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Incestuous Behavior in Spotted Owls

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ABSTRACT.—Inbreeding of closely related individuals can be referred to as incest, generally limited to parent-offspring or sibling pairs. Cases of incest in raptors are rarely reported because they require long term monitoring of marked individuals. We documented 3 cases of close inbreeding among 730 pairs of individually marked Spotted Owls (*Strix occidentalis*) across all 3 subspecies during 14 years of study. The incestuous pairings we observed may be the result of shorter than normal dispersal distances and chance encounters. Although the level of incest appears to be low in Spotted Owls, the level of actual inbreeding remains unknown. *Received 7 Jan. 1998, accepted 11 June 1998.*

Incest is extreme inbreeding of closely related individuals as in parent-offspring or full sibling pairs (Shields 1993). Incest in raptor species has been documented but appears to be quite rare. Six cases of incest have been reported among Barn Owls (*Tyto alba;* Petty et al. 1986, Shaw and Dowell 1989, Taylor 1994, Roulin 1996) and four cases for a Burrowing Owl (*Athene cunicularia*) population (Millsap and Bear 1990). We also found one case reported for each of the following species: Screech Owl (*Otus asio*; Van Camp and Henny 1975), Merlin (*Falco columbarius*; James et al. 1987), Osprey (*Pandion haliaetus*; Postupalsky 1989), and Spotted Owl (*Strix occidentalis;* Gutiérrez et al. 1995). Rosenfield and Bielefeldt (1992) reported a pairing between a female Cooper's Hawk (*Accipiter cooperii*) and her grandson, which is another example of close inbreeding. The relatedness of the individuals can be represented by the coefficient of relationship, r (Wright 1922). We use $r \geq 0.5$ (e.g., mother-son or full sibling pairs) to define incest and define $r \geq 0.25$ (e.g., grandmother-grandson or half-sibling pairs) as close inbreeding. Inbreeding depression can be a cost of close inbreeding while inbreeding avoidance may reduce the cost; these mechanisms are difficult to document in wild populations (Pusey and Wolf 1996).

Detection of close inbreeding requires long-term monitoring of marked individuals. Here we report two cases of incest and one case of inbreeding by half-siblings from five Spotted Owl demographic studies that cover all three subspecies (*S. o. occidentalis, S. o. caurina,* and *S. o. lucida*). The studies were located in northwestern California (Klamath Mountains), central California (Sierra Nevada), southern California (San Bernardino Mountains), Arizona (Coconino Plateau), and New Mexico (Tularosa Mountains). In these studies, individuals were marked with both uniquely numbered U.S. Fish and Wildlife Service (USFWS) aluminum leg bands and color bands (Forsman et al. 1996). These five studies span 14 years and involve 730 pairs with both individuals uniquely marked (for details on sexing, capturing and banding, see Franklin et al. 1996). We examined all pairings of known individuals for incestuous relationships across all studies and years. We include a half-sibling pair because it illustrates the potential dispersal patterns associated with inbreeding. We assumed that observed parents were the biological parents. Extra-pair copulation may occur in Spotted Owls, but it has not been documented (Gutiérrez et al. 1995).

We observed the first case of incest in the San Bernardino Mountains in southern California. This study began in 1987 and included the entire mountain range (1890 km^2) encompassing the local insular Spotted Owl population (LaHaye et al. 1994). In 1991, we located a female paired with her male offspring. The female was originally banded as an adult in 1990. She nested and fledged one young that year. In 1991, she was located in a different

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territory where she was seen copulating with a banded subadult male on 1 May. The male was recaptured on 14 May 1991 and determined to be the female's offspring from the previous year. The male had dispersed 5.3 km from his natal nest site. The birds were confirmed to be nesting but failed to fledge young.

The case of close inbreeding occurred in the San Bernardino Mountains in 1995 when a pair of half-siblings were located together. The female and male fledged in 1990 and 1992, respectively, from different nests in the same territory and shared the same mother. Each of the half-siblings had nested and fledged young with different mates prior to 1995. The male was first recaptured as an adult in 1994 and remained on the same territory through 1996. The female was recaptured in 1991 as a nonterritorial bird. She was rebanded with a unique color band and was resighted in 1992 and 1994 on a different territory before joining her half-brother on 16 May 1995. They were observed nesting 8.4 km from their natal nest sites and fledged two young. They remained paired but did not fledge young in 1996. Because the female made several movements between territories, of 13.0, 16.8, and 3.5 km respectively, we suspect that this pairing was a chance occurrence.

The second case of incest occurred in northwestern California near Willow Creek in 1997. This study began in 1985 and encompassed 2076 km^2 (Franklin et al. 1996). On 24 July 1997, we located a pair of previously banded owls with one fledgling. Upon recapture, both adults were determined to be siblings from the same nest. They had been banded in June 1994, and were located 10.6 km from their natal nest site. No owls were located at this site prior to 1997 and this was the first time these siblings were detected since 1994.

We have not observed any incest in the study areas in central California, Arizona, or New Mexico. This may be due to smaller sample sizes on these study areas as a result of both smaller geographic extent and shorter study periods.

It is unusual to find siblings associated with each other after they begin dispersing. In northwestern California, fledglings tend to disperse in random directions, and females typically move farther than males (for 33 females and 44 males, $\bar{x} \pm$ SD: 23.5 $\pm$ 17.4 km vs 17.4 $\pm$ 19.1 km; Gutiérrez, pers. comm.). The siblings and half-siblings reported above all dispersed less than the average, increasing the chances of pairing. This is similar to the dispersal behavior of the Merlin pair reported by James and coworkers (1987). Thus, we suspect that the sibling pairs were a result of both dispersal behavior and chance occurrence.

Although quite rare among Spotted Owls, incest occurs occasionally and appears to be a chance occurrence. The short dispersal distance of the incestuous birds may be a factor. Although inbreeding avoidance can account for dispersal patterns (Pusey 1987), we do not know if this explains the dispersal behavior of Spotted Owls. The previously reported case of incest in Spotted Owls was for a father-daughter pair in Oregon where the female did not disperse from her natal site (Gutiérrez et al. 1995). The proportion of cases (2 of 730) is fewer than that reported for a population of Barn Owls (2 in 130 pairs; Roulin 1996) and similar to that reported for Barn Owls in Scotland (1 in 157 pairs; Taylor 1994) and for the Mute Swan (*Cygnus olor*; 7 cases in 1389 pairs; Coleman et al. 1994), which is one of the few long-lived avian species with extensive data on mated pairs. We do not know how inbreeding may affect Spotted Owl populations. The San Bernardino Mountain population is of particular interest because it is geographically isolated and the chance for random matings resulting in inbreeding should be greater. Although incest appears to be rare in Spotted Owls, the level of inbreeding remains unknown.

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Red-cockaded Woodpeckers Ensnared in Mesh Snake Traps

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ABSTRACT.—The Red-cockaded Woodpecker (*Picoides borealis*) is a federally endangered cavity nesting species. Mesh snake traps are placed near the base of cavity trees to prevent tree climbing and potential nest predation by rat snakes. In 1997, we documented one live and four dead Red-cockaded Woodpeckers ensnared in mesh snake traps at the Bienville National Forest and Noxubee National Wildlife Refuge, Mississippi. *Received 21 Nove. 1997, accepted 11 June 1998.*

The Red-cockaded Woodpecker (*Picoides borealis*) is a federally endangered species that inhabits mature, open pine forests throughout the southeastern United States (Jackson 1994). Red-cockaded Woodpeckers excavate cavities in live pines for roosting and nesting. Suitable cavity sites are limited (Copeyon et al. 1991), and populations are declining throughout the species' range (James 1995). Intensive management techniques, such as midstory removal, cavity entrance restrictors, artificial cavity inserts, and mesh snake traps have been used to promote recovery of the species (Copeyon 1990, Richardson and Stockie 1995, Raulston et al. 1996). Red-cockaded Woodpeckers create and maintain a sap barrier around entrances to brood cavities, presumably to avoid predation by snakes (Rudolph et al. 1990). However, gray rat snakes (*Elaphe obsoleta spiloides*) remain important predators of Red-cockaded Woodpecker eggs and nestlings (Jackson 1978, Rudolph et al.

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