

TABLE 1. Frequency of color phases in downy and juvenal plumages of Tufted Puffins on Ugaiushak Island, 1976 and 1977, and the Barren Islands, 1977, Alaska.

Plumage	Color phase	Ugaiushak Island						Barren Islands ^a	
		1976		1977		Total		1977	
		No.	%	No.	%	No.	%	No.	%
Downy	Light	2	5.7	3	6.8	5	6.2	1	2.5
	Dark	35	94.3	41	93.2	76	93.8	39	97.5
Juvenal	Light			8	23.5			8	25.0
	Dark			26	76.5			24	75.0

^a M. J. Amaral (pers. comm.).

While studying the feeding and breeding biology of Tufted Puffins and Horned Puffins (*Fratercula corniculata*) on Ugaiushak Island, Alaska (56°47'N, 156°41'W), during the summers of 1976–1977 (Wehle 1980), I recorded the number of Tufted Puffin chicks in light and dark color phases in both downy and juvenal plumages. Comparative data collected by M. J. Amaral (unpubl. data) on the Barren Islands, Alaska (58°55'N, 152°10'W) reveal frequencies of color phases in each plumage almost identical to those I found on Ugaiushak Island (Table 1).

In downy plumage, the amount of white on the belly varied from patches measuring about 20 mm in diameter to patches covering virtually the entire belly. Belly feathers of chicks in juvenal plumage were either pure white or ranged in color from pale to charcoal gray. Chicks that were light-phase birds in downy plumage sometimes became dark-phase as juveniles and vice versa. Among birds in general, there is no relationship between the color of the natal plumage and the later plumages (Lucas and Stettenheim 1972).

On both Ugaiushak Island and the Barren Islands, the proportion of light-phase chicks was significantly greater ($P < 0.01$) in the juvenal than downy plumage. This higher incidence resulted from a number of dark-phase chicks acquiring white juvenal feathers through the down follicles. The variation in frequency of light-phase chicks between downy and juvenal plumages, therefore, appears to be the result of a genetically controlled change in morph for some birds rather than the result of differential mortality between the two color phases.

When chicks changing morph from dark-phase downies to light-phase juveniles were three to six weeks old, the black natal down feathers could be seen on the tips of the white contour feathers before they broke off. Presumably, Dement'ev and Gladkov's (1951) statement that the down becomes white refers to chicks in this transitional condition rather than to individual down feathers changing color. Although color of contour feathers may change without molting by fading, adherent substances, or wear (Lucas and Stettenheim 1972), twice-weekly checks of downy chicks on Ugaiushak Island provided no evidence of color change in individual down feathers.

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VOCALIZATIONS OF FEMALE NORTHERN ORIOLES

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Among the oscine birds, males usually possess relatively long, patterned, melodic vocalizations termed "songs."

These songs are believed to function primarily in territorial establishment and defense and in mate attraction (Armstrong 1963). In most oscine species, females sing less than males, or not at all (Nottebohm 1975). Females sing regularly, however, in several species, including the Cardinal (*Cardinalis cardinalis*; Lemon 1968), White-throated Sparrow (*Zonotrichia albicollis*; Falls 1969), and American Robin (*Turdus migratorius*; Nice 1943). As the vocal behavior of more songbirds is investigated, more species whose females sing doubtless will be found. Relatively

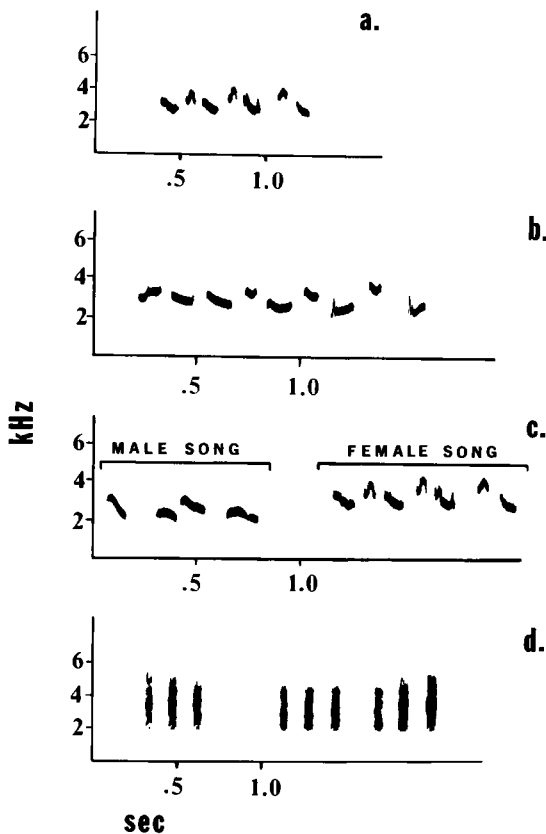


FIGURE 1. Sonograms of female Northern Oriole vocalizations; a-b: female oriole songs from two individuals, c: male oriole song immediately followed by his mate's song, d: chatter call.

little is known about the structure and function of female songs, often probably because female songbirds are frequently less conspicuous than their mates, and so their behavior is more difficult to observe and to quantify. The phenomenon of female song is of ethological interest: why do the females of some species sing?

While studying the vocal behavior of male Northern (Baltimore) Orioles (*Icterus galbula galbula*), I recorded several different female oriole vocalizations, including songs. Some of these female vocalizations, and their behavioral contexts, are described here. Miller (1931) described the songs of female Northern (Bullock's) Orioles (*I. galbula bullockii*), Bent (1958) described the female (Baltimore) orioles' "short, finished songs," and Armstrong (1963) credited the female Baltimore Oriole with being a "fine songster." Females of both the Scott's Oriole (*I. parisorum*, Bent 1958) and the Orchard Oriole (*I. spurius*; Beletsky, unpubl. data) sing. However, I have found no published spectrographic analyses of female oriole songs, or other vocalizations.

I recorded orioles in Kensington Metropark, in Oakland

Co., southeastern Michigan, in May 1980. Northern Oriole territories were in open, grassy fields with scattered trees, and in parkland areas with many trees. Observations and recordings were made from 05:00 to 09:00. Vocalizations were recorded at 9.5 cm/s with a Uher 4000 Report IC tape recorder equipped with a Uher 517 microphone and a 61-cm aluminum parabolic reflector. Wideband sonograms were prepared using a Kay Elemetrics Sona-Graph, model 6061B, connected to a Tandberg series 15 tape recorder. All recordings were made before incubation began. The orioles were not individually marked. I could recognize individual males by idiosyncratic advertising songs. Females were often identifiable as such by their lighter plumage color and by behavior. After observing a mated pair for several hours, I was able to distinguish, through behavior, the female, her mate, and conspecific intruders.

I heard female songs only occasionally, and in 15 h of recordings, I recorded only 12 songs for four females; sonograms of songs from two individuals appear in Figure 1a-b. Song characteristics, measured directly from sonograms, appear in Table 1. The female songs resembled those of males in approximate duration, frequency band used, and song figure durations (Beletsky, in press). However, the female songs rarely contained song figures that closely resembled figures used by their mates. Northern Oriole females of the western subspecies (*I. galbula bullockii*) may sing more often than the females described here: B. Y. Pleasants (pers. comm.) informed me that female song is common in Bullock's Oriole, and Miller (1931) reported that during some periods of the day in the early breeding season, Bullock's Oriole females sang more often than the males.

I recorded nine songs while a female was near her mate (within approx. 5 m), although she was not necessarily perched directly next to him. Female 4 uttered two songs immediately following male song; one of them began 350 ms after the termination of male song (Fig. 1c), and the other overlapped the male song by 100 ms. The songs recorded for female 3 were uttered when I approached the relatively low nest (approx. 5 m above the ground).

Among the calls produced by female orioles was a "chatter" call (Fig. 1d) of variable duration; the males possessed a similar call. Chatter may coincide with the "clu-r-r" call described by Miller (1931). Female chatter consisted of from 2-30 repetitions of the same call figure, the call having a duration of 250 ms to 1,950 ms. These calls appeared to serve a general aggressive function, as they do for males (Beletsky, in press), and were used in female-female agonistic encounters and when I entered the territory near the nest. I observed female-female interactions frequently, wherein resident females gave the call while chasing intruding females out of their territories. On four occasions, chatter was produced by both sexes during courtship flights.

Based upon the small sample sizes of female songs and contexts, my suggestions as to possible functions of the female songs described above are necessarily speculative. My observations of females singing in the presence of their mates and the occasional duet-like arrangement of the male and female songs suggest that female songs could perhaps play some role in pair-bond maintenance. Northern Orioles in Michigan spend most of their time in the dense vegetation of the tree canopy, and intra-pair com-

TABLE 1. Duration and frequency characteristics of female oriole songs.

Female	No. songs recorded	\bar{x} no. figures/song	\bar{x} song duration (ms)	\bar{x} high frequency (kHz)	\bar{x} low frequency (kHz)	\bar{x} frequency range (kHz)
1	1	5.0	780	3.0	1.5	1.5
2	3	9.0 \pm 0.0	1,410 \pm 10.0	4.0 \pm .1	1.5 \pm .1	2.4 \pm .1
3	2	5.0 \pm 1.4	1,110 \pm 169.7	3.5 \pm .1	1.6 \pm .2	1.9 \pm .3
4	6	6.2 \pm 0.4	801 \pm 89.3	4.2 \pm .2	2.2 \pm .1	2.0 \pm .2

munication in the form of male and female songs, at times perhaps analogous to the duets of various tropical and subtropical oscine species, could be advantageous for pair-bond maintenance, reproductive synchronization and for keeping the male and female aware of each other's location. Because one female sang as I approached her nest, the songs may also serve an aggressive or defensive function. Miller's (1931) observations of Bullock's Oriole females singing while chasing and excluding conspecific females from their territories supports this idea; in fact, Miller (1931) considered female oriole songs to be true territorial songs. Detailed behavioral studies of orioles and other species are required to adequately elucidate the phenomenon of female singing.

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MORNING VERSUS EVENING DETECTABILITY OF SOUTHEAST ALASKAN BIRDS

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Many avian ecological studies require estimation of either absolute or relative population densities (Kendeigh 1944). These estimates are influenced by the detectability of the birds under a particular set of environmental conditions (Emlen 1971). Birds of most species are most active in the early morning during the breeding season (Robbins and Van Velzen 1970). Therefore, counts are generally conducted within a few hours after sunrise, when birds are assumed to be most detectable (International Bird Census Committee 1970). We report here a study that we conducted in order to test that assumption and thereby strengthen census procedures for landbirds.

While sampling populations of forest birds in southeastern Alaska, we noticed that individuals of certain species were territorially active (singing and chasing interlopers) during the evening. This suggested that our morning counts might be biased by the lower detectability of these birds at that time of day. We therefore designed procedures to test for differences in results between morning and evening sampling periods.

This study was incidental to an investigation by the senior author on the effects of logging on forest birds (Kessler 1979, 1980). Birds were censused from late May to mid-July in 1978 and 1979 on Kosciusko and Prince of Wales islands (55-56°N, 133°W). Seventy-eight 300-m transects were established in a variety of successional and old-growth habitats within western hemlock-Sitka spruce (*Tsuga heterophylla*-*Picea sitchensis*) forest communities (Vioreck and Dyrness 1980). Each transect received four morning and four evening visits distributed throughout the sampling period. Direction of travel and transect order were reversed with each morning and evening visit. Morn-

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ing and evening counts began 0.5 h after sunrise (approximately 04:00 on 15 June) and 2.5 h before sunset (approximately 21:30 on 15 June), respectively, and lasted 2 to 3 h. All birds detected within 40 m of the transect were recorded.

For our test, morning and evening detections were summed by species for each transect. We omitted species detected fewer than 10 times altogether. Paired *t*-tests were used to determine if differences between morning and evening detections were significantly different from zero (Steel and Torrie 1960). Data were normalized by a square root transformation (Sokal and Rohlf 1969).

Data for 1978 and 1979 are presented separately (Table 1) because different plots were censused in each year. The 1979 plots, unlike those censused in 1978, were riparian. We believe that major differences between years in species recorded resulted from the different habitats represented in each year.

Morning and evening detections differed significantly in paired *t*-tests for eight and nine species in 1978 and 1979, respectively. The Chestnut-backed Chickadee, Winter Wren, Orange-crowned Warbler, and Townsend's Warbler were more detectable in the morning in both years. The Rufous Hummingbird, Yellow-bellied Sapsucker, Fox Sparrow, and Lincoln's Sparrow had greater morning detectability for the one year the sample size was large enough for analysis. In contrast, Hermit Thrushes were detected significantly more often in evening than in morning counts. For other thrushes, we found no differences in detectability between morning and evening counts.

The Dark-eyed Junco, Golden-crowned Kinglet, and Western Flycatcher yielded significantly different detectabilities for only one of the two years. Sample size of Western Flycatchers was small in 1978. We do not know why detectability of juncos and kinglets differed between years. Analysis of variance (Steel and Torrie 1960) conducted on the normalized junco data indicated that the difference between morning and evening counts varied significantly ($P < 0.005$) among types of habitat. However, comparison among habitats by Duncan's multiple range test (Steel and Torrie 1960) yielded no patterns to help us explain this result. For kinglets, morning and evening detectability did not differ significantly among habitats.