NOTES ON SOUTHWESTERN COSTA RICAN BIRDS

LLOYD F. KIFF
Western Foundation of Vertebrate Zoology
1100 Glendon Avenue
Los Angeles, California 90024

While engaged in field studies in Costa Rica in 1970 and 1971, I obtained significant distributional and other data on several species of birds in the southwestern portion of the country, i.e., the southern half of the Pacific slope. This report also includes data on specimens collected by Andrew Williams, my field companion in 1971, and by Walter and Elsie Fiala, permanent residents of Costa Rica. All specimens are deposited in the Western Foundation of Vertebrate Zoology collections.

Most of my field work was done in the vicinity of Sierpe, a small village located near sea level 13 km S of Palmar Sur, Puntarenas Province. Although the wet lowlands of the Palmar Sur-Sierpe region must have originally supported an impressive primary forest, the area has undergone recent intensive clearing and is now occupied almost entirely by banana plantations, rice fields, pastures, and scattered patches of second-growth vegetation.

Between 10 June 1971 and 15 November 1972, the Fialas collected birds at their farm, Finca Helechales, 15 km E of Potrero Grande, Puntarenas Province, from elevations of 1000 to 1500 m. Helechales, like surrounding areas, still contains some tracts of relatively undisturbed wet primary forest, although there have been some agricultural and lumbering incursions into the region. A prominent feature of the farm is a brushy savanna, apparently the result of a long history of aboriginal burning; it occupies a large ridge bisecting the essentially forested property.

In southwestern Costa Rica, as elsewhere in the American tropics, man's accelerated modification of natural habitats is causing profound changes in the avifauna. Wherever the human population gains access to the forest, whether by newly constructed roads or along natural tributaries, primary habitats are quickly removed and converted to agricultural or other uses. Local extinctions of native forest birds are accompanied by an advance of second-growth species that can circumvent traditional barriers by moving along newly formed corridors of open habitat.

It is probable that this "corridor effect" has made possible recent movements into southern Costa Rica by several of the open country species mentioned here, especially *Elanus leucurus* (White-tailed Kite), *Milvago chimachima* (Yellow-headed Caracara), and *Leistes militaris* (Red-breasted Blackbird). It is reasonable to expect that *Leistes* and *Milvago*, presently at their northwestern limits in the Palmar Sur-Sierpe area, will soon move northward into the heavily settled Valle del General. The nomenclature follows that of Eisenmann (1955).

Elanus leucurus. White-tailed Kite. Eisenmann (1971) has summarized the recent remarkable range expansion of this species in Middle America. During repeated visits to southwestern Costa Rica between June–August 1964, I did not encounter White-tailed Kites, and the first record for the region was that of Wolf (1966) in June 1965. In 1970 and 1971 the species was the most common raptor present in the Palmar Sur-Sierpe region. From 15 March to 30 May, I saw an average of four individuals daily near Sierpe. Although no nests were found, evidence of local breeding was provided by repeated sightings of juveniles with brownish underparts during late March and April.

Milvago chimachima. Yellow-headed Caracara. I saw this species four times between 18 April and 28 May 1970 in scrubby pasture and early second-growth areas near Sierpe. On 10 September 1971, a very worn female (EF 488) with a granular ovary was obtained by the Fialas at Helechales from a small tree in a brushy savanna. The bird weighed 355 g; the stomach contained several grasshoppers. The only previous Costa Rican record is a specimen taken by Arnold (1966) near Golfito.

Amaurolimnas concolor. Uniform Crake. I observed a single individual closely at Sierpe on 25 May 1970 as it perched low in a dense thicket of wild plaintain (*Heliconia* sp.) in wet second-growth. Orians and Paulson (1969) reported a specimen and a sight observation of this species from nearby Rincón de Osa, the only previous records for the Pacific slope of Costa Rica.

Rhinoptynx clamator. Striped Owl. Between 13 April and 28 May 1970, I observed almost nightly what was presumably the same individual of this species in an area of wet second-growth and open fields near Sierpe. The bird called regularly from a perch only a few feet away from my open window, enabling me to make notes on its vocalizations. Its most frequent call was a series of low muffled hoots, usually seven in number and given on the same pitch. Occasionally, as when I shined a light on the bird, the pitch moved at least two notes higher during the calling sequence. At times it uttered six or seven loud yapping sounds, resembling the bark of a small dog and pitched at least an octave higher than the usual hoots.

Lurocalis semitorquatus. Semicollared Nighthawk. A female (EF 433), collected by W. Fiala on 22 August 1971 at Helechales, is apparently the first Costa Rican specimen. It was shot at dusk as it foraged over the interface of a brushy savanna and forest. The bird weighed 81 g and had an unenlarged ovary. Its measurements (wing, 172.3 mm, tail, 73.1 mm) are very close to those of a female from the Canal Zone, Panamá (Wetmore 1968).

Slud (1964) did not list this species for Costa Rica, but at least two individuals have been seen repeatedly by numerous observers since 1969 at Finca La Selva, near Puerto Viejo, Heredia Province, in the Caribbean lowlands of the country. In addition, it is likely that the unidentified caprimulgids, seen during 1966–67 at Rincón de Osa, Puntarenas Province, were this species. Observers mentioned the relatively small size, dark coloration, and short tail, all good field marks for *Lurocalis*. These observations suggest that the species may be widespread but overlooked in Costa Rica.

Caprimulgus rufus. Rufous Nightjar. Williams collected a male (AW 340) on 7 May 1971 at Helechales. The bird was shot at midday when it flushed from the ground in a dense second-growth thicket along a small stream. The left testis was 6 × 5 mm, and the unworn specimen measures: wing, 177.0 mm, tail, 119.4 mm, within the ranges given by Wetmore (1968) for *C. r. minimus*, the resident form throughout Panamá. There is only one previous record for Costa Rica, a specimen collected by A. P. Smith on 9 July 1921 in the Estrella Valley of the southeastern Caribbean lowlands (Slud 1964).

Cypseloides cherriei. Spot-fronted Swift. A male (EF 126) was taken by W. Fiala on 12 June 1971 at Helechales from a flock of *C. rutilus* foraging over a brushy savanna. The bird weighed 24 g, with a

left testis 7 × 5 mm. This rare species was known previously in Central America only from four specimens taken on Volcan Irazú, Costa Rica, in the late 1890s (Collins 1968). There are no other Middle American records in this century.

Cypseloides cryptus. White-chinned Swift. Like *C. cherriei*, this species is known from less than 20 specimens from all parts of its known range. W. Fiala collected two males (EF 992 and 993) at Helechales on 2 June 1972, weighing 38 and 39 g with testes measuring 7 × 4 and 5 × 2 mm, respectively. The only previous Costa Rican record was a bird taken by C. Underwood near San Jose on 10 June 1910 (Slud 1964). Measurements of the Fialas' specimens (wing, 133, 132 mm; tail, 49, 51 mm, respectively) are nearly identical to those given for four British Honduras specimens by Russell (1964).

Cypseloides niger. Black Swift. The Fialas obtained a good series of this species at Helechales, all typical of the race *costaricensis*. Measurements in millimeters of seven males are: wing, 153.0–160.5 ($\bar{x}$ = 156.7), tail, 54.8–60.8 ($\bar{x}$ = 58.0), exposed culmen, 5.6–6.6 ($\bar{x}$ = 6.0); of nine females: wing, 149.2–158.1 ($\bar{x}$ = 153.8), tail, 49.0–55.1 ($\bar{x}$ = 52.2), exposed culmen, 5.1–6.4 ($\bar{x}$ = 5.8). These measurements are similar to those given by Ridgway (1911) for fewer examples, averaging only slightly smaller. Mean weights of the specimens were 36 ($\bar{x}$ of 7 males) and 35 g ($\bar{x}$ of 9 females).

Slud (1964) stated that the breeding status of the Black Swift is unclear in Costa Rica. No nests were located at Helechales, but the species apparently breeds in the area. Two females containing single ruptured ovarian follicles were collected on 1 June, and another taken on that date contained an enlarged follicle 10 mm in diameter. Seven males obtained in May–June all had enlarged testes. A male (EF 1473) taken on 24 October 1972 was in juvenal plumage, having prominent white tips to all feathers except those of the upper back, sides of the head, and throat, and it was notably smaller than all other specimens in the Helechales series (wing, 150, tail, 45 mm; weight, 31 g).

The Fialas collected swifts at all seasons at Helechales, but this species was obtained there only between 4 May–28 June, except for the single juvenile. Although the lack of specimens at other seasons may be due to sampling deficiencies, it may indicate seasonal shifts in local flyway or foraging patterns. Another possibility, raised by Slud (1964), is that the Black Swift is only a breeding summer visitor to Costa Rica, but there is presently a lack of corroborative records from localities further south.

Williams took an additional female (AW 280) on 19 April 1971 at Rincón de Osa, which I have tentatively assigned to the northern form, *borealis*, previously unrecorded south of Guatemala. The specimen is larger (wing, 158.4 mm; tail, 57.7 mm; exposed culmen, 6.5 mm) than females of *costaricensis* taken at Helechales, and the white tips on the abdominal and flank feathers are considerably narrower than those of the Helechales birds. Although it weighed only 36 g, the Osa specimen was very fat, suggesting migratory activity. It had a granular ovary and was taken from a foraging flock of *Chaetura spinicauda* (Band-rumped Swift).

Panyptila cayennensis. Lesser Swallow-tailed Swift. Although the distinctive nest of this species is well known by Costa Ricans, there were no specimen records for the country prior to Arnold's report of two birds collected in the Caribbean foothills in 1965 (Arnold 1966).

Lesser Swallow-tailed Swifts are fairly common at Helechales; the Fialas and I collected a series of nine specimens there between 29 April and 6 October. Weights ranged from 15–20 g ($\bar{x}$ of 4 males, 17.5 g; $\bar{x}$ of 5 females, 17.9 g). E. Fiala collected a nest near Potrero Grande on 31 January 1972 which contained two eggs, both broken when the incubating bird flushed from the nest.

An impressive late afternoon flight of several species of swifts occurs daily at Helechales as large flocks of several species move from lowland foraging areas to apparent roosting or nesting sites higher in the nearby mountains. Their most frequent route is the savanna-covered ridge which runs upward through the center of the farm; far fewer individuals are seen over unbroken forest. Based on observations and collecting at all seasons, *Chaetura vauxi* (Vaux's Swift) and *Cypseloides rutilus* (Chestnut-collared Swift) are the most abundant swifts in the Helechales region, and the larger *Streptoprocne zonaris* (White-collared Swift) also occurs in great numbers. No seasonal fluctuations in the numbers of these species has been noted. *Cypseloides niger* and *Panyptila cayennensis* are less common, but can be seen daily at some seasons. *Cypseloides cherriei* and *C. cryptus* are apparently very scarce. The most abundant swift in the adjacent lowlands, *Chaetura spinicauda*, has not yet been recorded from Helechales.

Progne subis. Purple Martin. A female (EF 1352), taken by W. Fiala on 3 October 1972 at Helechales, apparently represents the first Costa Rican record for this species. The weight was 53 g, and the bird had a granular ovary. According to E. Eisenmann (pers. comm.), who examined the specimen, it probably belongs to the nominate race, *subis*, because of its heavily marked underparts, the lack of a ring on the hindneck, and winglength (chord, 139.5 mm). However, he mentioned that since the bird is in apparent immature plumage, almost wholly lacking blue gloss on the dorsum, it may not be separable from the recently described race *arboricola*.

Like swifts, swallows also represent an important, if less spectacular, avian element of the aerial habitat at Helechales. In addition to the common resident species, *Progne chalybea* (Gray-breasted Martin), *Stelgidopteryx ruficollis* (Rough-winged Swallow), and *Pygochelidon cyanoleuca* (Blue-and-white Swallow), large migrant flocks of *Hirundo rustica* (Barn Swallow) and *Petrochelidon pyrrhonota* (Cliff Swallow) have been noted in late April to early May and during mid-September.

Leistes militaris. Red-breasted Blackbird. I found a small breeding colony of this species, previously unrecorded in Costa Rica, on 17 May 1970 in a large pasture about 2 km W of Sierpe. Between 17 and 28 May at least six males and three females were observed at this locality, and the birds were apparently breeding. I observed males performing aerial displays on several occasions, and a female was flushed from a partially finished nest on 23 May. The nest was destroyed when the field was mowed on 25 May, but the birds were still present in the area on 3 June. I did not visit the area again until November 1970 at which time I found no *Leistes* present. Since there is no published evidence to suggest that the species is migratory, it is likely that the birds moved to some nearby site, possibly in response to the considerable amount of plant growth which occurred in the pasture between June and November.

A male (LFK 1072) collected on 19 May was very worn, weighed 46.1 g, with a left testis 10 × 7 mm.

The stomach contained three lepidopteran larvae 2 cm long.

I am very grateful to Elsie and Walter Fiala and to Andrew Williams for their assistance in the field and permission to include their records here. C. Collins, T. Howell, F. G. Stiles, and, especially, E. Eisenmann examined various specimens and offered helpful comments. My field work and that of the Fialas and Williams was supported by the Western Foundation of Vertebrate Zoology.

LITERATURE CITED

ARNOLD, K. A. 1966. Distributional notes on Costa Rica birds. Wilson Bull. 78:316–317.

COLLINS, C. T. 1968. Distributional notes on some Neotropical swifts. Bull. Brit. Ornithol. Club 88: 133–134.

EISENMANN, E. 1955. The species of Middle American birds. Trans. Linnean Soc. of N.Y. Vol. 7.

EISENMANN, E. 1971. Range expansion and population increase in North and Middle America of the White-tailed Kite (*Elanus leucurus*). Amer. Birds 25:529–536.

ORIANS, G. H., AND D. R. PAULSON. 1969. Notes on Costa Rican birds. Condor 71:426–431.

RIDGWAY, R. 1911. The birds of North and Middle America. Bull. U.S. Natl. Mus. No. 50, 859 p.

RUSSELL, S. M. 1964. A distributional study of the birds of British Honduras. A.O.U. Monogr. No. 1, 195 p.

SLUD, P. 1964. The birds of Costa Rica. Distribution and ecology. Bull. Amer. Mus. Nat. Hist. 128:1–430.

WETMORE, A. 1968. The birds of the Republic of Panamá. Pt. 2. Smithsonian Misc. Coll. 150 (2).

WOLF, L. L. 1966. Notes on Costa Rican birds. Condor 68:400–401.

Accepted for publication 12 November 1973.

THE SURFACE AREA OF AN EGG

A. R. SHOTT

AND

F. W. PRESTON

Meridian Research Center
Box 49, Meridian Station
Butler, Pennsylvania 16001

IN MEMORIAM
(1897–1964)

Air Vice-Marshall D. V. Carnegie, C.B.E., birds' nester extraordinary and a life-long friend of one of us, Chief of the Coastal Command (Scotland), and Chief of the New Zealand Air Force, who learned camouflage from the birds and insects and taught the British how to disguise their airfields in the Battle of Britain.

The surface area of an egg is occasionally desired or needed for computations of shell permeability or probable period of incubation. It is not easily measured directly, and cannot be computed from measurements of length and (maximum) breadth without possible errors of several percent. This could be done if an egg were a true ellipsoid, i.e., a prolate spheroid, to which it is a rough, and sometimes a close, approximation. An indirect method is to measure the volume of the egg, for instance, by total immersion in water or other liquid of known density, and hence to estimate the surface area since there is a relation between area and volume. This can usually come within 1 or 2%. A still more indirect method is to weigh the egg, assume a density for it, and hence estimate the volume, and from the volume estimate the area.

This paper considers these indirect methods and their probable accuracy.

If we have a number of solids of identical shape but of different sizes, there is necessarily a relation between surface area (A) and volume (V) of the form

$$A = kV^{2/3} \qquad (1)$$

where k is a "dimensionless" constant for the series. For a different series (i.e., for a different shape), we shall have a different constant. Thus for cubes $k = 6$: for spheres $K = \sqrt[3]{36\pi} = 4.836$.

Many eggs approximate to prolate spheroids, that is, ellipsoids generated by rotating an ellipse around its major axis. Let the length of the major axis be $2a$, and of the minor be $2b$, and let the ratio b/a be called p. Then p is the reciprocal of what Preston has elsewhere called the "elongation" (e.g., Auk 86:246, 1969).

The volume V of such an ellipsoid is given by

$$V = 4\pi/3 \cdot b^2a = 4\pi/3 \cdot p^2a^3 \qquad (2)$$

so that

$$V^{2/3} = 2.598\ p^{4/3} \cdot a^2 \qquad (2a)$$

The surface area (A) of a prolate spheroid is

$$A = 2\pi\ b^2 + (2\pi\ a\ b \cdot \sin^{-1}\epsilon)/\epsilon \qquad (3)$$

where $\epsilon = c/a$, c being half the distance between the two foci of the ellipse, so

$$\epsilon = \sqrt{1 - b^2/a^2} = \sqrt{1 - p^2}$$

while $\sin^{-1}\epsilon$ is the number of radians in an angle whose sine is ϵ.

The surface area of the spheroid is then

$$\begin{aligned} A_e &= 2\pi\ a^2\ (p^2 + p/\epsilon \cdot \sin^{-1}\epsilon) \\ &= 2\pi\ a^2\ \{p^2 + (p/\sqrt{1-p^2}) \cdot \sin^{-1}\sqrt{1-p^2}\} \end{aligned} \qquad (4)$$

The surface area of the circumscribed sphere, A_s, $= 4\pi\ a^2$ so that the ratio

$$A_e/A_s = 1/2\ \{p^2 + (p/\sqrt{1-p^2}) \cdot \sin^{-1}\sqrt{1-p^2}\} \qquad (5)$$

and we can plot this for various values of p, i.e., of b/a, and see how the area contracts as the minor axis contracts.

We are here, however, more concerned with the constant k in equation (1) above, where $k = A_e/V^{2/3}$, and this is given by

$$\begin{aligned} k = 2\pi/2.598 \cdot 1/p^{4/3} \cdot (p^2 + p/\sqrt{1-p^2} \\ \cdot \sin^{-1}\sqrt{1-p^2}.) \end{aligned} \qquad (6)$$

We may note in passing that when p is nearly unity, $(\sin^{-1}\sqrt{1-p^2})/\sqrt{1-p^2}$ is unity, though both numerator and denominator are zero, and the expression is superficially ambiguous or "indeterminate." Then $k = 4\pi/2.598 = 4.836$, the correct value for a sphere.

No avian egg, however, is spherical. The elongations a/b have a range from about 1.19 to about 1.64 (Preston, op. cit.), so that p ranges from about 0.61 to 0.84, with a pronounced concentration in the approximate range 0.7 to 0.75.