SHORT COMMUNICATIONS

DISCOVERY OF A KITTLITZ'S MURRELET NEST

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On 22 July 1972 a Kittlitz's Murrelet (*Brachyramphus brevirostre*) was flushed from a nest at approximately 2500 ft elevation on the east side of Frosty Mountain located at Cold Bay (162°42′ W, 55°12″ N), near the tip of the Alaska Peninsula. A single pear-shaped egg was found in a slight gravel depression between rocks situated on a steep moraine between two snow banks and below a hanging glacier. The olive-green egg with brown and black splotches measured roughly 5 × 3.5 cm and was pipped in two places. I remained nearby the nest for nearly 2 hr, but the parent was exceedingly wary and flew near the nest only once. The nest site is about 8 miles from the sea.

The nest was revisited on 28 July, and a grayish downy young was present. The color description fits that given by Thompson et al. (Auk 83:349, 1966). I revisited the nest on 4 August when the chick was presumably 13 days old. Except for its somewhat larger size and pugnacious behavior, there was little change from a week earlier. The only plumage difference was the appearance of quills on the wings. The parent bird was never seen after initial discovery of the nest on 22 July.

When the nest was visited for the fourth time on 15 August, the chick was gone and presumed fledged.

I believe this is the fourth recorded nest of a Kittlitz's Murrelet in Alaska. An egg was found on the side of Pavlof Volcano about 30 miles E of Cold Bay on 10 June 1913 (Gabrielson and Lincoln, The birds of Alaska, Wildlife Management Institute, Washington, D. C., 1959). A male with incubating patches was collected with its egg near Wales, Alaska (65°37′ N, 168°05′ W) on 16 June 1943 (Bailey, Birds of Arctic Alaska, Colorado Museum of Natural History, 1948). A downy young and adult were collected on 26 July 1960 at Angmakrog Mountain, 15.5 miles NE of Cape Thompson, Alaska (165°33′ W, 68°17′ N) (Thompson et al., op. cit.).

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POLYGYNY IN THE DIPPER

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INTRODUCTION

The North American Dipper (*Cinclus mexicanus*) has been regarded as exclusively monogamous (e.g., Bent 1948; Hann 1950; Bakus 1959; Verner and Willson 1969). This paper reports on the discovery of polygyny (simultaneous pairing of two females with one male) in two Dipper populations in the Front Range of Colorado.

METHODS

As part of a continuing study on territoriality, food, and population dynamics of the Dipper, we have been collecting data on Boulder and South Boulder Creeks in the vicinity of Boulder, Colorado, from March 1971 to the present. Our two study areas are 19.3 km and 8.1 km long, and extend from approximately 1576–2105 m and to 1921 m elevation, respectively. Data were collected on 66 breeding adults during 1971 and 1972. Dippers were captured in mist nets and individually color-banded with plastic and aluminum leg bands. Only one of our breeding adults, a male in 1972, was unbanded.

RESULTS

Definitive proof of polygyny would require observation of a male copulating and maintaining pair bonds with two females. Although copulation of a male with two females was never observed, Dippers are strongly territorial during the breeding season and males actively participate in nesting. Therefore, we considered a male to be polygynous if there were no other adults in the nest area during egg laying, and if the male: (1) defended a territory which included both females' territories; and (2) fed both broods.

Table 1 summarizes our evidence for polygyny in the four males which meet these criteria and for which we have the most data. Females carried out most of the nest construction (males occasionally carried material) and all of the incubation. Monogamous males normally assisted in feeding nestlings and fledglings and all polygynous males in table 1 also assisted in feeding at both nests (Bock and Price, unpubl. data). Our data were not collected systematically, however, and we cannot evaluate relative attentiveness at the different nests.

Table 2 shows the frequency of polygyny in our populations and the reproductive success of polygynous versus monogamous birds. The productivity of polygynous birds was significantly higher than that of monogamous birds ($P < 0.001$ for each sex; two sample Student's t-test; Brownlee 1965).

The size of 17 monogamous males' territories averaged 944 m of streambed, while those of 6 males believed to be polygynous averaged 2031 m (1504 m without male no. 521; see table 1).

TABLE 1. Summary of 1971 and 1972 polygyny data.

♂ No. (Yr.)	♀ No.	Distance between females' nests (m)	Brood no.	Egg dates mo./days	Hatching date mo./day	Fledging date mo./day	Misc. notes
814	815		1	4/6–11	4/27	5/22	1. No other adults seen in area after 3/24
(1971)			2	5/24–28	brood failed		
		180					2. ♂ seen copulating with ♀ 815
	817		1	4/20–25	5/11	6/5	
			2	6/18–21	7/6	7/30	
814	815		1	4/11–15	5/1	5/24	1. No other adults seen in area after 3/8
(1972)			2	6/14–18	brood failed		
		180					2. ♀ 957 may have been deficient: abnormally long incubation periods, asynchronous hatching, low % hatching, nestlings small and died in 1 week
	957		1	3/26–31	4/18	failed	
			2	5/5–10	5/25	failed	
812	805		1	4/16–21	5/7	6/1	1. No other adults seen in area after 3/16
(1971)			2	6/4–7	6/23	7/7	
		440					
	806	&	1	4/1–6	4/22	5/15	
		390[a]	2	5/22–27	6/12	7/7	
521	549		1	3/28–4/2	4/18	5/16	1. No other adults seen in area
(1972)			2	5/26–30	brood failed		
		3,220[b]					2. No other adults seen in area after 4/7
	529		1	4/13–18	5/4	5/30	
			2	6/20–25	7/9	8/1	

[a] After her first brood fledged, ♀ 805 built a second nest 50 m closer to 806's nest.

[b] This male's "Home Range" extended for more than 4500 m, the largest we have observed, and it is doubtful that he defended the entire area. This was in the lower end of our study area and abutted on another territory only at the upstream end. The two nests were located on the only two suitable sites in the area.

DISCUSSION

The data in table 1 provide good evidence that Dippers are polygynous. In our sample, a sizable percentage of the males had more than one mate and these polygynous males and females realized a high level of reproductive success (table 2).

A number of authors have attempted to relate the occurrence of polygyny to other aspects of avian ecology. At this point we wish to indicate how our data apply to these various hypotheses.

1. Von Haartman (1969) observed that European passerine species with domed nests are more often polygynous than birds with open nests. As young in domed nests are better insulated from heat loss, they require less food and can be raised by the female with less help from the male (see Royama 1966, for supporting data on energy costs of nestlings). The male is thus freed to mate with other females. While this line of reasoning has been questioned by Verner (1964 and pers. comm.), the Dipper does construct a domed nest, usually in a protected site under a bridge or overhanging cliff.

2. A number of authors (Orians 1961; Verner 1964; Selander 1965; Zimmerman 1966; Martin 1971; others) have indicated that there is often a population reserve of nonbreeding males in polygynous species. A reservoir of nonbreeders has not been reported for the Dipper and we have not been able to prove that any nonbreeding adults exist in our study areas. It may be that the unusual simplicity of the Dipper's habitat provides insufficient refuges for nonterritorial individuals, which are thus forced to move to habitat unsuitable for breeding.

3. Verner and Willson (1966) noted that polygynous and promiscuous mating systems are more common in marshes, prairies, and savannahs. In these habitats productivity is concentrated in a narrow vertical range, and high food availability increases the potential differences between the quality of males' territories (see #5 below). Also, food supplies (insects) are rapidly renewed and the food supply on any given day is not affected by the number removed on previous days. The Dipper also feeds in an essentially two-dimensional habitat (streambed) which is simple (i.e., simple array of feeding niches; Verner and Willson 1966), productive, and lacks avian competitors. It seems likely that these characteristics of Dipper habitat have facilitated the evolution of polygyny in this species. However, we must still explain why polygyny occurred in only a small percentage of our population (see points 4 and 5 below).

TABLE 2. Frequency of polygyny and reproductive success[a] of polygynous and monogamous Dippers, 1971 and 1972.

	No. (%)	No. fledglings	$\bar{x} \pm$ S.D. per adult
Polygynous ♂♂	4 (12.8)	35	8.75 ± 4.27
Monogamous ♂♂	27 (87.2)	93	3.44 ± 1.77
	31 (100.0)		
Polygynous ♀♀	8 (22.9)	35	4.38 ± 2.03
Monogamous ♀♀	27 (77.1)	93	3.44 ± 1.77
	35 (100.0)		

[a] Includes birds which nested but failed to fledge young.

4. Species with widespread feeding areas but restricted nest sites are more commonly polygynous than species with common nest sites (Orians 1969; von Haartman 1956). If a single male's territory includes more than one site, it would be advantageous to several females to mate with him, provided the alternative nest sites are inferior. This seems especially applicable to the Dipper as this species nests mostly on cliffs and under bridges, which are not abundant in our study areas.

5. Many authors (Martin 1971; Orians 1969; Haigh 1968; Zimmerman 1966; Verner 1964) have noted that the territories of polygynous males are of better quality than those of monogamous or bachelor males. As noted by Orians (1969:593), polygyny will occur when the "quality of habitat on the territories of unmated males is such that the expected reproductive success of a newly arriving female is higher if she attempts to mate with a male already with one female but on a superior-quality habitat, rather than mating with an unmated male on poorer habitat." Preliminary analysis of our bottom fauna biomass samples from different territories does not indicate that polygynous Dippers defended territories with greater food densities than those of monogamous individuals. However, in all cases polygynous males defended "open-ended" territories adjacent to habitat unoccupied by other Dippers *due to lack of nest sites.* The larger average size of polygynous territories (table 2) was due to the absence of adjacent pairs.

Any comprehensive theory explaining the evolution of polygyny must include all aspects of a species' reproductive strategy. While we cannot do this, we feel we have discovered the proximate factor affecting the occurrence of polygyny in our populations. It appears that distribution of nest sites both directly and indirectly determines the occurrence of polygyny in the Dipper—directly, because a polygynous male must have several nest sites in his territory, and indirectly, because lack of nest sites in adjacent areas permits access to a larger food supply. Following Orians' (1969) reasoning, a male Dipper defending a territory with several nest sites adjacent to habitat lacking nest sites but with food will be likely to attract a second female. The greater reproductive success of polygynous females may be the result of their having relatively large feeding areas available to them as well as the part-time assistance of the male at both nests.

There seems to be no reason to regard our study populations as unique; it appears likely that polygyny is common in this species. Since the ecologies of other members of the Cinclidae are similar, polygyny may be fairly common in the family as a whole.

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