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SHORT COMMUNICATIONS

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RELATIONSHIP OF TEMPORARY SETTLING AREAS TO FIRST NESTING SITES IN COOPER'S HAWKS

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KEY WORDS: *Cooper's Hawk*; Accipiter cooperii; *floater*; *home range*; *natal dispersal*; *nesting*.

In territorial birds, floaters are dispersing, nonbreeding individuals that can enter the reproductive population when a breeding territory becomes available (Penteriani et al. 2008). Young birds often become floaters during their movements between natal sites and first breeding sites (i.e., natal dispersal, Greenwood 1980). Floaters are common in some populations, as evidenced by the rapid replacement of breeding individuals when they die or are experimentally removed (Newton 1992, Hogstad 1999, Bruinzeel and van de Pol 2004). The behavior of floaters, although difficult to study, is potentially important because floaters may influence the dynamics, distribution, and stability of the breeding populations in which they occur (e.g., Penteriani et al. 2005, Penteriani et al. 2006, Penteriani et al. 2008, Penteriani and Delgado 2009).

Movements of floaters may reflect a strategy for acquiring a breeding site, but limited information exists about how floaters move relative to where they eventually nest. Available evidence suggests that a common strategy among floaters is to restrict their activities to a limited area, become familiar with a small number of potential breeding sites, and be ''first in line'' when a breeding individual dies and an opportunity to nest becomes available (Smith 1978, Rohner 1997, Hogstad 1999, Bruinzeel and van de Pol 2004, Tobler and Smith 2004).

Patterns of movement by raptors during natal dispersal vary widely, but often initially include short movements within the natal area, followed by a period of wandering (i.e., relatively large-scale movements), followed by short movements again in one or more temporary settling areas (Delgado and Penterianai 2008, Delgado et al. 2009, Morrison and Wood 2009, Penteriani and Delgado 2009). Some Cooper's Hawks (*Accipiter cooperii*) follow this pattern and establish well-defined home ranges during their first winter of life, after a period of wandering (Mannan et al. 2004), but whether these home ranges are related to where they eventually nest has not been assessed. Herein, I examine the spatial relationship between the home ranges of first-year, nonbreeding Cooper's Hawks and sites where they nested later in life in an urban environment.

METHODS

The study was conducted in and near Tucson, Arizona, U.S.A. (32°13.3′N, 110°55.6′W), a metropolitan area that encompasses about 1460 km² with an estimated human population of about 1 014 000 residents (Pima Association of Governments 2009). The city is composed of a highly urbanized core surrounded by a mosaic of business complexes, high- and low-density residential areas, and parks and golf courses. Tucson is located in the Sonoran Desert and supports remnants of lower and upper Sonoran vegetation communities and riparian corridors (Brown et al. 1979), although much of the natural vegetation has been removed or replaced with nonnative plants.

Cooper's Hawks are widespread in North America and nest in woodlands and urban and suburban areas from southern Canada to northern Mexico (Rosenfield and Bielefeldt 1993, Stewart et al. 1996, Roth and Lima 2003). In the Sonoran desert, Cooper's Hawks nest most commonly in riparian corridors and some urban areas (e.g., Tucson, Mannan et al. 2008). Home ranges of floating Cooper's Hawks in Tucson were identified in 1999 and 2000 by tracking radio-tagged individuals over a period of up to 6 mo after fledging (see details in Mannan et al. 2004). Hawks radio-tagged in that study also were marked with a U.S. Geological Survey aluminum band on one leg, and a plastic, colored band etched with a unique alpha code on the other leg. Letters on the plastic bands could be read from the ground with a 15–45× spotting scope or 20× binoculars.

I identified radio-tagged hawks that acquired breeding sites later in life by reading their coded leg bands during annual nest surveys associated with a long-term study of the demographics of Cooper's Hawks in Tucson (Mannan et al. 2008). This study was initiated in 1993, and from 1999 through 2008 between 50 and 90 established nest sites were revisited annually to identify color-marked hawks. Also, new nest sites were located annually by searching areas with large trees, and investigating reports of hawks observed by homeowners or collected by rehabilitators (see Mannan et al. 2008 for details). I used a digital representation of the streets of Tucson (Shaw et al. 1996) and Arc-

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Table 1. Relationship of first nest sites to home ranges established in the first winter of life for Cooper's Hawks, Tucson, AZ.

HAWK ID[a]	PERIOD TRACKED IN HOME RANGE[b]	DATE AND FATE[c]	RELATIONSHIP TO HOME RANGE
M327	Sep 1999–Feb 2000	Mar 2002; dead	Inside
M457	Sep 2000–Dec 2000	Apr 2008; nesting	Inside
M885	Aug 1999–Mar 2000	Jan 2001; nesting	Inside
M854	Aug 1999–Oct 1999	Apr 2001; nesting	Inside
M313	Sep 2000–Dec 2000	Jun 2002; nesting	1.0 km from edge
F276	Sep 2000–Dec 2000	Feb 2003; nesting	Inside
F259	Aug 2000–Nov 2000	Mar 2002; nesting	4.6 km from edge

[a] M = male; F = female.
[b] Estimates of home range size reported in Mannan et al. (2004).
[c] Date located and identified, and fate.

view Version 3.2 (Environmental Systems Research Institute 1996) to measure distances between edges of home ranges and nest sites. All field methods were approved by the University of Arizona Institutional Animal Care and Use Committee (Protocol 03-119).

RESULTS AND DISCUSSION

Mannan et al. (2004) tracked 40 radio-tagged hawks (22 males and 18 females) during natal dispersal in Tucson, and gathered sufficient information to identify first winter home ranges for nine of them (five males and four females, each from different nests; Mannan et al. 2004). First winter home ranges averaged 771 ha (SD = 403), did not differ between males (804 ha, range = 492–1580 ha, SD = 456) and females (731 ha, range = 409–1294 ha, SD = 387; Mannan et al. 2004), and included between one and three breeding sites frequently used by other Cooper's Hawks.

I ascertained the fate of seven of the nine hawks that established home ranges in their first winter of life. Six were found nesting when they were between 2 and 8 yr of age (Table 1). Four of these hawks acquired breeding sites that were within the boundaries of their first winter home ranges, and the remaining two acquired breeding sites that were close to the edges of their first winter home ranges (Table 1). The seventh hawk was found dead inside the boundaries of its first winter home range. Of the six breeding sites acquired by hawks, three were sites that had been used previously by other hawks, and one was a new breeding site (i.e., a site I had searched previously and not found nesting hawks and where homeowners confirmed that nesting hawks were new to their property). The history of the remaining two sites was unknown.

I do not have information about the movements of radio-tagged hawks in the years between their first winter of life and the time I found them nesting (or dead). It is possible that during this period they wandered widely or settled temporarily in areas other than their first winter home ranges. It is also possible, given where I found them, that their movements while floating were largely restricted to the areas where they settled in the first winter of their lives. I cannot distinguish between these alternatives, but constrained movement during floating could confer at least two advantages. First, knowledge of sources of food, cover, and water in a restricted area would promote survival over the two or more years it might take to gain a nest site. And, second, being close to one or more established nest sites and thus being able to repeatedly assess whether nesting opportunities exist would increase the chance of acquiring a breeding site when one became available through death of a resident breeder (Bruinzeel and van de Pol 2004).

It is also possible that the nests where I found the hawks were not where they nested first. However, after settling in a breeding territory, Cooper's Hawks in Tucson maintain high site fidelity (males = 97%, females = 91%; Mannan et al. 2007); thus, the likelihood of the birds having switched nest sites between their first nests and the time I found them was low.

RELACIÓN ENTRE LOS SITIOS DE ASENTAMIENTO TEMPORALES Y LOS SITIOS DE LA PRIMERA ANIDACIÓN EN *ACCIPITER COOPERII*

RESUMEN.—En las aves territoriales, los transeúntes son individuos no reproductivos que se encuentran en fase de dispersión y pueden entrar en una población reproductiva cuando un territorio de cría se hace disponible. Existe poca información sobre el movimiento de estos individuos transeúntes con relación al sitio donde eventualmente anidan por primera vez. Examiné la relación espacial entre las áreas de vida de individuos de *Accipiter cooperii* no reproductivos en su primer año de vida y las áreas en que anidaron más tarde. De nueve halcones que establecieron áreas de vida en su primer invierno, seis adquirieron sitios de cría (y uno fue encontrado muerto) entre 2 a 8 años después, los cuales se localizaron en o cerca de las áreas de vida que establecieron durante su primer invierno.

[Traducción del equipo editorial]

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