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## A BATHING ASSEMBLY OF BLUE-VENTED HUMMINGBIRDS (*AMAZILIA SAUCEROTTEI*) IN COSTA RICA

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Although hummingbirds are solitary and usually meet with conspecifics only to mate, assemblies of hummingbirds have been reported. Three types of assemblies have been described: singing assemblies or leks, where males perch together and sing a specific song as part of courtship behavior (e.g., *Phaethornis longuemareus*, Slud 1964; *Colibri thalassinus*, Skutch 1967); feeding assemblies, where several hummingbirds gather at a dense patch of flowers and feed simultaneously (e.g., *Lophornis adorabilis*, *Amazilia edwardi*; Slud 1964); and bathing assemblies, where several individuals gather simultaneously at a pool of water to bathe.

Bathing assemblies have been described only briefly for Black-fronted Hummingbird (*Hylocharis xantusii*, Lamb 1925) and for Red-billed Azurecrowns (*Amazilia cyanocephala*, Wagner 1946). These reports neither state whether the hummingbirds were aggregating at the only available bathing site nor provide any information about the dynamics of individual interactions in the assembly or the long-term stability of the assembly.

I report here more detailed observations of a bathing assembly of Blue-vented Hummingbirds (*Amazilia saucerottei*) in Costa Rica. Observations were made during the dry season (24 January to 17 March 1980) at the Refugio de Palo Verde, Guanacaste Province, Costa Rica. I observed a large group of Blue-vented Hummingbirds, on nine days at a site along a spring-fed stream in the forest (Table 1). The stream was approximately ½ km long and ended abruptly as a ground sink. It was both narrow and shallow over its entire length; width varied between 0.5 and 2.0 m and the depth between 10 and 50 cm. The site of the assembly was a 5-m length of the stream and averaged 30 cm wide and 10 cm deep. This is similar to the shallow bathing sites reported by both Lamb (1925) and Wagner (1946).

Individuals bathed repeatedly in the stream; their submersion ranged from dipping the bill while hovering to

complete immersion. I do not know whether these birds drank during these bouts. Often as many as four birds bathed simultaneously, while others perched nearby in bushes and preened. Individuals often left their perch, hovered briefly at 1–2 m above the stream, and returned to a perch. I did not see any of these hovering birds hawk insects. Flying or hovering individuals occasionally chased each other. The chases were usually brief (3–5 s), and the birds rarely went out of my sight. Perched individuals occasionally joined the chasing conspecifics as they flew by; at times I could see up to four hummingbirds flying rapidly in a line near the stream. After a few seconds, they dispersed and returned to their perches. I did not see any fighting for perch sites. I do not know whether different individuals used favorite perches; however, each bird used several (5–10) perches during its stay at the bathing site. Birds often perched near one another and each bird used perches throughout the area, suggesting that individuals were not defending streamside territories. Because sexes of the Blue-vented Hummingbird are alike in plumage coloration, I could not tell the sex of individuals.

I netted some birds and marked 35 of them with paint spots and leg bands (Stiles and Wolf 1973). Only five marked birds were ever seen again and only one was recaptured (9 February; four days after marking), suggesting that a large number of birds was involved and that individual presence at the assembly was fluid. As the dry season progressed, fewer individuals attended the assembly and by 17 February no birds were present.

It is not clear why the assembly disbanded. This may have resulted from my netting activity or a change in the factors that led to the formation of the assembly. I think it unlikely that the assembly changed locations; no other streams occur within several kilometers, and on regular walks along the entire length of the stream I never saw hummingbirds bathe elsewhere, although several other places appeared to me to be similar. Although the stream diminished during the latter part of the dry season, it still flowed 30 days after the assembly disappeared.

The purpose for bathing in a large group rather than individually is a matter for speculation. The seeming availability of other bathing sites suggests that the hummingbirds chose to aggregate. They were not gathering in response to a local food supply; I never observed individuals at the assembly feeding on any of the streamside flowers and these flowers were not unique at this spot along the stream. I watched this assembly at the end of the breeding season (Skutch 1950) so it is unlikely that the gathering was part of mate selection or courtship behavior. The birds may have been bathing together rather than solitarily in order to lessen the risk of predation. Hummingbirds may be more vulnerable to predation while bathing than during other activities, especially while their feathers are still wet. Also, the vegetation along the stream was sparse and provided few places for hummingbirds to hide. By aggregating, the hummingbirds may have increased the likelihood that a predator would be detected.

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TABLE 1. Seasonal dynamics of the bathing assemblage.

Date	Observation period	Number of birds marked	Maximum number seen at one time
24 Jan. 1980	06:40–08:00	0	7
27 Jan.	07:35–09:00	0	4
30 Jan.	06:30–08:35	11	12
31 Jan.	06:30–08:00	17	10
3 Feb.	14:30–16:20	0	0
5 Feb.	06:30–08:35	6	8
9 Feb.	06:30–08:30	1	5
17 Feb.	06:30–08:30	0	0
26 Feb.	06:30–07:30	0	6 flew by but none entered the water

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## “WALKING-IN-LINE” BEHAVIOR IN SAGE SPARROW TERRITORIAL ENCOUNTERS

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“Walking-in-line” behavior was apparently first described in agonistic encounters between Red Grouse (*Lagopus lagopus scoticus*) (Watson and Jenkins 1964). In this behavioral sequence, two territorial neighbors meet on a mutual territorial boundary and walk parallel to each other for a distance of several to 120 m, occasionally running briefly or stopping but remaining parallel. Such encounters often last 5 min or longer and are accompanied by head-bobbing and both “attack-intention” and “flight-intention” calls. The encounters usually end when the birds move apart, but sometimes end in fighting, and may be repeated several times over a period of days. Similar behavior has been observed in other tetraonids including male Greater Prairie-Chickens (*Tympanuchus cupido*), Sharp-tailed Grouse (*T. phasianellus*) (Hjorth 1970; Sparling, pers. comm.), and Black Grouse (*Tetrao tetrix*) (Nethersole-Thompson and Nethersole-Thompson 1939).

Both the Killdeer (*Charadrius vociferus*; Phillips 1972) and Piping Plover (*C. melodus*; Cairns 1982) exhibit “parallel runs.” In the latter species, displays of low intensity are walked, and shoving between displaying birds has been observed. In Savannah Sparrows (*Passerculus sandwichensis*), two territorial males either walk or run parallel to each other on the ground along their mutual territorial boundary (Potter 1972). Occasional singing, buzzing, and fighting accompany their movement.

I observed “walking-in-line” behavior in the Sage Sparrow (*Amphispiza belli*) in Bingham County, Idaho on five occasions in 1976. During the first sequence, two territorial males approached each other in a series of short flights between perches in the tops of sagebrush (*Artemisia tridentata*) plants. Both began head-bobbing. After 10 s one male dropped to the ground while the other remained in the sage, and both birds moved parallel to each other about 0.3 m apart. This continued for 2 min and was interrupted by three brief fights wherein the males flew 2-4 m vertically in continuous contact. The birds moved a total of about 10 m. I heard no vocalization, but head-bobbing preceded each fight.

In four other encounters involving a different pair of males, the two birds moved parallel to each other on the ground and 2-6 m apart. Both sang low-volume full-length songs and pecked at the ground in a foraging manner; Sage Sparrows usually do not sing while foraging—they fly to exposed perches to sing. Also, I have heard males sing low-volume songs only in response to playback, and then only rarely. Each sequence covered nearly 50 m and lasted

several minutes with occasional fights as described above. No other displays were observed, but head-bobbing and unilateral wing-raising occurred shortly after the last sequence.

In Red Grouse, walking-in-line behavior is used by territory owners to defend precise boundaries of large feeding territories from intruders. Males meet on the same lines on different days and are often quite evenly matched. One bird raises the wing on one side and makes other presumably submissive postures, and both individuals bob their heads. On the leks of Greater Prairie-Chickens, Sharp-tailed Grouse, and Black Grouse, walking-in-line is also used to defend the boundaries of display areas. But in the Black Grouse, at least, precise boundaries are not always defended. Rather, groups of displaying birds may drift and, thus, walk-in-line along different lines (Wynne-Edwards 1962).

Parallel-run displays are also used for territory defense by Piping Plovers (Cairns 1982) and Killdeer (Phillips 1972). This display becomes much more important for the former species after territories are established. Piping Plovers show other accompanying behaviors similar to those of Sage Sparrows including head-bobbing, shoving (rather than fighting), and pecking at the ground (Cairns 1982). In Savannah Sparrows, walking-in-line is used to defend precise territorial boundaries (Potter 1972).

For Sage Sparrows, the walking-in-line behavior in the first case occurred in an area between the two males' territories early in the breeding season but ultimately did not define a precise physical boundary. For the second pair of males, one male eventually incorporated the encounter area into his territory and the other withdrew some distance for the remainder of the breeding season. In another part of southern Idaho, Sage Sparrows commonly used walking-in-line displays and these always defined precise territorial boundaries (Best, pers. comm.). The difference in the frequency of walking-in-line in these two Idaho populations was probably a result of different population densities. In my study area territories averaged over 4 ha with large buffer zones among them, whereas in the other study area males were much more densely packed (Peterson, pers. comm.). Thus, in the latter case the exact size of a territory and its boundaries may have been crucial to the reproductive success of the pair, and walking-in-line was used regularly in boundary defense. Where I made my observations, in apparently unsaturated habitat, this behavior may have been triggered by chance encounters with neighboring males. With little or no competition for space, these males simply avoided further contact with each other.

Walking-in-line is a highly ritualized behavior in the species discussed above and is a central feature of complex display sequences involving a variety of other behaviors. In several species it usually establishes which individual will have access to a portion of the area. The behavior of Black Grouse, however, suggests that this display may also