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Author(s): Teresa J Lorenz

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BETWEEN-YEAR BREEDING DISPERSAL BY WHITE-HEADED WOODPECKERS: A CAUTION ABOUT USING COLOR BANDS TO ESTIMATE SURVIVAL

TERESA J LORENZ

ABSTRACT—Between-year breeding dispersal has not been previously documented in White-headed Woodpeckers (*Picoides albolarvatus*). Therefore, resightings of color-banded adults on previous years' breeding territories have been considered a means of estimating annual adult survival. From 2013 to 2015, I observed 2 cases of between-year breeding dispersal by adult color-banded White-headed Woodpeckers in central Washington. Mean dispersal distance was 6.9 km, and both adults were successful in fledging young in their new territories. Without extensive searches outside of previous years' territories, such dispersal events could have been classified as mortalities leading to annual survival estimates that were biased low.

Key words: breeding dispersal, color band, mark-resight, *Picoides albolarvatus*, survivorship, White-headed Woodpecker

The White-headed Woodpecker (*Picoides albolarvatus*) is a species of concern throughout its range in western North America, which has prompted, in recent years, many research studies on its natural history. Most studies have focused on nesting ecology, but information is needed on survival rates. Like many woodpeckers, White-headed Woodpeckers are thought to have strong fidelity to breeding territories as adults (Garrett and others 1996; Frenzel 2004), and color banding has been used as a means of estimating survival (Frenzel 2004). Color banding has also been used to estimate survival in other woodpecker species (reviewed in Wiebe 2006), where observations of the same color-banded adult on breeding territories in consecutive summers indicate an individual has survived 1 y. Absences from a previous-year's territory, or permanent absences from the study area, are counted as deaths. Such mark-resight models of survival assume that there is no permanent emigration from searched territories or the study area (a closed population; Pollock and others 1990). Violations of this assumption would bias survival rates by counting dispersals as deaths, and the magnitude of this bias would depend on the

prevalence of breeding dispersal. In the only previous multi-year study of color-banding with White-headed Woodpeckers, neither divorce nor breeding dispersal (defined as dispersal between breeding sites with the exception of movements to adjacent territories; Greenwood and Harvey 1982) were observed in >100 adults banded over 7 y (Frenzel 2004), supporting suppositions that adults of this species do not disperse as breeding adults.

Here, I report on 2 observations of breeding dispersal to non-adjacent territories by color-banded White-headed Woodpeckers in Washington State. These observations occurred incidentally during research studies on woodpecker nesting ecology and space use, in which I color-banded, with unique color combinations, 46 adult-breeding White-headed Woodpeckers in Yakima County (approximately UTM: 10T 647567 5179816; Fig. 1) from 2011 to 2013. From May to July, 2011–2015, I visited study sites 2 to 7 days weekly. When breeding adult woodpeckers were sighted, I used a camera to photograph leg bands (or verify that no leg bands existed) and identified individuals based on their unique color combination. The 2 adult White-headed Woodpeckers described in this note dispersed 6.9 km on average between breeding sites and into non-adjacent territories, suggesting that color bands should not be used for estimating survival of adult White-headed Woodpeckers without accounting for breeding dispersal rates.

The 1st observation of breeding dispersal occurred for a female (Female A, Fig. 1) that I color-banded at a nest in the Tieton River watershed (approximate UTM: 10T 646410 5170424) on 6 July 2011. In 2011, Female A nested with a male that I also color-banded. The 2011 nest failed late during the nestling stage. I did not see Female A again until 2 y later, on 5 July 2013, when I observed her at a nest site 4.6 km to the southwest of her 2011 nest (Fig. 1). The

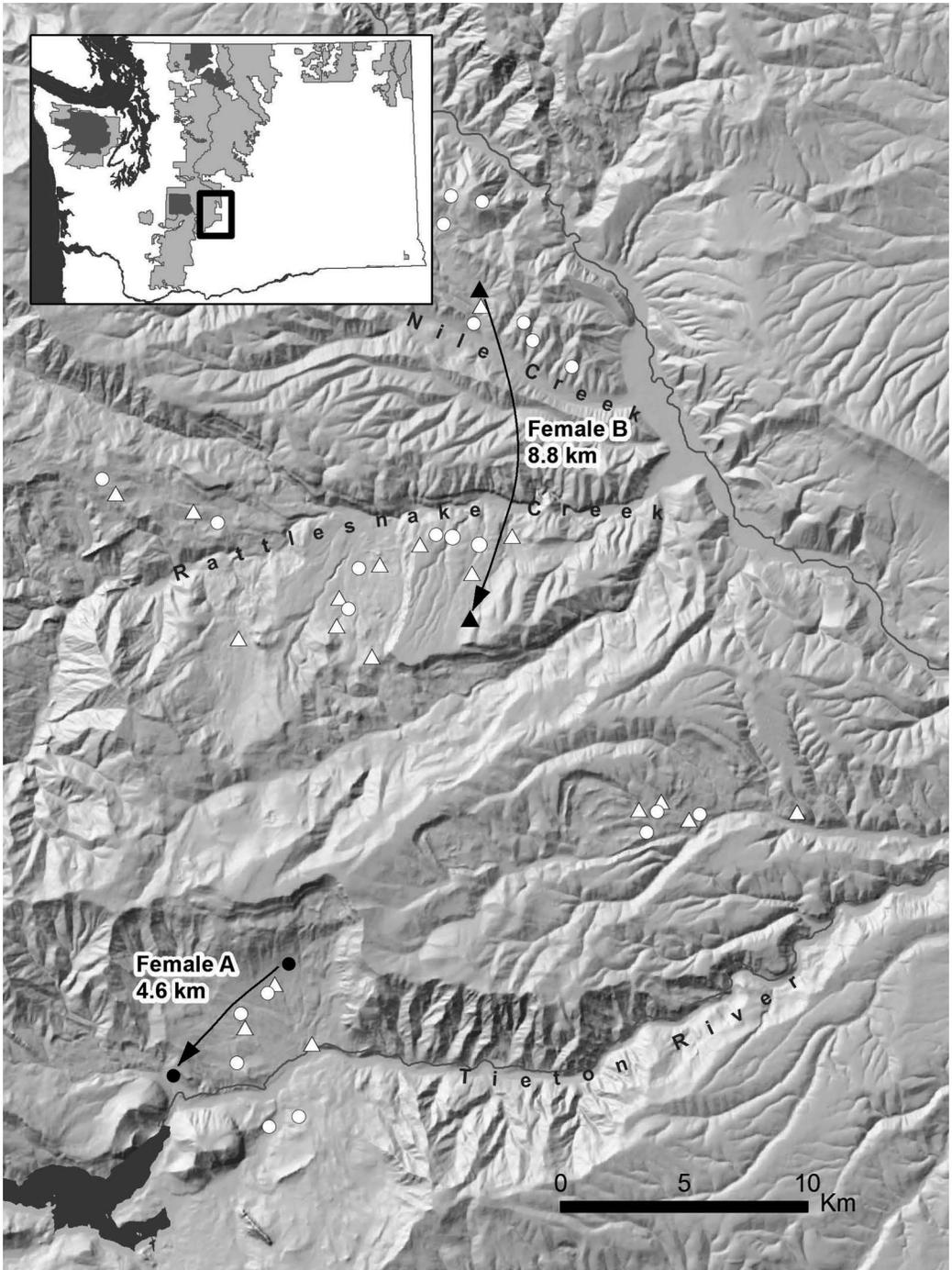


FIGURE 1. Between-year breeding dispersal by 2 color-banded female White-headed Woodpeckers in central Washington, 2011–2015. ● represents 1st (2011) and 2nd (2013) nests for Female A; ○ represents other known nest sites for other White-headed Woodpecker pairs in 2013; ▲ represents 1st (2012) and 2nd (2015) nests for Female B; △ represents other known nests sites for other White-headed Woodpecker pairs in 2015.

male attending this 2nd nest was unbanded. I was unable to obtain photographic evidence that Female A's original mate was alive and on his original territory in either 2012 or 2013. I was aware of 2 active White-headed Woodpecker nests located between the 2011 and 2013 nests for this female (Fig. 1). Thus, this female had not simply shifted her nest's location within 1 large territory, but rather had traversed neighboring territories during breeding dispersal. I observed 2 fledglings being tended near this nest on 14 July 2013, indicating that Female A's 2013 nest successfully fledged young.

The 2nd observation of adult dispersal also occurred for an adult female (Female B, Fig. 1). This 2nd female had been banded with an aluminum US Fish and Wildlife Service band as a hatch-year bird in the Rattlesnake Creek watershed (approximate UTM: 10T 647882 5185816) by the Institute of Bird Populations (Point Reyes Station, California). I captured her at a nest site in the Nile Creek watershed (approximate UTM: 10T 651304 5190587) on 6 July 2012, and placed colored bands on her legs. Her mate was also color-banded. Her 1st nesting attempt in 2012 failed due to predation, but she and her mate excavated a 2nd cavity from which they successfully fledged 1 young in 2012. At the time she was 4 y old. Three years later and on 3 May 2015, I observed this same female, now 7 y old. She had returned to the Rattlesnake watershed within 4 km of where she had originally been banded in her hatch-year, and was 8.8 km south of her 2012 nest site. In late May she excavated a nest cavity at this location with an unbanded male and succeeded in fledging 4 young. I returned to her previous territory in the Nile watershed on 7 May 2015, and found an unbanded male and female present and excavating a nest cavity 206 m from Female B's 2012 nest. I did not see Female B's original mate after summer 2012, so I do not know whether he died or emigrated. Also, I do not know whether Female B willingly dispersed and the same site was later settled by an unbanded pair, or whether she was forcibly ousted by the unbanded female or male. I was aware of 3 nest sites for other pairs of White-headed Woodpeckers between her 2012 and 2015 nest sites, evidence that Female B had not

simply shifted her nest location within 1 large, continuous territory.

These observations demonstrate that White-headed Woodpeckers will disperse to new territories as adults and do not always have fidelity to 1 breeding territory. Given the remoteness and ruggedness of the terrain in this study, and logistical challenges involved with resighting banded woodpeckers, adult dispersal may be more common than suggested by these 2 observations. Regardless, they demonstrate that survival estimates based on observations of color-banded adults may be biased low. Breeding dispersal has been observed in other non-migratory woodpecker species. In the Red-cockaded Woodpecker (*Picoides borealis*), one of the best-studied woodpeckers worldwide and a close relative of the White-headed Woodpecker (Weibel and Moore 2002a, 2002b; Fuchs and Pons 2015), 12% of adult females may disperse to new breeding territories each year (Daniels and Walters 2000).

I did not calculate dispersal rates because my study was not designed to measure breeding dispersal. However, the 2 incidental cases of breeding dispersal that I observed were unexpected because the only previous color-band study reported no cases of breeding dispersal among >100 color-banded White-headed Woodpeckers (Frenzel 2004). It is possible that breeding woodpeckers in my study area are more likely to disperse than those in Frenzel's (2004) study area in the Cascade Range of Oregon. However, it is also possible that differences in study methods increased the likelihood that I would detect breeding dispersal. Frenzel (2004) reports returning to the same White-headed Woodpecker territories and study areas each year. In contrast, I visited tracts of land outside of known White-headed Woodpecker territories during concurrent research with other woodpecker species.

These findings have implications for conservation of this species, because estimates of survival from color-bands have been used to inform management plans for White-headed Woodpecker (Mellen-McClean and others 2013). Unfortunately, because there is no information on the rates of breeding dispersal, it is not possible to correct survival rates estimated from color bands. This places land managers in a

quandary, where they must decide whether to incorporate potentially biased estimates of survival (from color-bands) in their planning, or no estimates at all. Studies that search for color-banded woodpeckers over larger areas outside of the territories or study areas in which woodpeckers were originally banded may increase the likelihood that breeding dispersal will be observed. Studies can also use modeling methods that account for rates of breeding dispersal, search effort, and other factors (for example see Cooper and others 2008). If breeding dispersal were low, size of search area should not affect survival estimates (Zimmerman and others 2007); however, my incidental documentation of 2 breeding dispersal events out of 46 marked birds suggests that for White-headed Woodpeckers, breeding dispersal may not be negligible and should be considered when designing studies of adult survival.

Studies are also needed that measure rates of breeding dispersal so that survival can be accurately estimated. In regions like central Washington where woodpecker territories are broadly distributed across fairly remote and rugged terrain, telemetry devices will likely be necessary for quantifying both dispersal and survival rates, although caution is needed to minimize the effects of transmitters on survival (Barron and others 2010; Noel and others 2013). I also suggest that future studies explore possible causes of breeding dispersal and whether breeding dispersal varies by sex, region, habitat type, or life experience. In some species, nest success is an important factor influencing breeding dispersal, and adults are more likely to disperse to new breeding territories following nest failure (reviewed in Greenwood and Harvey 1982). In both cases reported here, the dispersing females fledged more young at their 2nd nest sites compared to the nests where I first observed them, suggesting that this hypothesis should at least be considered. However, studies with larger sample sizes are needed. Additionally, I suggest that researchers and managers remain cautious about estimates of White-headed Woodpecker survival based on resightings of color-banded adults.

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- US Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98512; tlorenz@fs.fed.us. Submitted 28 December 2015, accepted 5 April 2016. Corresponding Editor: D Max Smith.*