE CHARACTERISTICS

Hatchlings are sparsely covered with white natal down until they are about 10 days old (Forsman 1981). The prejuvenal molt is completed in 34 to 36 days (Forsman 1981). Retrises reach full development by 75 days of age (Forsman 1981). The prebasic I molt begins at 8 to 9 weeks of age and is completed by late September or October (Forsman 1981). Plumage color is chocolate brown. The retrises and remiges are retained from the juvenal plumage (Forsman 1981, Moen et al. 1991). The tips of the retrises are white with pointed, downy tips and subadults are distinguished from adults by this characteristic (Moen et al. 1991). Juvenal retrises and remiges are molted at 26 months of age (Forsman 1981). Adult plumage characteristics are similar to Basic I plumage except for the tips of the retrises, which are rounded and mottled after this molt.

9 DISEASES AND PARASITES

Very little is known about diseases affecting Spotted Owls (Gutiérrez et al. 1995). However, Thomas et al. (2002) documented a case of spirochetosis and there is considerable concern that Spotted Owls may be susceptible to West Nile Virus (Rapploe et al. 2000, Komar et al. 2003, Male 2003).

The documentation of parasites in Spotted Owls is more substantial. These include ectoparasites (Young et al. 1993, Hunter et al. 1994, and Morishita et al. 2001), endoparasites (Hoberg et al. 1993), and hematozoa (Gutiérrez 1989).

10 SURVEY METHODS

10.1 PRESENCE-ABSENCE SURVEYS

Spotted Owls are very territorial and the majority of territory defense is accomplished through vocalizations (Forsman 1976, 1977, 1983). Thus, surveying known Spotted Owl sites or potential habitat can be accomplished by imitating Spotted Owl calls (Forsman 1983, Ward et al. 1991, USFWS 1993, Franklin et al. 1996, Reid et al. 1999).

Surveys are usually designed to cover an entire area thoroughly. Imitated calls can be heard for at least ½ kilometer from a survey point or route (Forsman 1983, Franklin et al. 1996). Thus, surveys are spaced to avoid gaps in coverage. Most surveys are accomplished by using a series of call points from which imitated or tape recorded owl calls are broadcast. Call points are established throughout an area of interest such as along existing roads and trails at a spacing that avoids or minimizes gaps in coverage (Forsman 1983, Franklin et al. 1996).

A complete survey is defined as the effort needed to access and survey all areas that could reasonably be expected to be included within a Spotted Owl territory (USFWS 1993). The current survey protocol requires three complete surveys per year for two consecutive years or six complete surveys during a single year (USFWS 1993).

10.2 SURVEYS TO ASSESS REPRODUCTION

Surveys to assess Spotted Owl reproduction are performed once presence-absence surveys have determined that a site is occupied and the project requires information on the reproductive activity of the owls occupying the site (Forsman 1983, USFWS 1993, Franklin et al. 1996). First, the owls must be visually located. Second, the owls must be fed mice to stimulate the owls to feed their young, if present (Forsman 1983, USFWS 1993, Franklin et al. 1996).

Standard minimum effort requirements include: attempting to visually locate the owl(s) on at least four occasions, feeding the owls a minimum of two mice per occasion, and attempting to verify the results of the first successful reproductive survey with a repeat survey (USFWS 1993). Some flexibility is required when attempting to complete reproductive surveys, because, the owls do not always cooperate fully.

10.3 CAPTURE TECHNIQUES

Capturing Spotted Owls is usually attempted during daylight hours when the owls are roosting (Forsman 1983, Franklin et al. 1996). Nighttime captures are also possible, but the owls are more active and have the advantage of superior night vision. In general, this species is approachable and appears somewhat tame. A common practice is to present a mouse or rat to them, which distracts them while a capture is attempted (Forsman 1983, Franklin et al. 1996). While this is typically accomplished using a live rodent, fur-covered toys, dead rodents and tethered raptors have also been used as lures.

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The most commonly used capture techniques used with Spotted Owls are mist nets, snare poles, noose poles, and by hand. The use of mist nets is based on the premise that Spotted Owls prefer to fly down-slope after capturing prey. Nets are positioned down-slope from a lure accessible to the owl such that the owl flies down-slope into the net after attempting to capture the lure (Forsman 1983, Franklin et al. 1996). Once the owl hits the net, the owl is quickly restrained and removed from the net.

A snare pole is a long (6-8 m) modified fishing pole with a snare (a noose that self-tightens when pulled against resistance) on one end (Forsman 1983, Franklin et al. 1996). Snare poles are used to capture owls while they are perched on branches at their roost or in a position where they were available for capture. Once the owl is in position, one person distracts the owl using a lure while another person slips the snare over the owl's head and onto its neck. When the snare has been placed in the correct position on the owl, it is drawn tight onto the owl's neck feathers by applying tension to the snare. Once the snare is snug on the owl's neck feathers, the owl is lowered to the ground and restrained. The snare pole is currently the most common technique used to capture owls.

Noose poles are similar to snare poles, except that the noose must be drawn tight by the operator. This is accomplished by the noose cord extending the length of the pole to the operator's hands. Once the noose is in position on the owl, the noose cord is pulled which closes the noose on the owl's neck feathers. Capturing owls with a noose pole is accomplished in the same manner as described for the snare pole.