

# Short Communications

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## Behavior of Post-nest Failure and Non-breeding Common Loons During the Breeding Season

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**ABSTRACT.**—Common Loon (*Gavia immer*) breeding, pre-migratory, and wintering behavior has been well described, but no previous author has characterized failed and non-breeding loon behavior during the summer breeding season. We quantified the summer behavior of non-breeding and failed breeding loons from 15 lakes in Kejimikujik National Park (Nova Scotia, Canada) and the Lepreau watershed (New Brunswick, Canada). Time-activity budgets and event quantifications were used to describe behavioral state and event patterns. The behavior of failed and non-breeders in summer is similar to that described for pre-nesting, pre-migratory, wintering, and breeding loons (except those with young chicks) with foraging the predominant behavior and peering the predominant event. We propose that the behavioral regimen of adult loons is relatively constant throughout the year, with the exception of a two-week period following chick hatching when adults brood their young. *Received 16 Dec. 1999, accepted 16 August 2000.*

Common Loon (*Gavia immer*) breeding behavior has been well described (Sjölander and Ågren 1972, McIntyre 1975, Evers 1994), as has the behavior of pre-migratory (McIntyre and Barr 1983) and wintering loons (McIntyre 1978, Daub 1989, Ford and Gieg 1995). However, no previous researcher has quantified the behavior of failed or non-breeding loons during the summer. The paucity of such data was acknowledged by Evers (1994) when he considered what the time distribution of loon pairs without breeding duties might be. Evers (1994) compared his pre-nesting behavioral catalogues to the fall and winter catalogues described by other researchers (e.g., McIntyre

1978, McIntyre and Barr 1983) and showed that foraging comprised 50–60% of behavioral activity. The question remained whether this would be true for non-breeding loons during the summer. As part of a larger study, we examined the summer behavior of non-breeding and failed breeding loons at two sites in Atlantic Canada. The results allow for a more complete description of the annual behavior of non-breeders and for those that lost their nest.

Between 1996 and 1997, 47 pairs of resident Common Loons in Kejimikujik National Park, Nova Scotia, Canada (44° 20' N, 65° 20' W) and the Lepreau watershed, south-western New Brunswick, Canada (45° 20' N, 66° 35' W) were selected during the spring pre-nesting season. We had no way of *a priori* selecting lakes or pairs that would or would not breed. Twenty-one pairs did not subsequently breed and we continued monitoring 14 of those pairs for the duration of the summer. Six pairs bred but failed early in incubation; we continued monitoring four of those pairs for the duration of the summer. The 14 non-breeding and 4 failed breeding pairs that we monitored resided on 15 lakes with varied lake chemistry, lake morphometry, and biological characteristics. Most of our study lakes were small (<100 ha) single pair territories, with only three lakes having more than one pair.

All observations were made with 8×42 binoculars and/or a 20–60× spotting scope, from a concealed location, between 1 May and 1 September, 1996 and 1997 for a total of 75 h of randomly distributed diurnal observation ( $n = 108$  observations, mean observation time = 41.7 min per bout, range = 11–120 min per bout). Only one randomly chosen individual of any pair was watched during an observational bout. Individuals were only identified to known residential pairs because many of the study subjects were unbanded and identifica-

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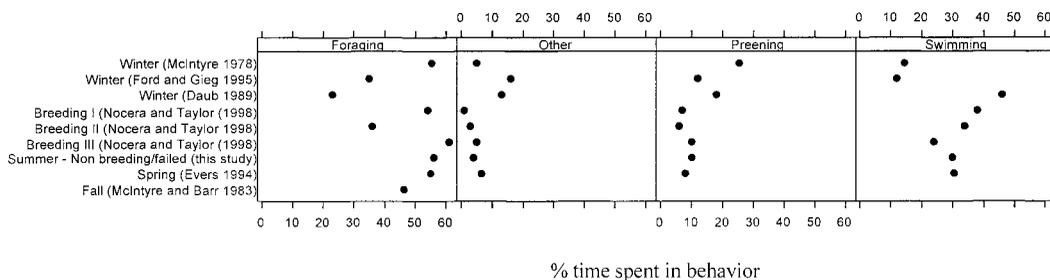


FIG. 1 Comparison of seasonal behavior descriptions for Common Loons. Categories of Breeding (Nocera and Taylor 1998) are: I = adults with chicks 14+ days old, II = adults with chicks 1–14 days old, III = nonincubating member of a nesting pair.

tion of unmarked individuals is often impossible.

We catalogued behavioral states (any behavior typically lasting longer than 5 s; Martin and Bateson 1993) of non-breeding and failed breeding loons using time-activity budgets. Time-activity budgets are commonly used to quantify the proportion of time that an individual spends in various behavioral states (Altmann 1974). We quantified event behaviors (any behavior typically lasting less than 5 s; Martin and Bateson 1993) to take into account subtler behaviors that are often overlooked in time-activity budgets. Behavioral states were categorized as swimming (including drifting), preening, and diving. Territorial encountering, bill tuck, and bathing were summed as “other”; these behaviors were rarely observed. Behavioral events included foot-wagging, stretching, vulture-posturing, splash-diving, peering, yawning, vocalizing (wails, tremolos, hoots, yodels and mews), penguin-dancing, and rushing (Sjölander and Ågren 1972, McIntyre 1975). Peering sometimes lasted longer than 5 s, but rarely exceeded 15 s. Thus, peering was classified as an event for the purposes of this investigation.

Non-breeding loons and loons with failed nests at both sites predominantly spent their time foraging (56%), followed by swimming (30%), preening (10%), and other activities (4%). All event behaviors occurred at least once; the predominant event was peering (19.2 events per h), followed by tremolo vocalization (4.2 per h); stretching and foot wagging were equally common (3.0 per h). All other event behaviors were relatively rare (<1.0 event per hour).

We detected few differences between be-

havioral catalogues of failed and non-breeders and those published of pre-nesting, breeding, post-nesting pre-migratory, and wintering loons (Fig. 1). The time-activity budget hierarchy we observed is similar to that described by McIntyre (pers. comm., 1978) for wintering loons (foraging > preening > swimming > other). McIntyre and Barr (1983) did not report complete time-activity budgets for loons on autumnal staging grounds, but they noted foraging as the predominant behavioral state. The spring time-activity budgets described by Evers (1994) were analogous to those of our study. Ford and Gieg (1995) reported wintering loons spent most of their time foraging, followed by swimming, preening and other, which again resembles failed and non-breeding loon behavioral patterns in summer. However, Daub’s (1989) designation of swimming and drifting as the predominant wintering state differs from our results.

Likewise, certain groups of breeding adults on our study lakes (Nocera and Taylor 1998) exhibited the same hierarchy (Fig. 1). The similarities to breeding loons are limited to non-incubating members of a nesting pair and adults with more developed young (> 14 d old), whereas the behavioral hierarchy of breeding adults with young chicks (< 14 d old) differs because of the necessity to brood chicks. However, even during this period, foraging was the predominant behavioral state (36%), followed by swimming (34%), with brooding (21%) as the third most common behavior.

Evers (1994) found that pre-nesting loons spent 53–57% of their time foraging, 29–32% swimming (sum of resting and locomotion), 8% preening, and 4–5% other. Those results

are almost identical to the percentages we found for failed and non-breeders (56%, 30%, 10%, and 4% respectively; Fig. 1). Our results differ from the wintering behavioral patterns described by Daub (1989) who found that drifting (equivalent to our designation of swimming) was the predominant behavior with less time devoted to foraging. One source of discrepancy may be that Daub (1989) used instantaneous sampling [as did Ford and Gieg (1995)], whereas we used continuous sampling. Instantaneous sampling may not offer the sensitivity necessary to accurately describe activity patterns of animals (Martin and Bateson 1993).

The strong similarities between the time-activity budgets of wintering, pre-migratory, pre-nesting, nesting, post-hatch (with chicks older than 14 d), and failed and non-breeding loons seem initially counter-intuitive because of habitat differences. Evers' (1994) study site at Seney National Wildlife Refuge in Michigan consisted of shallow, eutrophic pools with few shoreline irregularities, while the wintering studies occurred at sea under variable conditions (McIntyre 1978, Daub 1989, Ford and Geig 1995). Lakes in our Atlantic Canada study area tend to be deep and oligotrophic with a high degree of shoreline complexity (Kerekes and Schwinghammer 1973). Additionally, there may be a difference in fish availability between these study sites, which may affect foraging time requirements. We propose that foraging time for adult loons may be limited, but they may vary the intensity of foraging by modifying the time spent submerged. This idea is supported by observations of breeding loons (Nocera and Taylor 1998) that suggest adults with 1–14 day old chicks, spend less time diving and more time swimming.

We previously reported that breeding loons in our study sites exhibited aberrant behavioral patterns associated with increased mercury exposure (Nocera and Taylor 1998). Therefore, the comparison we have made between breeding loons and failed and non-breeders needs to be regarded with caution. However, the behavior of failed and non-breeders was

not sensitive to mercury exposure, lake chemistry, lake morphometry, or other select biological characteristics of a territory (Nocera and Taylor 1998).

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## Sloths in the Diet of a Harpy Eagle Nestling in Eastern Amazon

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**ABSTRACT.**—Prey remains of a nestling Harpy Eagle (*Harpia harpyja*) over 15 months in eastern Amazon, Brazil included 11 two-toed sloths (*Choloepus didactylus*), 9 three-toed sloths (*Bradypus variegatus*), and 1 gray four-eyed opossum (*Philander opossum*). We found no evidence of predation on primates despite their abundance in the area and their importance to Harpy Eagles studied elsewhere. We observed no sloths in 605 km of line transects, a finding that suggests the inadequacy of transect data to estimate prey density for Harpy Eagles. Received 12 April 2000, accepted 31 August 2000.

The Harpy Eagle (*Harpia harpyja*) is considered the most powerful raptor in the world (Sick 1997). Harpy Eagles prey upon large vertebrates, including primates, sloths, opossums, coatis, kinkajous, and macaws (del Hoyo et al. 1994). Although Bierregaard (1995) mentions that the Harpy Eagle is one of the most studied Neotropical raptors; there is little information available on its ecology in Brazil (Peres 1990, Galetti et al. 1997, Sick 1997). We present information on the diet based on the prey remains found under a nest in the eastern Amazon, Pará state, Brazil.

We found a Harpy Eagle nest on 21 June 1997 in a 40 m tall legume tree (angelim pedra, *Hymenobium petraeum*, Leguminosae) at Fazenda Cauaxi, Paragominas (3° 45' S; 48° 10' W), Pará, Brazil. The Fazenda Cauaxi is a private farm of about 400 km<sup>2</sup> consisting of a mosaic of pastures, primary forests and selectively logged forests. In June 1997, the nest was occupied by a nestling eagle and an adult Harpy Eagle was observed once about 400 m from the nest. We never observed the adult eagle feeding the juvenile.

We visited the nest of the Harpy Eagle ev-

ery three months from June 1997 to September 1998. During each visit we collected all available prey remains found under the nest. The bones found under the nest were compared to specimens in the Museu Paraense Emílio Goeldi in Belém, Pará. Our estimate of the number of individuals taken by the Harpy Eagle was based only on the skulls.

Prey remains found under the nest consisted of 21 individuals of 3 species of mammals: 11 skulls of two-toed sloths (*Choloepus didactylus*; body mass = 4.1–8.5 kg), 9 skulls of three-toed sloths (*Bradypus variegatus*; body mass = 2.3–5.5 kg; Emmons & Feer 1997), and 1 gray four-eyed opossum jaw (*Philander opossum*). The sloth skulls found in November and January might have been killed by the young eagle.

Other investigators found frequent use of sloths by Harpy Eagles, but not to the extent we found (Rettig 1978, Izor 1985). Sloths comprised about 36% (Rettig 1978) of the prey items for Harpy Eagles in Guyana. The most intriguing aspect of the eagle's use of sloths is that the two species were taken in similar numbers. Two-toed sloths are mainly nocturnal, while three toed sloths are mainly diurnal (Emmons and Feer 1997, Queiroz 1995); consequently, we would expect three-toed sloths to be taken more frequently than two-toed sloths.

In Guyana, primates (mainly capuchin monkeys, *Cebus* spp.) were the second most frequent item in the diet of Harpy Eagles (Izor 1985). We estimated a density of 22 individuals/km<sup>2</sup> of 5 primate species (*Saguinus midas*, *Cebus kaapori*, *Cebus apella*, *Chirotopes satanas*, and *Alouatta belzebul*) at Fazenda Cauaxi based on line transects. All the primates we observed could be taken by Harpy Eagles and we would expect primates to be the main prey for Harpy Eagles based on their abundance. We never observed sloths in a mammal census in the area (ca 605 km of line transects), indicating the limitation of transect

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censuses to estimate prey density for Harpy Eagles.

Our work shows that at least one pair of Harpy Eagles of the eastern Amazon frequently uses sloths to feed their nestling, even more than observed in Guyana (Rettig 1978, Izor 1985).

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## Food Habits of Northern Goshawks Nesting In South Central Wyoming

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**ABSTRACT.**—Northern Goshawks (*Accipiter gentilis*) nesting in south central Wyoming consumed at least 33 species of prey; 14 were mammals and 19 were birds. Based on percent occurrence in regurgitated pellets, dominant (>10% frequency) prey species included: red squirrel (*Tamiasciurus hudsonicus*; present in 50% of pellets), Northern Flicker (*Colaptes auratus*; 34%), American Robin (*Turdus migratorius*; 30%), golden-mantled ground squirrel (*Spermophilus lateralis*; 27%), and Uinta or least chipmunk (*Tamias spp.*; 10%). Woodpeckers [combined frequency of occurrence for Northern Flicker, Red-naped Sapsucker (*Sphyrapicus nuchalis*), Hairy Woodpecker (*Picoides villosus*), Three-toed Woodpecker (*Picoides tridactylus*), and unknown species] were present in 52% of pellets. Unusual food items in the diet included mule deer (*Odocoileus hemionus*) and American marten (*Martes americana*). Received 3 March 2000, accepted 17 August 2000.

Northern Goshawks (*Accipiter gentilis*) eat a diverse diet that varies by region, season, and prey availability (Squires and Reynolds 1997). Goshawk diets are best known for populations nesting in the northwestern (Moore and Henny 1983, Reynolds and Meslow 1984, Bull and Hohmann 1994) and southwestern (Kennedy 1991, Boal and Mannan 1994, Reynolds et al. 1994) United States. Land managers need to understand how goshawk food habits vary across the species' range to render informed management decisions

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(Reynolds et al. 1992). To address this information need, which is particularly lacking for populations nesting in the central Rocky Mountains (Shuster 1980), I examined the food habits of goshawks nesting in south central Wyoming.

#### METHODS AND STUDY AREA

In 1992, I collected 793 regurgitated pellets from 40 active goshawk nests ( $\bar{x}$  = 19.8 pellets/nest) after the young had fledged. All nests were located on the Medicine Bow-Routt National Forest in the Sierra Madre and Medicine Bow Mountain Ranges (2438–3353 m elevation) in south central Wyoming. Dominant tree species in both ranges included lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*; Marston and Clarendon 1988). Nests were located primarily in lodgepole pine forests with scattered quaking aspen (*Populus tremuloides*, Squires and Ruggiero 1996). Sagebrush grasslands were commonly adjacent to forests on the study area. The climate is montane with precipitation ranging from 81 cm at 2440 m to 122 cm at 3350 m (Marston and Clarendon 1988).

Regurgitated pellets were washed in a fine mesh nylon bag and sorted according to similar hair, bone, and feather fragments. I used xylene to clarify 5–7 guard hairs from each sorted pile to identify prey species based on internal characteristics of the medulla according to Moore and coworkers (1974). I identified feather fragments to order based on node and barb characteristics (Robertson et al. 1984, Brom 1986, Brom 1990) and compared complete feathers and bones to museum specimens at the University of Wyoming for identification to species when possible. Although pellet analysis cannot be used to quantify the number of individuals consumed per prey type (Marti 1987), the technique adequately represents raptor diets (Kennedy 1991, Collopy 1983, Real 1996). Hence, the percent occurrence of prey in the pellets approximates the diet of goshawks nesting on the study area.

#### RESULTS

Goshawks nesting in south central Wyoming consumed at least 33 species of prey; 14 of these species were mammals and 19 were birds (Table 1). Based on percent occurrence in pellets, dominant (>10% frequency) prey species included: red squirrel (*Tamiasciurus hudsonicus*; present in 50% of pellets), Northern Flicker (*Colaptes auratus*; 34%), American Robin (*Turdus migratorius*; 30%), golden-mantled ground squirrel (*Spermophilus lateralis*; 27%), and Uinta or least chipmunk (*Tamias spp.*; 10%). Woodpeckers [Northern Flicker, Red-naped Sapsucker (*Sphyrapicus nuchalis*), Hairy Woodpecker (*Picoides villosus*), Three-toed Woodpecker (*Picoides tri-*

TABLE 1. Contents of Northern Goshawk pellets ( $n$  = 793 pellets collected from 40 nests) from south central Wyoming, 1992.

Prey species	Number (%) pellets with prey item
<b>Mammalian prey</b>	
Red Squirrel ( <i>Tamiasciurus hudsonicus</i> )	400 (50)
Golden-mantled Ground Squirrel ( <i>Spermophilus lateralis</i> )	214 (27)
Uinta or Least Chipmunk ( <i>Tamias spp.</i> )	77 (10)
Deer Mouse ( <i>Peromyscus maniculatus</i> )	55 (7)
Red-backed Vole ( <i>Clethrionomys gapperi</i> )	20 (3)
Montane Vole ( <i>Microtus montanus</i> )	14 (2)
Snowshoe Hare ( <i>Lepus americanus</i> )	9 (1)
American Marten ( <i>Martes americana</i> )	3 (<1)
Long-tailed Vole ( <i>Microtus longicaudus</i> )	3 (<10)
Long-tailed Weasel ( <i>Mustela frenata</i> )	2 (<1)
Mule Deer ( <i>Odocoileus hemionus</i> )	2 (<1)
Western Jumping Mouse ( <i>Zapus princeps</i> )	2 (<1)
Ermine ( <i>Mustela erminea</i> )	1 (<1)
Richardson's Ground Squirrel ( <i>Spermophilus richardsonii</i> )	1 (<1)
<b>Avian prey</b>	
Northern Flicker ( <i>Colaptes auratus</i> )	270 (34)
American Robin ( <i>Turdus migratorius</i> )	234 (30)
Black-headed Grosbeak ( <i>Pheucticus melanocephalus</i> )	18 (2)
Steller's Jay ( <i>Cyanocitta stelleri</i> )	14 (2)
American Kestrel ( <i>Falco sparverius</i> )	13 (2)
Red-naped Sapsucker ( <i>Sphyrapicus nuchalis</i> )	11 (1)
Pine Siskin ( <i>Carduelis pinus</i> )	7 (1)
Townsend's Solitaire ( <i>Myadestes townsendi</i> )	6 (1)
Dark-eyed Junco ( <i>Junco hyemalis</i> )	5 (1)
Evening Grosbeak ( <i>Coccothraustes vespertinus</i> )	4 (1)
Hairy Woodpecker ( <i>Picoides villosus</i> )	4 (1)
Pine Grosbeak ( <i>Pinicola enucleator</i> )	4 (1)
Ruffed Grouse ( <i>Bonasa umbellus</i> )	4 (1)
Western Tanager ( <i>Piranga ludoviciana</i> )	4 (1)
Gray Jay ( <i>Perisoreus canadensis</i> )	2 (<1)
Mountain Bluebird ( <i>Sialia currucoides</i> )	2 (<1)
Red Crossbill ( <i>Loxia curvirostra</i> )	2 (<1)
Three-toed Woodpecker ( <i>Picoides tridactylus</i> )	2 (<1)
Black-billed Magpie ( <i>Pica pica</i> )	1 (<1)
Unknown Piciformes	119 (15)
Unknown Passeriformes	23 (3)
Unknown Columbiformes	1 (<1)

*dactylus*), and an unknown Picidae] were present in 52% of pellets. Mammalian remains were found exclusively in only 14% of pellets, while 79% of pellets contained both mammalian and avian remains.

#### DISCUSSION

Based on the analysis of regurgitated pellets, goshawks nesting in south central Wyoming forage primarily on red squirrels, Northern Flickers, American Robins, golden-mantled ground squirrels, and chipmunks. The degree to which western populations depend on mammalian compared to avian prey varies (Moore and Henny 1983, Boal and Mannan 1994, Bull and Hohmann 1994, Reynolds et al. 1994). Red squirrels are widely distributed throughout North America (Young 1999) and broadly overlap the goshawk's distribution (Reynolds et al. 1992). Limited data indicate that red squirrels are usually present in 5–12% of regurgitated pellets (see Squires and Reynolds 1997: appendix 2). However, I found red squirrels in 50% of pellets suggesting that goshawks nesting in south central Wyoming in 1992 may have preyed on red squirrel more than goshawks in other populations. I found that Northern Flickers accounted for 34% of the diet and Piciformes in general provided 52%. Northern Flickers may be prominent in goshawk diets because their conspicuous markings and behavioral displays attract predators (Grzybowski and Eaton 1976, Reynolds and Meslow 1984, Younk and Bechard 1994). Piciformes, in conjunction with American Robins (30%), accounted for most of the avian prey eaten by nesting goshawks during my study.

Reynolds and coworkers (1992) identified 14 prey species that are particularly important to southwestern populations. All the dominant (>10%) prey of goshawks on this study are included among those 14 species. Thus, although the specific habitat recommendations as discussed by Reynolds and coworkers (1992) for the Southwest may not be directly applicable to lodgepole pine forests in Wyoming, the idea that these prey species should be the focus of habitat management is consistent with my findings.

Five pellets contained prey items that are unusual in goshawk diets; two pellets were composed entirely of mule deer (*Odocoileus hemionus*) hair and three pellets contained Ameri-

can marten (*Martes americana*) hair. Goshawks will feed on mule deer carrion and possibly this accounts for its presence in the pellets (Squires 1995). I also recovered a jaw from a 1–3 week old mule deer from inside an active goshawk nest bowl. Mule deer average about 3.7 kg at birth (Robinette et al. 1973), which is similar in weight to the largest hares killed by goshawks (Kenward et al. 1981). The jaw was fresh and blood stained indicating the fawn had been recently killed or scavenged. There was no tissue present to check for hemorrhaging to determine if the goshawks had killed the fawn or scavenged it. Male martens weigh up to 1250 g (Clark et al. 1987), well within the size class of potential prey that goshawks can kill. I believe this is the first documentation that goshawks may occasionally prey on or scavenge American martens.

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## Itinerant Breeding and Mate Switching by an American Dipper

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**ABSTRACT.**—Several bird species are thought to be itinerant breeders, reproducing in different localities during the same season, but this behavior has been documented conclusively only in the Red-billed Quelea (*Quelea quelea*). In 1997, I observed a case of itinerant breeding and mate switching by a banded female American Dipper (*Cinclus mexicanus*) in western Montana. This female raised a successful first brood on a bridge early in the breeding season, then moved 5 km to a neighboring drainage and successfully raised a second brood in a crevice with a different male. This reproductive behavior may have been facilitated in my study area by the use of low-elevation bridges as nest sites by dippers. *Received 15 Feb. 2000, accepted 22 June 2000.*

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Itinerant breeding, or breeding in different localities during the same season, is a reproductive strategy that may increase the overall productivity of certain multi-brooded species, particularly when the food supply in a given area is abundant only long enough for the raising of one brood (Ward 1971). Several bird species are thought to exploit an itinerant breeding strategy (Ward 1971; Walsberg 1977; Bucher 1982, 1992; Hamilton 1998). However, this behavior has been documented conclusively only in the Red-billed Quelea (*Quelea quelea*; Jaeger et al. 1986). The presence of marked queleas in distant breeding colonies within a period of a few months suggested that the birds were raising successive broods in different locations (Jaeger et al. 1986). Whether these birds were successful in either breeding attempt was not known. Phainope-

plas (*Phainopepla nitens*) also breed in two distinct habitats during different times of the year, but whether the same birds breed in both areas has not been confirmed (Chu and Walsberg 1999). During a study of American Dippers (*Cinclus mexicanus*) in Montana's Bitterroot Mountains, I documented a case of itinerant breeding in which a banded female dipper successfully raised a brood with one male, then moved to a neighboring drainage and raised a successful second brood with a different male.

This behavior is of interest because, to my knowledge, successive monogamy (as defined by Ford 1983), or mate switching by females within a breeding season, has not been recorded in American Dippers. Dippers set up Type A (Nice 1941) linear territories of about 1–2 km in length along streams (Price and Bock 1973, Ealey 1977) and are typically thought to be monogamous within a breeding season (Kingery 1996), although several instances of polygyny have been recorded (Price and Bock 1973, Marti and Everett 1978). Dippers also generally raise second broods at the same site as or in close proximity to their first nest attempt (Sullivan 1973, Price and Bock 1983). Until now, no case of itinerant breeding has been documented in any of the five dipper species. Finally, this behavior is especially intriguing since it may have been facilitated in my study area by a human modification of the American Dipper's environment, namely, the building of bridges, which have been adopted as nest sites.

My study area was comprised of 23 streams in the Bitterroot Mountains of western Montana (Ravalli and Missoula counties: 46° 46' N to 46° 11' N, 114° 04' W to 114° 23' W). During the course of a two-year study, I surveyed streams and located and monitored 49 American Dipper nest sites (for a detailed description of study area and methods, see Osborn 1999). I banded 27 adult dippers and 33 juveniles with an aluminum USFWS band and 3 plastic color bands each. On 16 June 1997, a banded female (#8061-3405) and male (#8061-3406) successfully fledged three young from a bridge nest on Fred Burr Creek (elevation 1158 m). Less than one month later on 11 July 1997, I located female #3405 while surveying neighboring Sheafman Creek (elevation 1597 m). She and an unbanded male

were feeding 3- to 5-day-old nestlings in a crevice nest between two boulders.

Based on the length of time needed to build a nest and to lay and incubate eggs, the female must have left her first territory within a day or two of her first brood's fledging. Juvenile American Dippers depend on their parents for 1–2 weeks after fledging (Sullivan 1973). One of the fledglings from the female's first brood was resighted within 1 km of its nest in August 1997, assuring that it was successfully cared for by male #3406 until its independence. Although we did not resight male #3406, the timing of the nesting chronology and the survival of at least one fledgling from the first brood indicate that female #3405 switched mates and was not just responding to the death of a first mate when she moved territories.

The female (and her unbanded mate) successfully fledged two young from her second nest. The site of this second nest was approximately 5 km southwest of her previous site in straight-line distance.

Although the distance that this female dipper moved between nesting attempts is less dramatic than those traveled by Red-billed Queleas (Jaeger et al. 1986) and Phainopeplas (Chu and Walsberg 1999), both of which may move several hundred kilometers, it is nonetheless meaningful. Dippers are altitudinal migrants, but are not known to travel extensively to exploit ephemeral food resources as are queleas (Jaeger et al. 1986) and Phainopeplas (Chu and Walsberg 1999). Price and Bock (1983) recorded movements of 22–75 km (straight-line distance) by banded dippers, but these were by dispersing juveniles over 1–2 years. Because female #3405 left her original territory, flew over several other dipper territories, switched drainages, and likely traveled more than the 5 km straight-line distance to reach her new nest site, her behavior does not represent a typical re-nest but rather an ecologically significant movement.

Thus far, suspected cases of itinerant breeding have all occurred in primarily granivorous or frugivorous birds (Walsberg 1977, Bucher 1982, Jaeger et al. 1986, Seutin et al. 1991, Hamilton 1998) that are faced with a seasonally abundant food supply. Although their primary prey consists of aquatic invertebrates (Mitchell 1968), itinerant-breeding dippers

may be subjected to dwindling food supplies at low-elevation nest sites as the season progresses or may be exploiting a more abundant food supply at higher elevations, because the availability of aquatic invertebrates peaks later at higher elevations (Price and Bock 1983).

Because there were no natural nest sites in the lower stream reaches within my study area, bridges in these areas may have facilitated the case of itinerant breeding that I observed. American Dippers generally initiate nesting earlier at lower elevations than they do at higher ones (Sullivan 1973, Osborn 1999). In my study area, dippers began nesting significantly earlier at the lower elevation bridge nest sites than they did at the higher elevation natural nest sites (Osborn 1999). As a result, the presence of these low elevation bridge nest sites may have allowed dippers to produce an early first brood, before moving to higher elevations to produce a second brood.

Female #3405 was the only itinerant breeder that I documented. I suspect, however, that this strategy was exploited by other dippers as well. Seven of the 22 low elevation bridge-nesting pairs that I monitored in my study area fledged young before June 15, then were not sighted again on their territories. It is likely that some of these early bridge nesters moved upstream and raised second broods on natural substrates. Dippers typically exhibit a seasonal movement upstream at the end of their breeding season (Price and Bock 1983), so movements upstream after their first nesting attempt would not have been unusual.

If itinerant breeding by dippers in western Montana is not uncommon, dipper researchers should be cautioned not to underestimate the rates of second broods and productivity of individual females. Because the timing of breeding may necessitate surveying dippers at lower elevations slightly earlier in the year than those at higher elevations, double counting and therefore overestimating population estimates of breeding dippers are real risks.

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