

## BREEDING BIOLOGY OF THE VAUX SWIFT

By PAUL H. BALDWIN and NICK K. ZACZKOWSKI

The few reports on the breeding of the Vaux Swift (*Chaetura vauxi*) that appeared in the early part of the present century are cited by Bent (U.S. Nat. Mus. Bull. 176, 1940:294-304) in his account of the life history of this swift. From these sources we know the general pattern of nesting, but many facts on the breeding biology are unreported, such as the lengths of the incubation period and of the nestling period. A detailed knowledge of nesting of the closely related Chimney Swift (*C. pelagica*) has recently become available through the work of Fischer (N.Y. State Mus. and Sci. Serv. Bull. 368, 1958:1-141) and others, and this intensifies our need for comparative information on the Vaux Swift. Baldwin and Hunter (Auk, 80, 1963:81-85) observed part of the nesting regime of the Vaux Swift in a chimney at the Montana State University Biological Station on Flathead Lake, Montana, in 1961. The present report includes information obtained in 1962 at the same locality particularly on earlier phases of the nesting, together with the results of a search by the junior author for nesting in natural cavities, since no instance of the latter was known for northwestern Montana.

A new nest of coniferous twigs and saliva was observed on June 17, 1962, in the chimney at the Montana State University Biological Station. The nest was fastened 15 inches above the floor but in a different corner of the chimney from that used in 1961. One parent carried the band "01," which in 1961 was placed on an adult associated with the nest in this chimney. The other parent was unbanded and given band "48." These two swifts were first captured on June 24, and they were the only adults found in the chimney until August 9, when unbanded adult visitors, presumably migrating, appeared in the chimney at night. Three other adults and three young that were fledged from the nest in the chimney in 1961 were not recaptured in 1962.

## ACKNOWLEDGMENTS

Financial assistance for this research was received through the program for Research Participation for High School Teachers of the National Science Foundation. For suggestions and aid we are grateful to Dr. R. S. Hoffmann, J. G. Lepley, W. F. Hunter, R. W. Schneider, and C. Loveland.

## EGG LAYING PERIOD

In 1962 we recorded new information on clutch size, the interval between laying of eggs, and parental attentiveness. The nest contained four eggs on June 17 at 1:15 p.m.; no bird was in the chimney or vicinity at this time. At 6:45 p.m. a swift was in the flue clinging slightly above the nest, and that night two swifts perched together on the chimney wall, leaving the four eggs unattended.

On June 18 at 6:30 a.m. one bird was on the nest and the second bird was on the wall; at 9:15 a fifth egg was in the nest, but the swifts were absent. The nest was unattended through the day, but after sunset the swifts fluttered into the chimney ten minutes apart; neither sat on the five eggs but both perched on the wall. The closely related Chimney Swift starts incubation with the laying of the penultimate egg (Fischer, *op. cit.*:84), and, since the largest clutch reported for the Vaux Swift by Bent (*op. cit.*:298) is six eggs, we expected incubation to start immediately. On June 19 at 6:45 a.m. the five eggs were still unattended; by 7:30 the birds had vacated the chimney, and although we saw swifts in high flight, none re-entered the chimney until dark. On June 20 at 6:45 a.m. two birds were in the chimney, one on the nest; at 7:50 the perching bird

left, and one hour later the attentive bird left, revealing six eggs. The fifth and sixth eggs were laid during the night or early morning. Even after the laying of the sixth egg, incubation did not commence immediately, for the nest remained unattended through the day. On June 21 we saw a swift on the nest at 6:45 a.m.; it departed by 8:20, and none returned until dusk. Nonattentive periods of two days occurred after both the fifth and sixth eggs were laid.

Incubation started two days after the laying of the sixth egg, because on June 22 at 6:45 a.m. a swift was on the nest; for the next 25 days no periods of unattentiveness were observed. It was not until both the attentive parent and the nonattentive adult were removed from the chimney for banding at 9:00 p.m. on June 24 that a seventh egg was discovered in the nest. Dexter (see Fischer, *op. cit.*:80), after examining 26 Chimney Swifts' nests, found one with seven eggs; he suggested that sets greater than six might involve more than one female. We had no evidence of nest visitors in the chimney during the egg laying period. This, together with the delayed incubation, suggests that the seven eggs were from one female, although, conceivably, another female could have laid one of the first four eggs before the nest was observed.

#### INCUBATION AND HATCHING

By marking adult "01" on the rump with yellow dope and adult "48" on the crown, we could distinguish the two in the chimney and determine the role played by each parent. Inattentiveness was not observed during the incubation period in 81 random nest visits, between 5:15 a.m. and 10:05 p.m., made on 19 days of the incubation period. Sixty-eight daylight nest visits disclosed the crown-marked swift incubating 35 times and the rump-marked bird, 33. Diurnal attentiveness appeared about equally shared. The crown-marked swift was found incubating during nine observations made in the early morning before either bird left the chimney. In three evenings from June 25 to July 7, between 7:30 and 10:05 p.m., the rump-marked bird was incubating on two evenings and the crown-marked bird on one; the mate was variously absent or present in the chimney on these occasions. In 16 nest visits at about hourly intervals on July 7 from 6:45 a.m. to 9:00 p.m., the crown-marked bird was incubating ten times (alone in chimney seven times; mate in chimney, three), and the rump-marked swift was incubating alone six times. The adults were never seen incubating together on the nest. Fischer (*op. cit.*:84) believed the female Chimney Swift did a little over half the incubating; we did not learn the sex of either of our parent Vaux Swifts.

At no time during incubation was the sitting bird known to leave the nest without being relieved. After the feeding bird entered the chimney, the mate flew out in one or two minutes.

There were no young at 7:10 a.m. on July 9; 24 hours later the entire clutch of seven eggs had hatched. This was the 19th day of continuous attentive behavior (June 22 to July 10); thus, continuous incubation endured 18 full days and possibly a few hours into the 19th day. Since all eggs hatched within a 24-hour period, the seventh egg was probably laid not later than June 22, although it could have appeared on June 21. Hatching may have occurred late on July 9 rather than early on July 10. These data reveal that the period between laying and hatching of the last egg was from 18.5 to 20 days.

#### NESTLING PERIOD

Continuous attentiveness persisted in the early period of nestling development. Forty nest visits during the week following hatching revealed brooding 36 times. Brooding appeared to end simply for physical reasons. On the night of July 17 we watched

an adult trying to settle on the nest only to be pushed off each time by the squirming young; finally the adult fluttered to the chimney wall. No further brooding was observed.

Feeding of the young was apparently shared equally by the parents as long as brooding continued. The two marked adults always alternated between feeding and brooding, the returning bird entering the chimney and about one minute later the relieved bird leaving. In 16 instances between 8:00 a.m. and noon on fair weather days, the lapse of time between feedings averaged 18 minutes, the extremes being 10 and 35 minutes. A notable increase in frequency of feeding occurred between 8:31 and 8:47 p.m. on July 17, when five feeding trips were made in 16 minutes.

Two young died during the nestling period. On day 3 an individual smaller than the others disappeared from the nest. On day 19 a well developed nestling which starved after tumbling from the nest was found on the chimney floor. Fischer (*op. cit.*:128) reports similar starving in nestlings of the Chimney Swift and states that "a swift thus isolated begs when a parent enters with food, but it is the young that remain where the old birds are in the *habitus* of feeding who get the food."

On July 30, 20 to 21 days after hatching, the five surviving young were out of the nest for the first time. They perched on the chimney wall above the nest. Young were never seen in the nest again. After leaving the nest, the young dispersed in the lower half of the flue during the daytime but came together in a compact group at night. Clumping apparently was a heat conserving behaviorism, as it also occurred on a cool, rainy day. On August 9 a third fledgling was found starved to death at the bottom of the chimney, although it had been healthy when last recaptured on August 6.

#### FLEDGING AND DEPARTURE

Two of the banded young made their first flights out of the chimney on August 7, 28 days after hatching, between 8:30 and 9:20 a.m. At 5:00 p.m. on August 9 we found the chimney void of birds for the first time. That night only one young returned. Neither parent was seen after 9:00 p.m. on August 7, but from this night on, visitors which were mostly young-of-the-year from elsewhere began to roost in the chimney. The first was found at 4:55 p.m. on August 7; its unsheathed primaries, general condition of the plumage, and peeping call indicated the bird was young. At 5:20 p.m. the same evening, a second young visitor was present, and later a third. A second chimney at the opposite end of the small building was never known to attract swifts in this summer or the previous one.

On the evening of August 9, activity by swifts in the flyways above the lake shore greatly increased; later, at 8:00 p.m., the chimney contained 16 birds—11 young and five adults. Of the young, one was a repeating visitor and another was from our nest.

TABLE 1  
MOLT OF THE PRIMARIES OF ADULT VAUX SWIFTS ON AUGUST 9\*

Bird	Primary						
	1	2	3	4	5	6	7 to 10
"72"	N	$\frac{7}{8}$	$\frac{3}{8}$	P	0	0	0
"80"	N	N	$\frac{7}{8}$	$\frac{1}{2}$	D	0	0
"71"	N	N	N	$\frac{4}{8}$	$\frac{1}{2}$	0	0
"75"	N	N	N	N	$\frac{7}{8}$	$\frac{1}{2}$	0
"76"	N	N	N	N	N	$\frac{3}{4}$	0

\* N = feather renewed;  $\frac{1}{2}$  = new feather one-half grown, and so forth; 0 = old feather still present; D = old feather dropped, follicle empty; P = pinfeather emerging.

The adults were identified by the molting primaries (table 1). Three adults had some rectrices new or missing, two had old rectrices only. A comparison of weights and wing lengths of the two age groups indicates that adults are heavier and larger at this time (table 2).

TABLE 2  
COMPARISON OF TWO AGE GROUPS OF VAUX SWIFTS ON AUGUST 9

Age	Number of birds	Body weight (gm.)		Wing length (mm.)	
		Average	Range	Average	Range
Young	11	17.3	16.5-18.5	112.8	107-118
Adult	5	19.2	18.3-19.9	115.0	114-116

At 6:45 a.m. the next morning the chimney harbored no swifts. It remained empty for the next four days, after which observations ceased. In all, 17 "migrant" swifts used the chimney from August 7 to 10, at the termination of the nesting season; all were captured and banded.

DEVELOPMENT

The weights of nestlings increased rapidly until about the 26th day, and maximal weights were maintained until the nestlings left the nest (fig. 1). During the ensuing days in the chimney the weight decreased, probably due in part to greater activity such

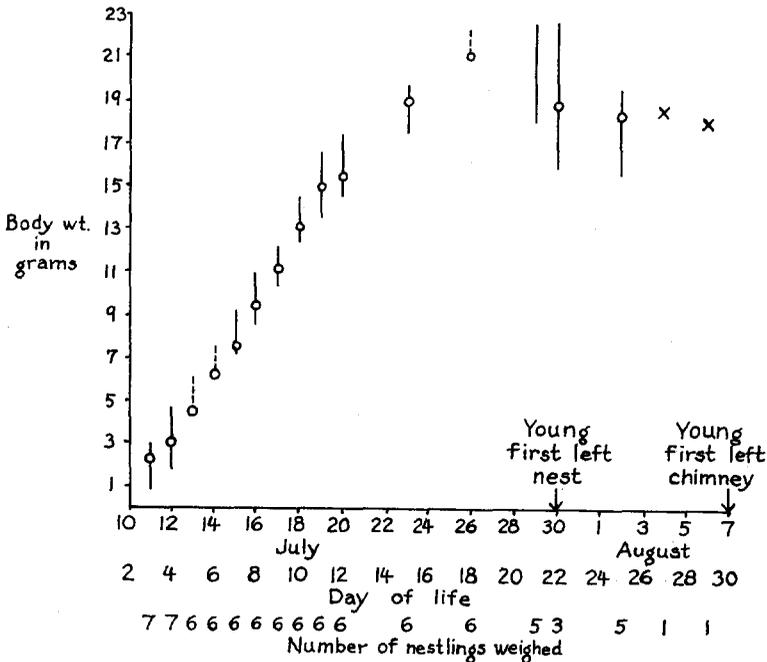


Fig. 1. Weights of young Vaux Swifts (*Chaetura vauxi*) from one nest. Circles indicate means obtained by weighing all nestlings at once, except for day 22, when individual weights were used; solid lines indicate range; broken lines lead to weight of one large nestling in the group.

as clambering about and whirring the wings. The gradual decline in weight was apparently not due to any reduced feeding from severe weather, as conditions were mild through the fledging period. Similar activity was thought to account for late loss of weight in young Chimney Swifts (Fischer, *op. cit.*:109).

On day 4 (assuming July 9 to be day 1) feather tracts were faintly visible on the dorsal body surfaces of the naked young. On day 5 the secondaries bulged under the skin but did not break through. All feather tracts showed dark papillae on day 6, and the ninth primary was 1 mm. long. The eyes were open on day 13, although Fischer (*op. cit.*:126) recorded that the eyes of Chimney Swifts usually opened on day 15 or 16. A nestling on day 10 is shown in figure 2 (eyes closed; primaries 9 mm. long; and the central rectrices, 4 mm. long).

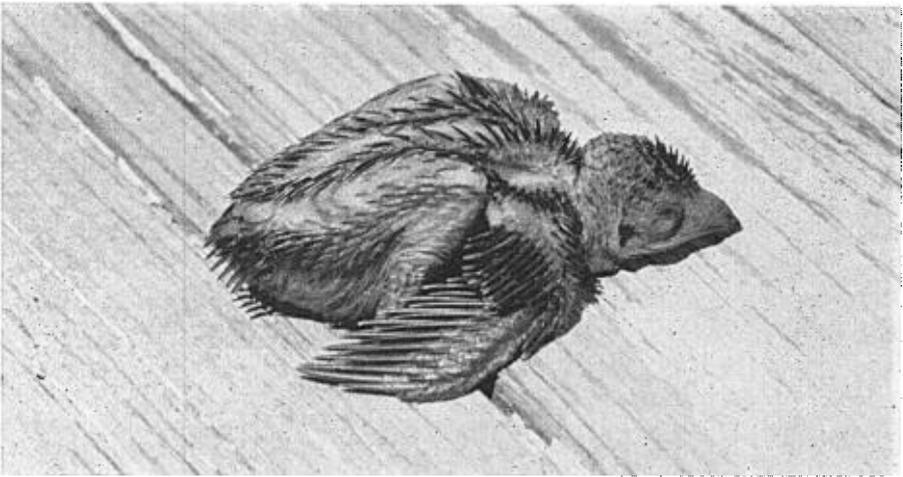


Fig. 2. Nestling of Vaux Swift after ten days of growth, July 19, 1962.

#### NATURAL NESTING SITES

The discovery of three natural nesting sites of the Vaux Swift in Glacier National Park in 1962 provides first records of nesting in natural cavities for Montana and extends the known breeding range to within four miles of the Continental Divide.

All these nests were in McDonald Valley, near Avalanche Creek, at an elevation of 3500 feet. This area escaped the ravages of recent fires and has many old "topped" trees with hollow trunks. Western red cedar (*Thuja plicata*), Douglas fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) are the dominant conifers. The main interruptions of the forest canopy are the bed of McDonald Creek and the clearings for the highway and access road to campsites at Avalanche Creek.

Nesting was suspected on June 22, when a swift was seen plunging into a 42-foot stub at the Avalanche campground. The pattern of activity of Vaux Swifts at this stub in the next two weeks was similar to that at the chimney nest of the Biological Station. The stub was a hemlock with the top broken off 42 feet up. A few green boughs remained two-thirds of the way up. A cavity extended down ten feet, the only access being through the top. On July 9 a small hole was cut near the nest, which was found glued to the south wall 14 inches from the bottom of the cavity. Flat strips of decaying heartwood projecting into the cavity formed a maze that made direct flight from the outside to the nest impossible. The nest contained seven young and no eggs; the length of young

(36.5 mm. from bill to tail) and absence of visible feather follicles indicated newly hatched young, probably not more than 24 hours old. An adult was on the nest when it was first viewed, despite the commotion from climbing the tree and entering the cavity. Several white egg shells were below the nest. Nest remains at the bottom of the cavity were evidence of previous nesting. On July 26 one of the seven young was out



Fig. 3. Hemlock stub, 58 feet tall, used for nest site by Vaux Swifts, August 2, 1962.

of the nest, clinging to the cavity wall six inches above the nest. A comparison of its measurements with those of its six nest mates revealed no age difference. All seven young were banded.

The second natural nest was in a western hemlock one-quarter mile northeast of the Avalanche Creek bridge. With its top broken off at 58 feet, rotting condition, and several green branches (fig. 3), it resembled the first nesting site. Although most of the trunk was hollow, the cavity was not continuous. The top chamber was 24 feet deep; the nest was on the northeast side five feet above the bottom. A side entrance to the cavity was made on August 2; five young were in the cavity, none on the nest. One young was banded.

The third natural nesting site was not verified by direct evidence, but the frequency of flights by adults in and out of the cavity was similar to that at the other nesting sites.

The tree was a hemlock, broken off 60 feet up but retaining several green stems on the rotted trunk; it was located one-half mile southwest of Avalanche campground on the east bank of McDonald Creek.

For four and one-half miles along McDonald Valley, from the upper end of McDonald Lake to one-half mile above the entry of Avalanche Creek, Vaux Swifts could be observed almost any clear day. The swifts were most numerous in the evening, when they were partial to airways above the highway and the stream. Thus, the nests were near optimal foraging grounds. Once a Vaux Swift was noted at Trout Lake, one mile beyond the mountainous north rim of McDonald Valley.

The Swan River valley, lying geographically between McDonald Valley and Flathead Lake, was the only other place where we noted regular foraging flights of Vaux Swifts. The lake shore and river edge forests of this valley seemed to offer excellent nesting sites for the swift.

On July 31 six swifts were foraging over the Greenough mansion in the northeast section of Missoula, Montana. Frequent flights into one tall chimney were observed. A visit with the owner of the mansion disclosed that these birds first appeared "about five years ago" and had entered the living quarters via a fireplace. After that incident the chimney tops were screened. In 1962 the screen blocking the east chimney was blown off, making entry possible. Some time before our visit the maid had captured a bird in the ventilator hood above the kitchen stove. The vent pipe, 6 inches in diameter, entered the east chimney after a vertical rise of two feet and a horizontal run of four feet—a dark maze through which to navigate.

#### SUMMARY

A chimney nest was established by Vaux Swifts for the second consecutive summer at Flathead Lake, Montana; one of the adults from 1961 returned as a parent in 1962. Seven eggs were laid and were continuously incubated for 19 days. The nestlings left the nest 20 to 21 days after hatching but remained in the chimney seven more days before taking first flights outside. Incubation, brooding, and feeding were carried on equally by the two color-marked parents. Departure of all young and adults occurred by the third day after the first flight of the fledglings.

Nests in natural tree cavities were found in Glacier National Park.

*Biological Station, Montana State University, Missoula, Montana, and Department of Zoology, Colorado State University, Fort Collins, Colorado; and St. Benedict's, St. Joseph, Minnesota, January 31, 1963.*