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TRAPPING FLOCKS OF CHIMNEY SWIFTS IN ILLINOIS

BY RICHARD M. ZAMMUTO AND EDWIN C. FRANKS

INTRODUCTION

In the late 1920's and 1930's thousands of Chimney Swifts (*Chaetura pelagica*) were banded annually (Musselman, 1926; Everett and Everett, 1927; Bartram, 1929; Green, 1930a, b, 1940; Coffey, 1936, 1937, 1938; Peters, 1937; Calhoun, 1938; Calhoun and Dickinson, 1942; Bowman, 1952; Coffey, 1958). After 1950, Dexter analyzed his own banded returns (1952, 1953, 1954, 1956b, 1960, 1962, 1964, 1966, 1968b, 1977), including individual life histories and mating activity (1950a, 1950b, 1951, 1956a, 1968a, 1969, 1978). In the 1960's and 1970's published research on Chimney Swift trapping had ceased except for the continuing work of Dexter cited above.

Our research had two major objectives: (1) to determine the composition of roosting flocks and thus population turnover during migration, and (2) to relate swift weights and amount of fat deposition to season.

METHODS AND MATERIALS

Study Area

The study was conducted at Macomb, in western Illinois. The center of the city has 3 or 4 blocks of 3 to 5-story buildings with no space between them; the central area is surrounded on each side by about 10 blocks of 1 to 3-story homes averaging 10 m apart. Macomb is the largest city (population = 23,000) in the county and is surrounded by cultivated farmland. Because of its large size in relation to the other towns in the area, Macomb is the major source of chimneys and and thus probably holds the major portion of the Chimney Swift population in the 1,500-km^2 county.

Flock Trapping

Flocks of Chimney Swifts were trapped in spring 1977, using a trap similar to that described by Lincoln and Baldwin (1929) (Fig. 1). The trap consisted of a light-weight wooden frame covered with black plastic. Attached to this was an aluminum funnel and burlap bag to collect the swifts. The bag was fastened to the bottom of the funnel with a metal collar. A 58 × 79-cm bag was used for flocks of less than 30 birds, whereas flocks of more than 100 required a 125 × 200-cm bag to avoid suffocation. Before a flock was trapped, the flue opening was measured so the trap could be modified to fit the chimney. For small chimneys, the trap entrance was reduced by adding strips of black plastic to the bottom

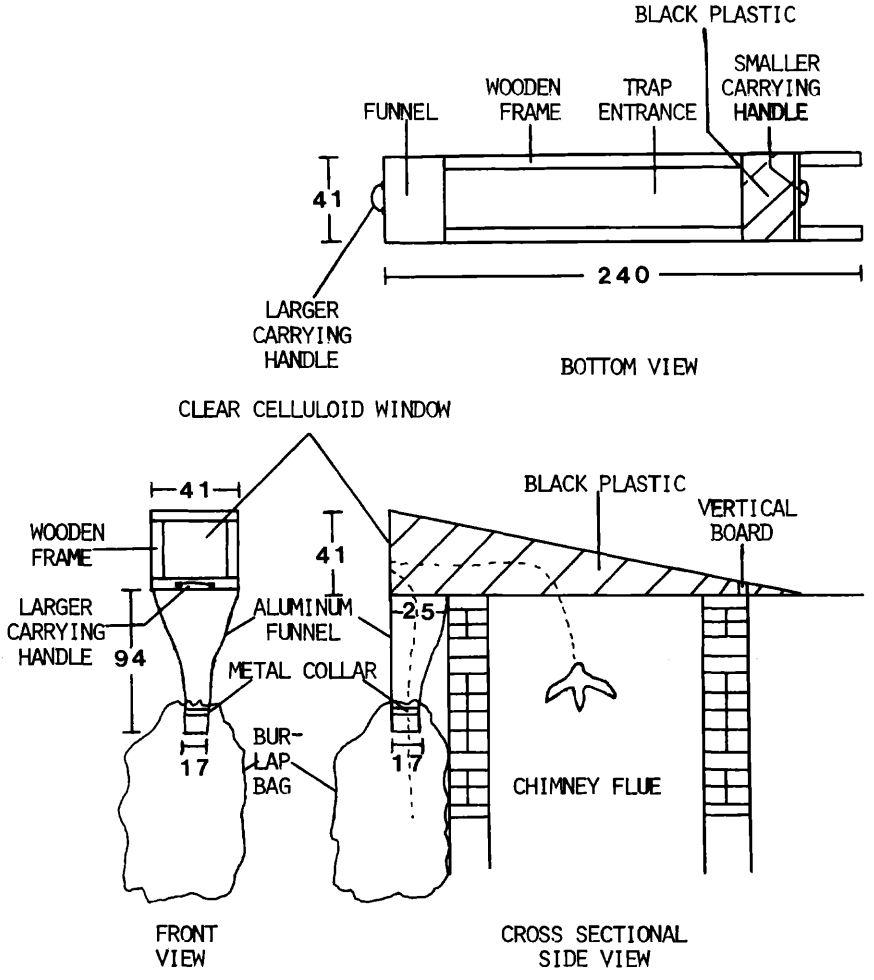

FIGURE 1. Design of the trap used to capture flocks of Chimney Swifts (all measurements are in cm).

of the trap. For large chimneys (>41 × 120 cm), the trap was placed over the chimney top without modifications and boards were placed beside the trap to cover any remaining opening (Peters, 1937).

The evening before a morning trapping, we counted the number of swifts entering the chimney, and then covered the chimney top completely with screens and boards. The trap was placed over the top of the chimney an hour before dawn. The clear celluloid window was faced east so that the early morning light would cause the swifts to fly out of the chimney towards the window as suggested by Dexter (1950a, b).

Counting the swifts that entered the night before trapping gave us a

good estimate of the number that would be trapped the next morning and the size of the gathering bag that would be needed. By counting the swifts as they fell into the funnel or as they hit the clear celluloid window, we knew when most of the swifts that had entered the chimney were in the burlap bag.

To frighten the birds out of the chimney we went to the base of it, and shined a flashlight inside the flue as suggested by Musselman (1926) while simultaneously shaking a cowbell as suggested by Lincoln and Baldwin (1929). If the swifts did not come out, we used Fischer's (1951) method of scooping them one by one off the chimney wall into a tethered can.

After the swifts were frightened into the burlap bag, the bag was removed. If any swifts remained inside the chimney, a new bag was attached and the trap was left in place until the first batch of swifts was banded and released.

All weighing was done within the confines of an automobile to prevent interference from the wind. Swifts were placed head downward into a vertical paper cone similar to the screen and board cones used for other animals (Erickson, 1947) and were weighed with a 50-g Pesola spring scale.

Adult and juvenile weights were averaged monthly, and for each hour after capture time to see if they lost weight during banding operations.

In spring and early summer, the age of Chimney Swifts is not discernable externally. But in late summer, adults are molting whereas juveniles have all new feathers and are not molting (Coffey, 1937; Johnston, 1958).

We obtained some swifts for study of fat depostion, sex ratio, gonad size, and sexually dimorphic measurements. The amount of fat was estimated qualitatively using the method described by Wolfson (1954). This technique consisted of plucking all the feathers in the furcula region and observing the amount of yellowish fat beneath the skin. Each swift was placed in one of four fat deposit categories: heavy, medium, little, or none.

Sex was determined by examination of gonads. Testes were measured with calipers and their average size related to season. Follicles were not measured with the calipers because of their seemingly constant tiny size in all female swifts opened.

To determine if any external sexually dimorphic characters were present in the Chimney Swift, we took measurements of: (1) greatest width of lower mandible, (2) culmen length, (3) greatest width of abdomen, (4) width of internostril space, (5) length of longest tail spine, (6) length of longest rectrix excluding spine, (7) length of tarsus, and (8) color of throat. These measurements were analyzed to determine any sexual dimorphism. We did not measure wing chord because Fischer (1958) demonstrated that it showed no sexual dimorphism.

RESULTS AND DISCUSSION

Flock Trapping

In 30 trapping mornings involving 15 different chimneys, 2,402 Chimney Swifts were banded, and there were 193 repeats. The largest flocks were captured in spring and late summer during migration, but a few large flocks were captured in midsummer. Only two of our flocks had over 500 birds, thus our average capture was much smaller than the captures by many other investigators (Bartram, 1929; Green, 1930a, b, 1940; Coffey, 1936, 1937, 1938; Peters, 1937; Calhoun, 1938; Calhoun and Dickinson, 1942; Bowman, 1952; Hight, 1953; Coffey, 1958). Most of these researchers captured swifts in the southern states during fall migration.

In one of our first large captures, 75% of 300 swifts died, probably because the gathering bag was too small and many suffocated. Other investigators have also had trouble with gathering bags and cages. Dexter (1957) reported accidentally suffocating 125 swifts. Worth (1940) specified the size of the gathering cage in response to the trouble he had. Other researchers alluded to similar difficulties.

Flock Turnover

Bartram (1929), Green (1930a, b, 1940), Coffey (1936, 1944), and Calhoun (1938) all reported that the flocks they studied turned over very quickly, with no flock staying in a particular chimney for more than a few days. They felt that the individual birds moved to new locations almost daily, and were continually replaced by incoming migrants or other local swifts. Their conclusions were based on the fact that if they captured a flock at the beginning of a week, and returned to capture at the same roost at the end of the week, almost none of the birds in the later trapping period were recaptures from the earlier period. Our observations suggest an alternative conclusion.

Almost 100% of the flocks that we captured disappeared from the trapped chimney the evening after trapping. Every time we observed a roost the evening after a capture period, very few swifts came to enter the roost, but these few left the chimney and flew away shortly after arriving. Those that came out after entering flew away in a straight path as if quickly trying to escape something. We do not know what caused these swifts to come out after they entered but this happened on 90% of the evenings after trapping. Generally, no swifts appeared at the roost the next evening (1½ days after trapping). It appears that trapping frightens swifts from the trapped roost site, so they disperse to new locations the following evening.

Some flocks were left uncaptured and the swifts entering the roost were counted day after day without interruption. One such flock of 250 birds was watched entering or leaving the roost every day for 16 con-

TABLE 1.

Adult weight with respect to number of hours after capture time.

Hours after capture	Number weighed	Average weight ± SD of mean[1]	Range
0–1	334	23.7 ± 1.2	19.8–29.8
1–2	496	23.6 ± 1.3	19.5–29.8
2–3	326	23.3 ± 0.9	19.1–28.5
3–4	160	23.9 ± 0.7	19.9–27.5
4–5	119	23.7 ± 0.5	20.6–28.1
5–6	74	23.3 ± 0.8	19.8–29.0
6–7	111	23.8 ± 0.7	17.0–29.0
7–8	59	22.8 ± 0.8	20.2–27.3
8–9	55	23.4 ± 1.6	20.1–28.7
9–10	53	23.6 ± 1.4	21.0–27.4
10–11	18	24.0 ± 1.0	22.3–26.1
Totals and averages	1,805	23.6 ± 0.3[2]	

[1] Unweighted standard deviation of the daily means for the entire year.
[2] Unweighted standard deviation of the 11 hourly means shown.

secutive days. The flock size did not vary appreciably for the entire time. Then it was captured, and the next evening a single swift used the roost overnight. Most flocks were observed for shorter periods of time (<2 weeks) and then trapped. Again, they stayed at a similar flock size for days and then dropped to nearly zero birds the evening after trapping.

In summer, flocks generally remained fairly stable unless they were trapped or the weather changed (Zammuto and Franks, unpubl. data). During spring and autumn migration the flocks seemed to turn over every few weeks on somewhat of a cycle. The first few nights a roost was used, few swifts entered, but the number increased each evening

TABLE 2.

Juvenile weight with respect to number of hours after capture time.

Hours after capture	Number weighed	Average weight ± SD of mean[1]	Range
0–1	43	21.5 ± 1.6	18.6–25.4
1–2	85	21.5 ± 1.5	18.5–26.2
2–3	34	22.0 ± 0.6	18.5–23.8
3–4	—	—	—
4–5	12	20.6 ± 1.0	19.0–22.3
5–6	—	—	—
6–7	—	—	—
7–8	3	22.7 ± 0.5	22.7–22.7
Totals and averages	177	21.7 ± 0.7[2]	

[1] Unweighted standard deviation of the daily means for the entire year.
[2] Unweighted standard deviation of the 5 hourly means shown.

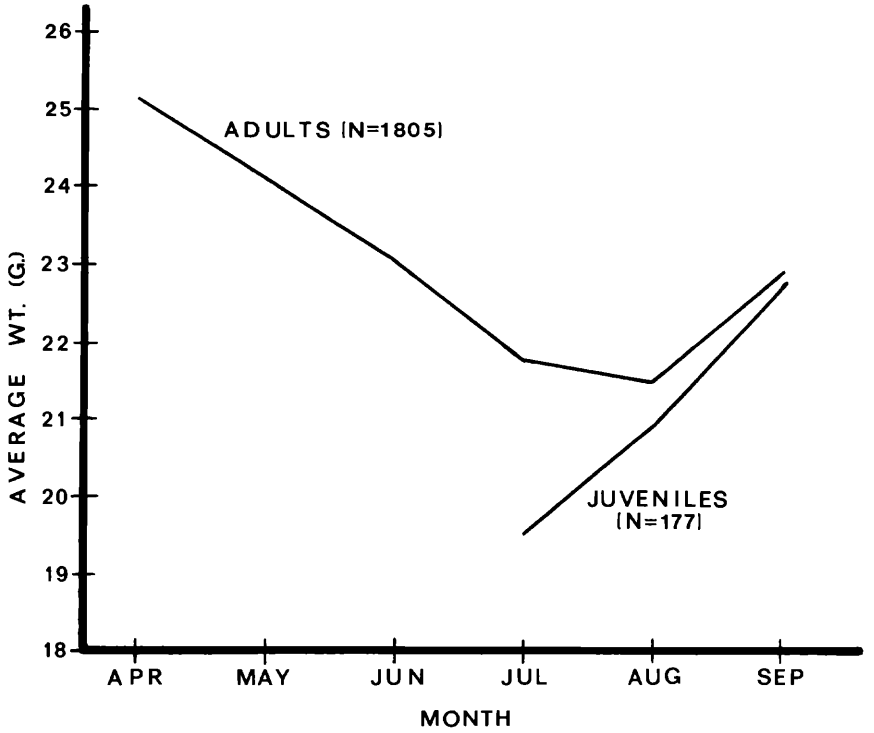

FIGURE 2. Average weights with respect to time of the year.

for about two weeks. Then the number using the roost each evening generally decreased until the roost was abandoned. For example, the number entering one roost every evening from 3 June to 21 June, 1977, was as follows: 24, 32, 38, 99, 125, 133, 119, 90, 87, 74, 67, 72, 76, 64, 57, ?, ?, ?, 0.

Banding and Weighing

Of the 2,402 swifts banded, 1,982 (1,805 adults; 177 juveniles) were weighed, nearly as many as the total number of weights that have been reported in the literature (Stewart, 1937; Bartlett, 1952; Coffey, 1958; Johnston, 1958). Our figures do not agree closely with any of the previous data ranging above some and below others. The average weight of 1,805 adults was 23.6 ± 0.3 g (range 17–29.8) and of 177 juveniles it was 21.7 ± 0.7 g (range 18.3–26.2) (Tables 1 and 2). As seen in Figure 2, and observed by Coffey (1958) and Johnston (1958), adult swifts generally weighed less during midsummer than during spring or autumn. There was little relative difference between the weights of adults and of juveniles in fall postbreeding flocks in our study (Fig. 2) as well as in Coffey's (1958).

TABLE 3.
Percentage of swifts in each fat category during 3 months.

Date captured	Number examined	Percent in fat category[1]			
		Heavy	Medium	Little	None
3 and 5 May 1977	309	31.4	42.7	21.7	4.2
13 July 1977	23	0.0	13.0	56.5	30.4
5 September 1977	24	4.2	45.8	50.0	0.0
Total	356				

[1] After Wolfson (1954).

A total of 165 swifts, 6.9% of all those banded, were captured twice, and 28, 1.2% of all those banded, were captured three times. Recaptures ranged from 1 to 151 days after banding, averaging 49.6 ± 43.5 days. Our recaptures, as well as Coffey's (1958), did not weigh the same at each capture.

No definite relationship was found between weight and the number of hours in captivity awaiting banding (Tables 1 and 2). However, 16 individuals that were weighed, set aside, and reweighed three hours later, all lost weight, with the weight of this group dropping 0.16 g per bird per hour. Coffey (1958) demonstrated a similar trend.

It appears that the reason for the nondecreasing average weights with respect to hour after capture as seen in Tables 1 and 2 is because some of the heavier swifts evaded being picked out of the gathering bag until only a few birds were left. Juveniles generally stayed near the top of the gathering bag and adults stayed at the bottom.

Age

As soon as juveniles appeared in the flocks (two in a flock of 163 on 13 July) and until mid-September, the difference between adults and juveniles was clear (see Methods). After mid-September, those adults that completed molting could not be distinguished from the juveniles. Johnston (1958) found it difficult to differentiate between adults and juveniles in early September, but Coffey (1937) aged swifts until October. Brooke (1969) felt that the juveniles' four outermost primaries are tipped with white in the autumn, but we found that the juveniles' primaries were no longer tipped with white after August.

Study of Dead Chimney Swifts

Fat deposition.—The fat deposits in dead swifts obtained in May, July, and September were measured (Table 3). Except for the sample on 13 July, the amount of fat ranged through all four categories. Spring migrants had more fat than fall migrants, and both had much more fat than summer residents.

Sex ratio, gonad size and sexually dimorphic measurements.—The sex ratio

was 0.92:1 for 169 males, 184 females, and 15 unknowns among 368 dead swifts. This difference was not statistically significant. Dexter (1957) found a 1.02:1 sex ratio for 119 swifts from a flock in Ohio.

As Johnston (1958) found, testes were much larger in spring (3–9 mm) than in summer (2–4 mm) or autumn (1–3 mm). Size of follicles did not vary appreciably from 1 mm in any sample. Johnston (1958) found some differences in size of largest follicles in late May and early June, but we had no samples from that period. No differences were found between the sexes in any measurement taken (see Methods). There was overlap in every regard as Fischer (1958) had found.

SUMMARY

We banded 2,402 Chimney Swifts that were captured a total of 2,595 times (193 repeats) at 15 different locations in Macomb, Illinois. The average time span between banding and first recapture was 50 ± 44 days (range 1–151) for 165 swifts captured at least twice. Of these 28 were captured three times. Weights of 1,805 adults averaged 23.6 g and 177 juveniles averaged 21.7 g. Adults and juveniles weighed the same during fall migration. Fat deposits and body weights are at a maximum in spring, a minimum in summer and intermediate in the autumn. Flocks seemed to turn over every few weeks during migration, but remained fairly stable in the summer. Trapping alienates swifts from entering the chimney where they were recently captured. The sex ratio of 368 dead swifts was 0.92:1. Throat color and seven measurements showed no sexual dimorphism.

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Department of Zoology, University of Arkansas, Fayetteville, AR 72701 (R. M. Z.); Department of Biological Sciences, Western Illinois University, Macomb, IL 61455 (E. C. F.). Received 17 December 1978, accepted 24 January 1979.