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## LITERATURE CITED

- AVERY, M. I. 1984. Lekking in birds: choice, competition and reproductive constraint. *Ibis* 126: 177-187.
- FOSTER, M. S. 1977. Odd couples in manakins: a study of social organization and cooperative breeding in *Chiroxiphia linearis*. *Amer. Natur.* 111: 845-853.
- . 1981. Cooperative behavior and social organization of the Swallow-tailed Manakin (*Chiroxiphia caudata*). *Behav. Ecol. Sociobiol.* 9: 167-177.
- GILLIARD, E. T. 1959. Notes on the courtship behavior of the Blue-backed Manakin (*Chiroxiphia pareola*). *Amer. Mus. Novitates* No. 1942.
- HAVERSCHMIDT, F. 1968. *Birds of Surinam*. London, Oliver & Boyd.
- LILL, A. 1974a. Sexual behavior in the lek-forming White-bearded Manakin (*M. manacus trinitatis* Hartert). *Z. Tierpsychol.* 36: 1-36.
- . 1974b. Social organization and space utilization in the lek-forming White-bearded Manakin, *M. manacus trinitatis* Hartert. *Z. Tierpsychol.* 36: 513-530.
- . 1976. Lek behavior in the Golden-headed Manakin, *Pipra erythrocephala*, in Trinidad (West Indies). *Z. Tierpsychol. Suppl.* 18.
- MEYER DE SCHAUENSEE, R., & W. H. PHELPS. 1978. A guide to the birds of Venezuela. Princeton, New Jersey, Princeton Univ. Press.
- ROBBINS, M. B. 1983. The display repertoire of the Band-tailed Manakin (*Pipra fasciicauda*). *Wilson Bull.* 95: 321-342.
- SCHWARTZ, P., & D. W. SNOW. 1978. Display and related behavior of the Wire-tailed Manakin. *Living Bird* 17: 51-78.
- SICK, H. 1967. Courtship behavior in manakins (Pipridae): a review. *Living Bird* 6: 5-22.
- SKUTCH, A. F. 1969. Life histories of Central American birds. III. Pacific Coast Avifauna No. 35.
- SNOW, D. W. 1962a. A field study of the Black and White Manakin, *M. manacus*, in Trinidad. *Zoologica* 47: 65-104.
- . 1962b. A field study of the Golden-headed Manakin, *Pipra erythrocephala*, in Trinidad. *Zoologica* 47: 183-198.
- . 1963a. The display of the Orange-headed Manakin. *Condor* 65: 44-65.
- . 1963b. The displays of the Blue-backed Manakin, *Chiroxiphia pareola*, in Tobago, W.I. *Zoologica* 48: 167-176.
- . 1979. Pipridae. Pp. 245-280 in Check-list of birds of the world, vol. 8 (M. A. Traylor, Jr., Ed.). Cambridge, Massachusetts, Museum of Comparative Zoology.

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## Starvation of a Flock of Chimney Swifts on a Very Small Caribbean Island

PETER SPENDELOW

Department of Zoology NJ-15, University of Washington, Seattle, Washington 98195 USA

Islas del Cisne (the Swan Islands) are two adjacent islands totaling less than 4 km<sup>2</sup> in area, located about 180 km north of Honduras, the closest land. The islands are not suitable for large flocks of aerial foragers such as swifts and swallows, because they are so small and distant from other land. Thus, it is surprising that a southward-migrating flock of Chimney Swifts (*Chaetura pelagica*) landed on the islands and stayed there for approximately one week, during which time hundreds of birds, perhaps the entire flock, died of starvation.

In mid-October of the fall migration of 1979, a flock of Chimney Swifts arrived on Islas del Cisne. The swifts spent the daytime foraging over the islands and roosted at night on the trunks of two palm trees just outside the dormitory of the former U.S. Weather Service station on the island. Birds in the roost clustered tightly in contact with each other, but not in multiple layers as described by Stager (1965) for an open roost of Vaux's Swift (*C. vauxi*). Nighttime temperatures on Islas del Cisne averaged 25°C, compared

to a low of 3°C for the roost described by Stager. On 19 October, a few days after the arrival of the flock, 11 swifts were found dead under the roosting trees, and many swifts were noticed to be roosting during the daytime. The bulk of the swift population died over the next 2 days, and not a single swift was seen alive after 24 October. It is not known if any swifts left the island during this period. Weather service custodians disposed of many of the swift bodies before any count was made, but a rough estimate of the number of bodies encountered and the number of swifts present near the beginning of the die-off indicates that most or all of the 200-300 swifts that were present at the beginning of the week died.

Forty of the swifts were salvaged for the University of Washington Burke Museum and eventually preserved as skeletons or skins (specimen numbers 32433-32443 and 32445-32473). By gonad inspection, there were 20 females, 16 males, and 4 unsexable specimens. The sample apparently included a mix of age classes. Five of the females had smooth or nearly

smooth ovaries characteristic of first-fall birds, while the remaining 15 had moderately granular to granular ovaries, indicative of previous breeding. None of the 31 swifts checked during preparation showed any sign of body molt or had any growing remiges. A more detailed examination of the 7 swifts preserved as skins showed 3 to have sheathing remnants at the base of one or more of their fully grown outermost primaries, indicating that they had just completed molt (specimens 32443, 32445, and 32464).

All of the swifts collected were emaciated, showing severely atrophied pectoral muscles and no visible body fat. At an average of 13.9 g (range 12.7–15.6 g, with no significant difference between the sexes), these swifts were approximately 40% below published weights for healthy Chimney Swifts during spring migration and summer (Stewart 1937, Bartlett 1952, Fischer 1958). A small proportion of this weight loss might be due to one day's dehydration after death. Weight loss after the birds were frozen in plastic bags probably was minimal (Clark 1979).

I salvaged 21 other emaciated birds on the Islas del Cisne during the spring (mid-April through May) and fall (October and November) of 1979. These included 1 thrush, 1 vireo, 6 warblers of 5 species, 4 Blue-winged Teal (*Anas discors*), 1 Cattle Egret (*Bubulcus ibis*), 1 Bank Swallow (*Riparia riparia*), and 7 Barn Swallows (*Hirundo rustica*). All 8 swallows were salvaged in a period from late April through the end of May. None of the three local species of landbirds, Vitelline Warbler (*Dendroica vitellina*), Smooth-billed Ani (*Crotophaga ani*), and White-crowned Pigeon (*Columba leucocephala*), were encountered emaciated, although all were fairly common. Although starvation of migrants was fairly common, no other species showed the spectacular die-off of the Chimney Swifts. The conspicuous roosting location of the swifts might have made them particularly noticeable.

Very small Caribbean islands are known to attract weakened migrants from the passing stream. From his experience on the Dry Tortugas south of Florida, Bill Robertson (pers. comm.) notes that following contrary winds in spring migration, many migrants arrive in an emaciated condition, at times weighing less than their recorded fat-free weights. Small flycatchers, swallows, and warblers will attempt to feed, but any that do not make it off the island within a day or two usually perish quickly. Larger birds such as Cattle Egrets, which have a more substantial but still inadequate food supply, may survive for weeks and often accumulate conspicuously, with as many as 100 egrets dying slowly throughout the summer on an island group of only 40 ha. However, I have found no other record of an entire flock of any species arriving on an island and remaining until the last

one perishes, as apparently occurred with the swifts on Islas del Cisne.

Swifts can fly in excess of 30 km/h (Schnell 1965). The larger and possibly faster-flying Alpine Swift (*Apus melba*) has been known to fly as far as 1,620 km in 3 days (Bourliere 1950). At 180 km to the south, the Honduras mainland would be only 4–6 h away at swift migration rate, but it would not be visible to any swift flying over Islas del Cisne at an altitude below 1 km. Weather records did not indicate any bad storms that might have forced the swifts to remain on the island, and the weather on the island was sunny for at least part of most days. In addition, records for North America for the 2-week period preceding the arrival of the swift flock revealed some rain but no unusual weather conditions or major storms. Ovary condition and recent completion of primary molt indicate that many of the swifts were adults, so this was not a case of displaced immature birds not finding the normal wintering grounds. It seems strange that the birds did not assess the low abundance of flying insects on the first day and immediately continue southward toward their South American wintering grounds.

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#### LITERATURE CITED

- BARTLETT, L. M. 1952. On the weight of the Chimney Swift. *Bird-Banding* 23: 157–159.
- BOURLIERE, F. 1950. Esquisse ecologique. Pp. 1089–1099 in *Traite de zoologie*, tome XV. Oiseaux. (P. Grasse, Ed.). Paris, Masson et Cie.
- CLARK, G. A. 1979. Body weights of birds: a review. *Condor* 81: 193–202.
- FISCHER, R. B. 1958. The breeding biology of the Chimney Swift *Chaetura pelagica* (Linnaeus). *New York State Mus. Sci. Serv. Bull.* 368.
- SCHNELL, G. D. 1965. Recording the flight speed of birds by Doppler radar. *Living Bird* 4: 79–87.
- STAGER, K. E. 1965. An exposed nocturnal roost of migrant Vaux Swifts. *Condor* 67: 81–82.
- STEWART, P. A. 1937. A preliminary list of bird weights. *Auk* 54: 324–332.

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