

flange on the trochlea for digit 4 is slender as in *Aquila* and *Spizaetus*, and is not short and stubby as in *Morphnus woodwardi* (Howard, Condor 37:208, 1935). The facet for metatarsal I is larger and higher than it is in *Aquila* of similar size. The femur indicates a proportionally small bone. The diagnostic region around the pneumatic foramen has largely been destroyed and the assignment of it and the tibiotarsus which is crushed almost beyond recognition is based entirely on their association with the holotype of *S. tanneri*.

Spizaetus tanneri is the oldest known member of the genus as the species nearest it in age, *S. pliogryps* (Shufeldt), from Fossil Lake, Lake County, Oregon, cannot be older than Middle Pleistocene. *Spizaetus pliogryps* is based on phalanges which, according to Howard (1946), have greater depth of shaft than do those of *S. grinnelli*. As no phalanges of *S. tanneri* are known it cannot be satisfactorily compared with *S. pliogryps*. *Spizaetus willetti* Howard from Smith Creek Cave, White Pine County, Nevada, and *S. grinnelli* (Miller) from Rancho la Brea, Los Angeles County, California, are both Late Pleistocene in age. Miller (1943) has also reported *S. grinnelli* from San Josecito Cave in México. *Spizaetus tanneri* is the first record of this genus from the Central Great Plains. It seems closer to *Aquila* than do other species of *Spizaetus*, and it would not be surprising if the two genera had a fairly immediate common ancestry.

NOTES ON THE BREEDING OF THE SULPHUR-BELLIED FLYCATCHER IN ARIZONA

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The breeding range of the Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*), a widespread species in México and Central America, barely extends into southeastern Arizona. In Arizona these flycatchers breed only in riparian mountain canyons where sycamore (*Platanus racemosa*), oaks (*Quercus*), walnuts (*Juglans*), Arizona cypress (*Cupressus arizonica*), and two species of pines (*Pinus leiophylla* and *P. engelmanni*) are common.

I observed nesting Sulphur-bellied Flycatchers in Cave Creek Canyon of the Chiricahua Mountains, Cochise County, Arizona, during the summers of 1964 and 1966 while I was engaged in other studies.

SPRING ARRIVAL AND COURTSHIP

Sulphur-bellied Flycatchers are among the last of the summer residents to arrive in the mountain canyons of southern Arizona, typically appearing in late May or early June (Bent 1942:100; Phillips et al. 1964:80). Courtship apparently begins soon after arrival. At 18:40 on 26 May 1964 I watched a duet in which both birds shook their heads vigorously and popped their mandibles synchronously. This was repeated several times before they began flying within a small area, one behind the other, shrilly calling *she-eu she-eu*.

Certainly it is useful to unite them in a single subfamily, Aquilinae, as was suggested by Howard (1932).

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Their calls were almost perfectly synchronized. When the lead bird perched, the follower did likewise, alighting several inches from the first. These events terminated when the lead bird flew at the other and drove it from its perch. These were my only observations of what appeared to be pair formation or courtship activities. Other authors (Gross 1950; Skutch 1960:374) have not described the bill-popping and head-shaking displays in either the Sulphur-bellied or the closely related Streaked Flycatcher (*M. maculatus*).

NEST SITES AND THE NEST

In Arizona nest sites are usually in natural cavities in living sycamores. However, one nest was located in an old flicker (*Colaptes auratus*) hole and another was in a bird box that I had placed high in a sycamore. Six Arizona nests ranged in height from 6.8 to 13.4 m (mean, 11.0 m). Skutch (1960:387) found seven nests at heights of 3.4-27.7 m above the ground.

Unlike *Myiarchus* flycatchers which also nest in cavities, Sulphur-bellied Flycatchers usually do not place their nests deep inside a hole. Instead they often fill a deep hole with large twigs almost up to the rim and then place the nest proper on this platform. However, this is not invariable (cf. Bent 1942:100; Skutch 1960:388). Five nests I located were 10 cm (woodpecker hole), 27.5 cm (natural cavity), 11.25 cm (natural cavity), 2.5 cm (natural cavity), and 25.0 cm (bird box) below the rim of the hole. The nest in the old flicker hole was situated directly on top of a nest and four unincubated eggs of the Olivaceous Flycatcher (*Myiarchus tuberculifer*), another common tyrannid of Cave Creek Canyon. Bent (1942:105) recorded a Sulphur-bellied Flycatcher nest built over the fresh eggs of a Flicker.

According to Skutch (1960:388), the female alone constructs the nest, but its mate often is present. I observed only one bird, presumably the female, carrying nest material. At two nests, the time elapsed

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TABLE 1. Composition of four nest cups of the Sulphur-bellied Flycatcher.

	Nest 1		Nest 2		Nest 3		Nest 4	
	No.	% ^a	No.	%	No.	%	No.	%
Needles of <i>Pinus leiophylla</i>	484	35	151	15	898	70	2053	96
Leaf petioles and twigs from deciduous trees	910	65	920	85	385	30	80	4

^a Per cent of the total number of items used.

from the beginning of construction to egg-laying was 9 and 11 days.

The cup is placed on top of the stick platform and is composed of leaf petioles and dried pine needles. In Arizona, petioles of walnut leaves are said to be used almost exclusively (Bent 1942:100; Brandt 1951:417). However, all nests examined in Cave Creek Canyon also contained numerous dried needles of *Pinus leiophylla* and these were utilized extensively in two of four nests investigated (table 1). No soft materials were used, making the nest unlike that of many other tyrannids.

EGGS AND INCUBATION

The eggs have been described by several authors (Bent 1942:101; Brandt 1951:416; Skutch 1960:389), all of whom comment on their unusual beauty. Four eggs composed the clutch in the four nests I studied in 1964. These were laid 12–18 June. Usually one egg is laid per day, although exceptions to this occur. At one nest the first two eggs were laid by 10:00 on 9 June; there were still two eggs at 16:30 the following day. The third egg was laid before 12:00 on 11 June and the fourth by 17:00 on 12 June. At another nest the second egg had not been laid by 9:00, about 24 hr after the laying of the first.

In 1966 a two-egg clutch was laid in the bird box on 6–7 July, and at another nest the first egg was laid on 25 July. Howard (1899) found a nest containing newly hatched young on 28 August. Possibly late nesters either lost or were unable to obtain a suitable nest site earlier. Both late nests located in 1966 were

at an elevation of 5400 ft near or on the grounds of the Southwestern Research Station of the American Museum of Natural History, where I had not recorded breeding sulphur-bellies earlier in the season.

Incubation is performed solely by the female (Skutch 1960:389). I attempted unsuccessfully to mark a female with paint in the manner described by Skutch. However, I could recognize the incubating bird at two nests by means of the mashed, rumpled rectrices, which apparently resulted from the birds' incubating in a small cavity. Incubating birds also appeared to be slightly smaller and duller than their mates.

The incubation period at one nest was 16 days, agreeing with the figure given by Skutch (1960:390).

PAIR RELATIONS DURING INCUBATION AND NESTLING PERIODS

Relationships described below are based on birds sexed by condition of the rectrices, as described above. The male does not feed the female during incubation, although they are usually together when she is away from the nest. The female passes most of her inattentive periods perched quietly near the nest, preening and occasionally capturing an insect.

After the eggs hatch one bird often forages away from the nest area while the other remains near the nest. When the forager returns it may be met in the air by its mate. Following high intensity vocalizations, both may feed the young in quick succession.

Agonistic behavior often is apparent in the relationships of the pair as might be expected in such a highly aggressive species. The male frequently dives at his

TABLE 2. Weights (g) of nestling Sulphur-bellied Flycatchers in four nests.

Age (days)	Nest 1, nestling ^a :			Nest 2, nestling:				Nest 3, nestling:				Nest 4, nestling:				
	1	2(17)	3(27)	4(49)	1	2(6)	3(6)	4(24)	1	2(0)	3(0)	4	1	2(0)	3(24)	4(36)
0		4.2	4.2	X ^b				X ^b				X ^b			3.7	X ^b
1	6.6	6.4			5.8	5.3	5.4		5.9	5.3	5.4		5.7	6.0	5.6	5.4
2			8.9	5.4					7.3	6.5	6.3		8.3	8.6		
3	10.7	11.4	11.9	6.6 (dead)				7.5	9.2	9.7	8.6				11.0	9.9
4	14.6	15.5			11.4	11.3	11.4						14.8	14.4		
5			19.7					11.7							14.8	15.3
6	22.4	23.4	26.7		17.2	17.5	20.5		17.9	19.4	17.6		20.4	19.8	18.4	18.1
7	31.5	28.8						20.6					22.6	24.0		
8					28.2	27.3	28.2		25.8	27.9	25.9					
9			34.4					27.6							23.0	25.1
10	35.6	37.8			33.3	33.5	33.6		33.4	37.2	33.0		27.6	28.9		
11			37.2												26.1	30.2
12	38.2	39.2						35.0	36.9	39.5	36.4		31.3	34.7		
13					39.6	41.5	38.7								35.4	38.7
14			39.3					36.5					37.1	38.9		
15	41.7	40.5	37.6		37.5	41.9	36.9		38.4	40.9	37.6				36.1	40.0
16	39.7												37.8	38.7		

^a Numbers 1–4 indicate sequence of hatching. Numbers in parentheses indicate approximate number of hours each egg hatched following hatching of the first egg.

^b Egg unhatched. In nest three one egg failed to hatch.

mate when she emerges from the nest. This behavior presumably is kept at a low intensity as a result of the passive response of the female. Following such dives and when diving is not exhibited, the male often closely follows the female as she flies from the nest area.

Other birds may be pursued more vigorously. A female Black-headed Grosbeak (*Pheucticus melanocephalus*) was chased as she flew near the flycatcher's nest, as was a Wied's Crested Flycatcher (*Myiarchus tyrannulus*) and an intruding sulphur-belly.

DEVELOPMENT OF YOUNG

The young sometimes hatched at irregularly staggered intervals, suggesting that incubation began before the clutches were complete. All young hatched were reared at three of the four nests studied closely. At nest one the last-hatched died at two to three days of age, apparently of starvation (table 2).

Newly hatched nestlings possess long down growing from the capital, humeral, alar, spinal, and femoral feather tracts. At hatching the skin is bright pink; it soon attains a grayish cast. Down appears to be black at hatching and to become lighter in 24 hr. However, this apparent color change may be caused by thinning of the down as the bird grows rather than by fading. Quills of the alar and caudal tracts are visible even on newly hatched nestlings.

By three days the mandibles have darkened, as has the skin, which dorsally is almost black. By seven days the eyes are opening and quills protrude from the major feather tracts. By ten days the culmen is about 40 per cent adult size, and the tarsus is fully grown. The calls of the day-old nestlings were similar to the distress calls of domestic chicks; at 12 days these were interspersed with adult-like "she-u" calls. Fledging took place when the young were 18 days old at a nest that had not been disturbed the preceding three days. It occurred at 16 or 17 days in the three other nests.

At fledging the young could fly only short distances. One fledgling perched two feet up did not move as I approached. This bird had defecated more than 40 times from this perch, indicating that movement was infrequent at this stage.

FURTHER NOTES ON COSTA RICAN BIRDS

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Recently Orians and Paulson (1969) published a series of observations, mostly sight records of Costa Rican birds. Some of these sight records were of species, specimens of which they knew had been collected (via a copy of my field catalogue that had been supplied them); in fact, some of these birds were collected while we were all in the field together. Unfortunately they did not avail themselves of these data, and did not include notes on the specimens or on certain additional species of interest, thus necessitating this note. These specimens were collected 4 February–15 March 1967 when I was in Costa Rica as a temporary staff member of the Organization for Tropical Studies. Specimens are deposited in the collection at Cornell University, Ithaca, New York.

SUMMARY

The Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*) arrives in southwestern Arizona in late May or early June. In 1964 egg-laying was completed in four nests by 18 June. The female alone builds the nest and incubates. The nest proper often is constructed atop a loose platform of large twigs and sticks and is composed principally of leaf petioles and pine needles. Incubation lasts 16 days. The young hatch at irregularly staggered intervals. At one nest the last-hatched chick starved. The nestling period is 16–18 days. Recently fledged young fly weakly and may remain at one perch for long periods.

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Yellow-crowned Night Heron. *Nycticorax violacea*. An adult female was collected and several other individuals were seen along a fresh water stream at Hacienda Taboga (or Taboga, 12 km SW of Cañas, Guanacaste Province) on 9 February. Its stomach was full of insect material. Slud (1964:41) wrote that the population of this species in Costa Rica "consists inferentially of residents and winter visitants." Thus it seems worthwhile to record a definite record of *N. v. violacea* of eastern North America. The depth of the bill at the nostril is 20.7 mm and at the base, 22.0 mm. These measurements fall within the range of *violacea* (18.4–21.91 mm) and outside of the ranges for *N. v. bancrofti* of the Pacific lowlands from México south to El Salvador (23.2–26.4 mm, Huey 1929:167) or *caliginis* of the Pacific coastal areas of Panamá to Ecuador (22.2–25.1 mm, Wetmore 1946:49).

Least Bittern. *Ixobrychus exilis*. Four adult males were collected from small cattail marshes at Taboga, 11 and 22 February, and several additional birds were seen. All four birds were about the same size (wing chords, 114–115 mm; culmen from nostril, 45–48 mm; weights, 84.6–93.5 g), yet represent two subspecies based on color differences. Three paler birds with