BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

VOL. XIII APRIL, 1942 NO. 2

MIGRATORY MOVEMENTS OF CHIMNEY SWIFTS, *Chaetura pelagica* (Linnaeus) TRAPPED AT CHARLOTTESVILLE, VIRGINIA[1]

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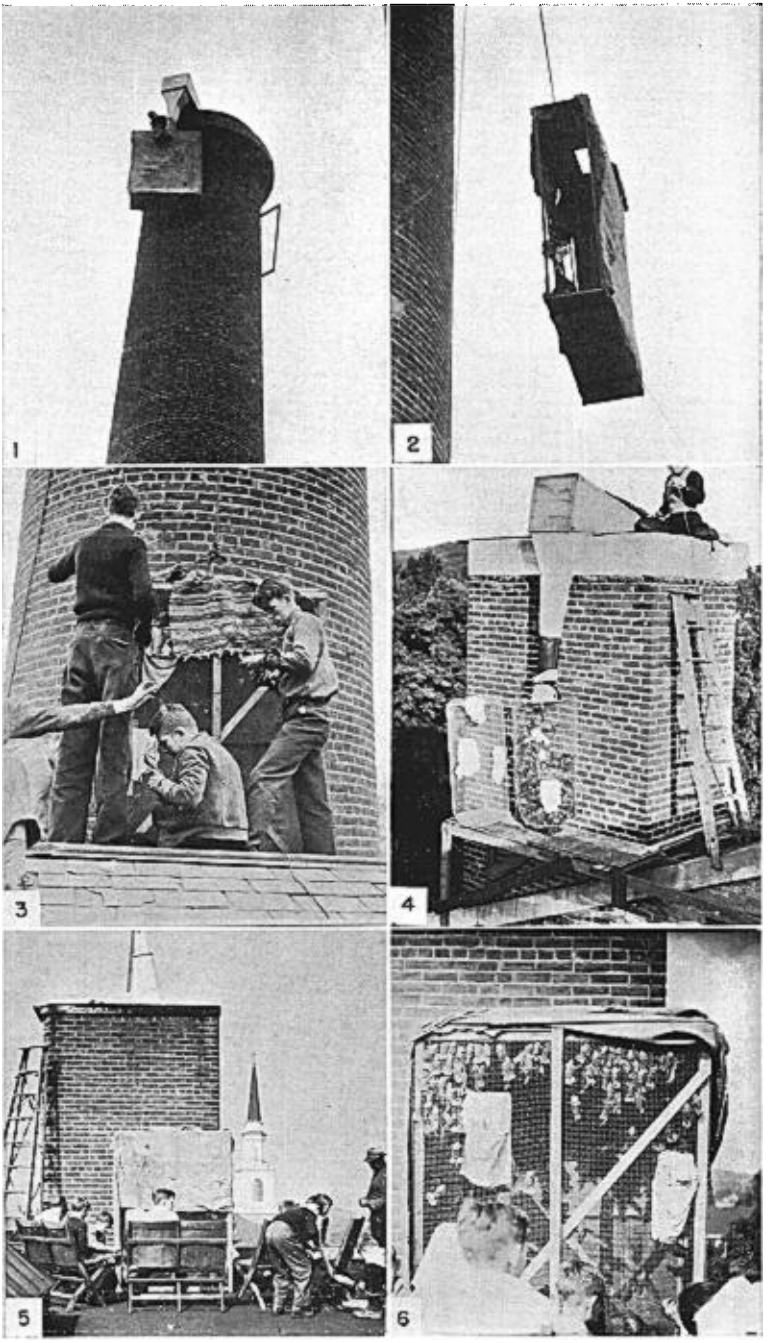
INTRODUCTION

FIELD observations may show that a given species of bird is present in one part of its range at one time of the year and in another part at a different time, but afford little information as to the exact route followed by individual birds or groups of birds. To obtain such information was one of the aims of the American Bird Banding Association organized in 1909. So great was the interest in this undertaking that the amount of banding that was carried out soon began to overtax the capacities of this private organization. In 1920 the work was taken over by the United States Biological Survey, under whose auspices 3,712,327 birds had been marked with aluminum bands by the end of 1940.

Among this number there have been banded over 265,000 Chimney Swifts, (*Chaetura pelagica* (Linnaeus)), during the past twenty years. Stoddard (1926) described the method of banding swifts as developed by C. A. Handley, which in its essentials has been followed by all later workers (Green, 1940; Peters, 1937). It is to be regretted that all the banding operators have not published on the results of their Chimney Swift banding operations, for even though most of the records are filed with the Fish and Wildlife Service of the United States Department of the Interior, formerly the Biological Survey, it is the individual operator who can best analyze the results derived from the particular conditions under which his banding operations were conducted.

During the fall of 1936 H. S. Peters (1937) in banding 21,503 swifts in six towns in Alabama and in Atlanta, Georgia found that at this season there occurred considerable random movement between the stations, ranging from 5 to 105 miles. Calhoun (1938) discusses the interstation movements on the basis of 15,876 birds banded at Nashville, Tennessee by Amelia R. Laskey and himself in the fall of 1938. Since at each banding station Chimney Swifts

[1] Joint contribution from the Department of Zoology, Northwestern University and the Department of Biology, University of Florida.



BANDING CHIMNEY SWIFTS

were captured from all other sites of banding in Nashville, it was evident that there was no rigid flock unity. In the evenings the swifts evidently stop at the first convenient chimney roost depending on where their day's wanderings have taken them. Thus in any flock at a given chimney the numbers may remain fairly constant from day to day although the flock composition may change due to local movements rather than to an influx of swifts from more northern points. At all times parts of a fall flock are in migration, moving southward or southwestward, and these are replaced by migrants from the north. For this reason there is only a gradual change in the composition of the Chimney Swift population in an area of concentration, such as a city with many fireless chimneys. The actual status of the unity of fall flocks will probably never be known. However, both Peters and Calhoun report one erratic movement at this season. This is a northeasterly wandering in the fall up to five hundred miles, a type of wandering which is the rule with such birds as the Little Blue Heron (*Florida caerulea* (Linnaeus)), the Wood Ibis (*Mycteria americana* Linnaeus), and others.

Coffey (1938) includes a map of Chimney Swift recoveries between Tennessee (Clarksville, Memphis, and Nashville) and other points in eastern North America. It shows that swifts passing through middle and western Tennessee are predominantly restricted to the western side of the Appalachian system.

Green (1940) discusses the results of an excellent swift banding project which was conducted from another Tennessee banding station, Chattanooga and environs. Of the 17,165 swifts banded in 1928 to 1930, many were recovered at widely separated points in eastern North America in the ensuing ten years. Many interesting data are given on longevity. According to Pond (1940), who synthesized the data from Green's paper, the number recovered after one to eleven years from the date of banding are respectively: 1 year (406), 2 years (147), 3 years (20), 4 years (11), 5 years (17), 6 years (8), 7 years (3), 9 years (3), 10 years (1), 11 years (1). Green's foreign recovery[2] records show that the members of a fall banded flock are widely scattered at or about the same time in the following spring. We believe this indicates that the spring migration is a hurried one and that different groups of swifts in the same migration route assume different rates of migration.

BANDING AT CHARLOTTESVILLE, VIRGINIA

Banding operations with the Chimney Swift at Charlottesville were preceded by two years of observation on their migratory behavior in that region. It was noted that flocking of these birds occurred in approximately equal intensity both in the fall and in

[2] A foreign recovery is a bird recaptured at a later date at a locality other than that at which it was banded.

the spring. In many regions where banding operations with this species have been conducted, spring flocking rarely occurs. In Gainesville, Florida, Dickinson has observed only small flocks in the spring. For the most part these Florida flocks have been composed of about 25–30 birds as opposed to flocks of 1,000-1,500 in the fall. The occurrence of flocking at both seasons at Charlottesville made this region an ideal one in which to carry out banding operations. Another ideal factor is that the residential nature and small size of Charlottesville (population, 19,400) provides only a few large chimneys in schools, churches, etc., where night roosting of large flocks occur.

With these factors in mind Dickinson and Calhoun began banding operations in the fall of 1937. In this and the following season the capture of larger flocks was made possible by covering over with wire screen the majority of the chimneys in use as roosting sites, which caused the swifts to concentrate in the remaining available chimneys.

The authors wish to express their thanks to James M. Vardaman, who has kindly made accessible to them a complete record of the Chimney Swift banding operations which he conducted at Charlottesville during the fall of 1939 and the spring of 1940. We are indebted to Dr. Johnson, superintendent of the city schools, who allowed us to place screen covers on the chimneys and air shafts of all the city schools. We are also indebted to Mr. Hartman, superintendent of buildings and grounds at the University of Virginia, for his cooperation in our banding operations on the University of Virginia campus buildings. Dr. Ivy F. Lewis, chairman of the Miller School of Biology at the University of Virginia, kindly allowed us the use of one of the Mountain Lake Biological Station station-wagons from time to time to transport our equipment. To the many others who assisted us in the actual banding operations we here express our appreciation.

TABLE 1. SEASONAL DATA OF CHIMNEY SWIFTS CAPTURED

Season	*Number Banded*	*Number of Returns*	*Number of Repeats*	*Number of Foreign Swifts*	*Total Number Handled*	*Percentage of Total Swifts Handled*[3]
Spring of 1936....	32			1	176[4]	0.76
Fall of 1937.....	1,186		18	4	1,208	5.20
Spring of 1938....	3,874	64	151	6	4,095	18.04
Fall of 1938.....	4,706	177	100	6	4,989	21.97
Spring of 1939....	7,512	737	54	24	8,327	36.67
Fall of 1939.....	2,068	178	47	7	2,300	10.01
Spring of 1940....	1,473	120	15	5	1,613	7.10
Total of all seasons	20,851	1,276	385	53	22,708	100.00

SEASON OF 1936

SPRING. Banding operations at Charlottesville were begun by Calhoun with a small and crude trap. 176 swifts were captured (174 on April 19, and 2 on April 26). Of these 32 were banded and the remainder released. One of these was subsequently captured at Opelika, Alabama, Sept. 1936. Banding operations were discontinued due to lack of equipment and assistance.

SEASON OF 1937

FALL. Dickinson and Calhoun with improved apparatus resumed banding operations. Their work continued through the spring of 1939. The 1,186 swifts banded during this season were as follows: 144 on Oct. 2; 566 on Oct. 3; and 476 on Oct. 10.

Recoveries of foreign banded swifts at Charlottesville: On Oct. 3: Kingston, Ont., May 12, 1934 (1); Kingston, Ont., May 16, 1937 (1); Tuskegee, Ala., Oct. 9, 1936 (1). On Oct. 10: Tilton, N. H., Aug. 27, 1937 (1).

Charlottesville banded swifts captured elsewhere: From Oct. 2: Macon, Ga., Sept. 22, 1940 (1). From Oct. 3: Hufsmith, Texas, April 30, 1940 (1); Macon, Ga., Sept. 22, 1940 (1). From Oct. 10: West Gloucester, Mass., June 1938 (1).

SEASON OF 1938

SPRING. The 3,874 banded during this season were as follows: 134 on April 21; 17 on April 22; 134 on April 23; 112 on April 30; 100 on May 2; 434 on May 13; and 2,943 on May 15.

Recoveries of foreign banded swifts at Charlottesville: On April 23: Opelika, Ala. Oct. 6, 1936 (1). On May 13: Opelika, Ala., Sept. 26, 1936 (1). On May 15: Tuskegee, Ala., Oct. 9, 1936 (1); Atlanta, Ga., Oct. 10, 1936 (4).

Charlottesville banded swifts captured elsewhere: From April 22: Boonesville, Va. (near Charlottesville), May 2, 1938 (1). From May 2: Cape May, N. J., May 19, 1938 (1). From May 13: Red Hill, Va. (near Charlottesville), May 20, 1938 (1); Algonquin Park, Ont., May 30, 1938 (1); Nashville, Tenn., Sept. 5, 1938 (1); Baton Rouge, La., Sept. 27, 1938 (1): 12 miles east of Charlottesville, Va., June 4, 1939 (1). From May 15: Burnleys, Va. (near Charlottesville), May 21, 1938 (1); Crozet, Va. (near Charlottesville), July 2, 1938 (1); Charlottesville, Va., July 18, 1938 (2); Nashville, Tenn., Sept. 7, 1938 (1); Nashville, Tenn., Sept. 10, 1938 (1)—(This swift was also retrapped at Charlottesville on April 28 and May 2, 1939); Baton Rouge, La., Oct. 1, 1938 (1); Baton Rouge, La., Oct. 8, 1938 (1); Standardsville, Va. (near Charlottesville), April 23, 1939 (1); Nashville, Tenn., Sept. 13, 1939 (1)—(This swift was also retrapped at Charlottesville on May 2, 1939); Ash Lawn, Va. (near Charlottesville), May 3, 1940 (1)—(This swift was also retrapped at Charlottesville on Oct. 1, 1938); near Charlottesville, Va., April 21, 1941 (1)—(This swift, No. 38-173936, which had been retrapped previously at Charlottesville on May 2, 1939 was captured on April 21, 1941 by Dr. S. W. Britton who found it nesting in his home with No. 40-37259 that was banded May 6, 1940); near Charlottesville, Va., May 1, 1941 (1).

FALL. The 4,706 banded during this season were as follows: 1,283 on Sept. 11; and 3,423 on Oct. 1.

[3] Percentage of total swifts handled = $\frac{\textit{Total No. handled per season.}}{\textit{Total No. handled in all seasons.}}$

[4] 143 swifts were released unbanded after they had been examined for foreign bands.

Recoveries of foreign banded swifts at Charlottesville: On Sept. 11: Memphis, Tenn., Oct. 1, 1936 (1); Athens, Ga., Oct. 11, 1936 (1). On Oct. 1: Tuskegee, Ala., Oct. 9, 1936 (1); Kingston, Ont., May 16, 1937 (1); Kingston, Ont., May 22, 1938 (1); Clarksville, Tenn., Sept. 11, 1938 (1). (In the twenty days that elapsed since the banding of this swift and its recapture in Charlottesville it had traveled 480 miles northeast and may have crossed the Appalachian Mountains.)

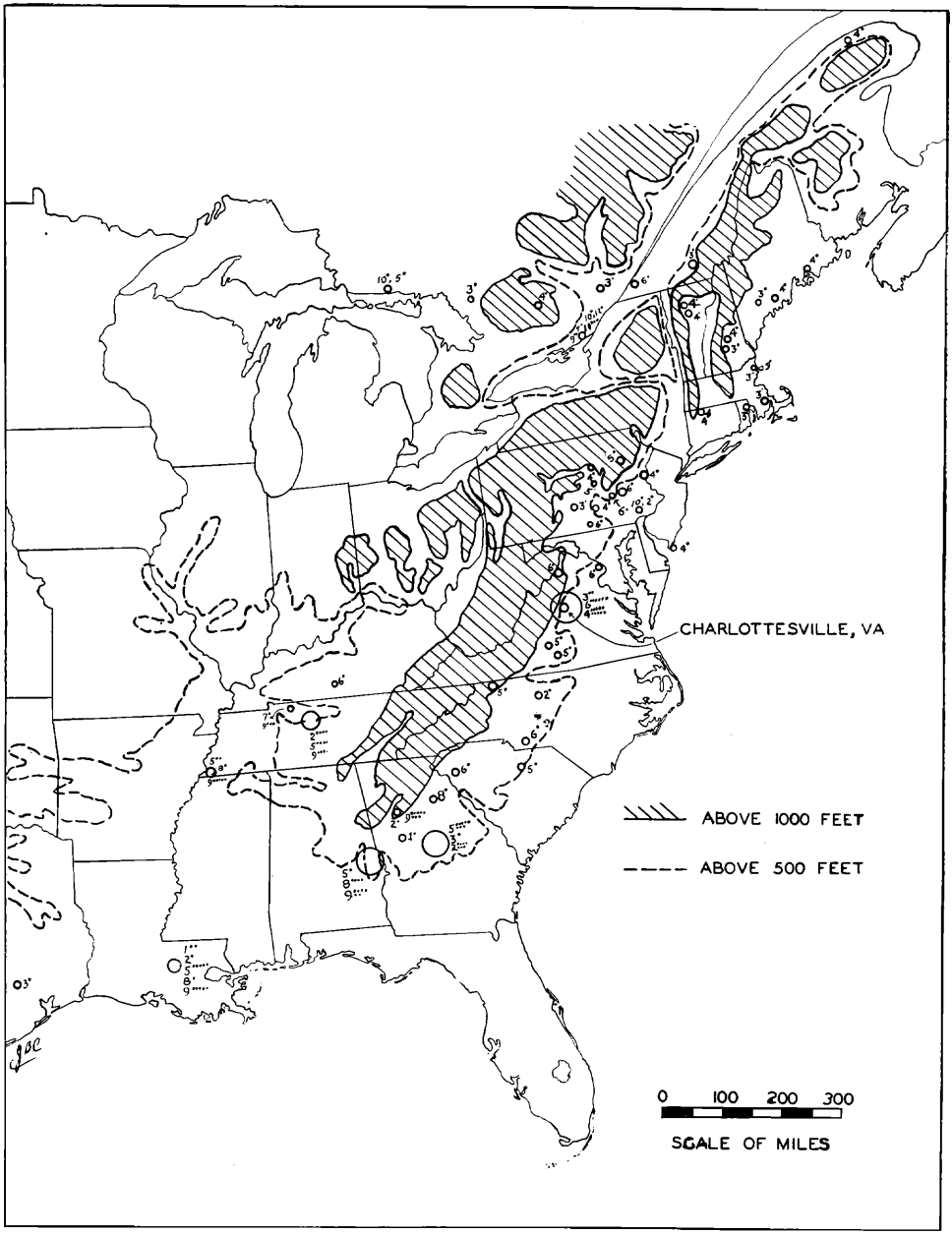
Charlottesville banded swifts captured elsewhere: From Sept. 11: Concord, Ga., Sept. 25, 1938 (1); Baton Rouge, La., Oct. 8, 1938 (2); Free Union, Va. (near Charlottesville), May 12, 1939 (1); Buckingham, Quebec, July 16, 1939 (1); Round Oak, Ga., Sept. 17, 1939 (1); Nashville, Tenn., Sept. 23, 1939 (1); Macon, Ga., May 5, 1940 (1); Greensboro, N. C., August, 1940 (1); Macon, Ga., Sept. 20, 1940 (1); Macon, Ga., Sept. 22, 1940 (1). From Oct. 1: East Waterford, Pa., May 1939 (1); Lake Auburn, Maine, June 1, 1939 (1); Nashville, Tenn., Aug. 14, 1939 (1); Chester, Pa., Sept. 1, 1939 (1); Nashville, Tenn., Sept. 13, 1939 (1); Baton Rouge, La., Oct. 7, 1939 (1); Macon, Ga., Sept. 22, 1939 (2); Standardsville, Va. (near Charlottesville), May 12, 1940 (1); Bridgewater, Mass., May 12, 1940 (1); Concord, N. H., May 20, 1940 (1); Arcadia, R. I., June 6, 1940 (1); Macon, Ga., Sept. 22, 1940 (1); Atlanta, Ga., Sept. 25, 1940 (1); Nashville, Tenn., Oct. 1, 1940 (1).

SEASON OF 1939

SPRING. The 7,512 banded during this season were as follows: 7 on April 27; 293 on April 28; 3,200 on May 2; 1,485 on May 13; and 2,527 on May 14.

Recoveries of foreign banded swifts at Charlottesville: On May 2: Kingston, Ont. (No. 38-86359, date of banding unknown) (1); Kingston, Ont., May 12, 1935 (1); Opelika, Ala., Sept. 20, 1936 (1); Atlanta, Ga., Oct. 10, 1936 (1); Memphis, Tenn., Sept. 19, 1937 (1); Opelika, Ala., Sept. 21, 1937 (1); Memphis, Tenn., Oct. 4, 1937 (1); Baton Rouge, La., Oct. 15, 1937 (1); Chester, Pa., June 6, 1938 (1); Nashville, Tenn., Sept. 5, 1938 (1); Nashville, Tenn., Sept. 23, 1938 (1); Clarksville, Tenn., Sept. 24, 1938 (1); Baton Rouge, La., Oct. 1, 1938 (2). On May 13: Opelika, Ala., Sept. 20, 1936 (1); Kingston, Ont., Sept. 20, 1937 (1); Blind River, Ont., Aug., 23, 1938 (1); Nashville, Tenn., Aug. 27, 1938 (1); Clarksville, Tenn., Sept. 11, 1938 (1); Memphis, Tenn., Sept. 21, 1938 (1); Clarksville, Tenn., Sept. 24, 1938 (1); Baton Rouge, La., Oct. 1, 1938 (1).

Charlottesville banded swifts captured elsewhere: From May 2: Carlisle, Pa., May 27, 1939 (1); Montoursville, Pa., June 1, 1939 (1); Ennice, N. C., Aug. 18, 1939 (1); Nashville, Tenn., Sept. 9, 1939 (1); Nashville, Tenn., Oct. 1, 1939 (1); Memphis, Tenn., Oct. 8, 1939 (1); Edinburg, Va., May 8, 1940 (1); Hamburg, Pa., May 8, 1940 (1); Fairfax, Va., May 10, 1940 (1); Gettysburg, Pa., June 1, 1940 (1); Milton, Pa., August, 1940 (1); Macon, Ga., Sept. 20, 1940 (1); Macon, Ga., Sept. 22, 1940 (1); Macon, Ga., Oct., 3, 1940 (1). From May 13: Arvonia, Va. (25 miles south of Charlottesville), May 15, 1939 (1); Ellsworth Falls, Maine, June 1939 (1); Calais, Vt., June 13, 1939 (1); Blind River, Ont., Aug. 21, 1939 (1); Altavista, Va., Aug. 27, 1939 (1); Memphis, Tenn., Oct. 1, 1939 (1); Camden, S. C., Oct. 3, 1939 (1); Nathalie, Va., Oct. 5, 1939 (1); Baton Rouge, La., Oct. 14, 1939 (1); Glasgow, Ky., May 4, 1940 (1); Marshville, N. C., May 5, 1940 (1); Mont-Joli, Matane Co., Quebec, June 9, 1940 (1). From May 14: Raubsville, Pa., May 20, 1939 (1); Mt. Royal, Montreal, Quebec, May 25, 1939 (1); Cedar Grove, Maine, June 1, 1939 (1); Dyke, Va. (near Charlottesville), June 2, 1939 (1); 12 miles east of Charlottesville, Va., June 4, 1939 (1); Ruckersville, Va. (near Charlottesville), June 17, 1939 (1); Ruckersville, Va., July, 1939 (1); La France, Anderson Co., S. C., April 23, 1940 (1); Standardsville, Va. (near Charlottesville), May 12, 1940 (1); Wilkes-Barre, Pa., Aug. 28, 1940


CHARLOTTESVILLE, VA
ABOVE 1000 FEET
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0 100 200 300
SCALE OF MILES

(1); Milledgeville, Ga., Oct. 1, 1940 (2); Macon, Ga., Oct. 3, 1940 (1); Milledgeville, Ga., Oct. 6, 1940 (1); Newmanstown, Pa., May 12, 1941 (1).

FALL. The banding operations were entirely taken over by Vardaman who continued the work through the spring season of 1940. The 2,068 banded during this season were as follows: 855 on Sept. 16; 337 on Sept. 21; 554 on Sept. 22; 79 on Sept. 29; 253 on Oct. 4.

Recoveries of foreign banded swifts at Charlottesville: On Sept. 16: Kingston, Ont., May 24, 1936 (1); Opelika, Ala., Sept. 21, 1936 (1); Memphis, Tenn., Sept. 21, 1938 (1). From Sept. 22: Loachapoka, Ala., Sept. 19, 1936 (1); Kingston, Ont., May 15, 1938 (1); Baton Rouge, La., Oct. 1, 1938 (1).

Charlottesville banded swifts captured elsewhere: From Sept. 21: Stokes Center, via Sherbrooke, Quebec, May 31, 1940. From Sept. 22: Magnetawan, Ontario, June 30, 1940.

SEASON OF 1940

SPRING. The 1,473 banded during this season were as follows: 105 on May 3; 118 on May 6; 445 on May 8, 558 on May 10; 87 on May 16; and 160 on May 18.

Recoveries of foreign banded swifts at Charlottesville: On May 3: Atlanta, Ga., Oct. 11, 1936 (1). On May 10: Nashville, Tenn., Aug. 31, 1938 (1); On May 18: Baton Rouge, La., Oct. 12, 1937 (1).

Charlottesville banded swifts captured elsewhere: West Hartland, Conn., May 30, 1940 (1); Stowe, Vt., June 10, 1940 (1); Macon, Ga., Oct. 3, 1940 (1); near Charlottesville, Va., April 21, 1941 (1).

KEY TO THE RECOVERIES OF CHIMNEY SWIFTS SHOWN ON THE MAP

Each dot following one of the key numbers represents one Chimney Swift recovery. For the purpose of analyzing the recoveries the pre-breeding and breeding season is empirically set as from April through July, and the post-breeding season from August through October. Recoveries fall into two groups:

Group I. Swifts banded at Charlottesville and later recovered elsewhere. The key numbers for this group are placed on the map at the place of recovery.

1. Fall banded swifts recovered the same fall.
2. Fall banded swifts recovered in a subsequent post-breeding season.
3. Fall banded swifts recovered in a subsequent pre-breeding or breeding season.
4. Spring banded swifts recovered the same pre-breeding or breeding season.
5. Spring banded swifts recovered in a subsequent post-breeding season.
6. Spring banded swifts recovered in a subsequent pre-breeding or breeding season.

Group II. Swifts banded in other places in the United States and Canada and later recovered at Charlottesville. The key numbers for this group are placed on the map at the place of banding.

7. Fall banded swifts recovered the same post-breeding season.
8. Fall banded swifts recovered in a subsequent post-breeding season.
9. Fall banded swifts recovered in a subsequent pre-breeding or breeding season.
10. Spring banded swifts recovered in a subsequent pre-breeding or breeding season.
11. Spring banded swifts recovered in a subsequent post-breeding season (i.e. during another year).
12. Spring banded swifts recovered in the fall of the same year.

ANALYSIS OF RECOVERY RECORDS

Recovery records indicate that practically all of the spring migration of swifts, which were banded in Charlottesville either during the spring or fall, takes place between the elevations of 500 and 1,000 feet. For this reason we have chosen to designate this flyway as the Piedmont Flyway (see map index numbers 3 and 6). While there are in our records twenty recoveries of northbound migrants stretched along the eastern slope of the Appalachian Mountains from Georgia to Maine, there is only one from west of the Appalachians. The latter is from south-central Kentucky. Taking into consideration the evidence furnished by the above twenty-one records and correlating it with the fact that there is only one definite record of a swift which may have flown across the Appalachian mountains from Clarksville, Tennessee to Charlottesville (see seasonal data, fall season of 1939), it is evident that the five recoveries of Charlottesville banded birds that were recovered as breeders in the St. Lawrence drainage system, probably indicate that these birds utilized the valleys of the Hudson, or Mohawk Rivers to reach their breeding grounds. These valleys form the only major breaks in the Appalachians below an elevation of 1,000 feet. The capture in Charlottesville of eight swifts banded in Kingston, Ontario at the northern end of Lake Ontario (two of which were recovered the same year that they were banded) offer additional support to this "valley flyway" hypothesis. The fact that swifts banded in the above mentioned area migrate along the west as well as the east side of the Appalachian mountains is evidenced by the fact that Calhoun, and also Coffey, record the capture of eight and seven Kingston banded swifts in Nashville and Memphis, Tennessee, respectively.

The capture in Nashville, Tennessee of four of our fall-banded swifts during subsequent fall seasons shows that the same swift may during one fall season use the Piedmont Flyway and during another fall season the Mississippi Flyway. At least with Chimney Swifts, there are no definite, well fixed routes from the aspect of the individual; although from the standpoint of the population as a whole certain general fixed routes are quite well determined. The recovery of spring banded swifts (see index number 5 on the map), which at the time of banding were either residents or were migrating northward, also shows a bifurcation of the fall migration route. Although the majority (14) used the Piedmont flyway, a considerable number (7) were captured in the Mississippi flyway. Two of these seven form the most interesting of all the recovery records. They were each banded May 15, 1938. One of these was captured Sept. 10, 1938 at Nashville, Tennessee by Amelia R. Laskey, and the following spring it was recaptured at Charlottesville on April 28,

and May 2, 1939. The other swift was recaptured May 2, 1939 at Charlottesville, and then on Sept. 13, 1939 it was caught at Nashville, Tennessee, also by Amelia R. Laskey. Here is found additional evidence that those Charlottesville banded swifts, which may use the Mississippi Flyway in the fall, customarily use the Piedmont Flyway in the spring.

As mentioned above the Piedmont Flyway south of New York is limited mainly to the region lying between the 500 and the 1,000 foot lines of elevation. There then must be some limiting factor which separates this group of migrating swifts from the hordes of swifts which migrate along the Atlantic Coastal Plain. The authors are unable to arrive at a satisfactory explanation for this phenomenon. The actual barrier is probably an ecological one, but its nature yet remains to be determined. At first it was thought that the earlier season of the coastal region allowed an earlier influx of swifts into that region in the spring, which, from the population aspect, might act as a barrier when migration of swifts began through the Piedmont region. However, the migration dates listed in the *Raven* (the official publication of the Virginia Society of Ornithology) give no supporting data for this hypothesis. In fact, the average of four spring arrival dates for the coastal plain was April 16, and for the Piedmont region of Virginia an average of seven spring arrival dates was April 14.

Green (1940) lays particular stress on the fact that at about the same time of the year he had recoveries of his swifts from a single banding date from widely separated points in the United States and Canada. Our records give little evidence of the occurrence of this phenomenon. Yet there are a few instances of it having happened. On May 12, 1940 one swift was recovered near Charlottesville, which had been banded on Oct. 1, 1938; and another from this same date of banding was recovered May 12, 1940 at Bridgewater, Mass. Two other swifts, banded May 2, 1939, were caught on May 8, 1940, one at Edinburg, Va. and the other at Hamburg, Pa. Another from this same date of banding was captured four days earlier, May 4, 1940, at Glasgow, Kentucky. There is nothing unusual in having two swifts from the same date of banding recovered on the same day at widely separated localities; for one of these may stop and begin nesting activities while another may continue north to another breeding area.

In contrast to the above recovery records, the return records show that there is some flock unity. Among the several groups of banded swifts associated together the most outstanding are: (1) six swifts captured as a group on April 21, and May 15, 1938, and on May 14, 1939; (2) twelve swifts captured as a group on May 15, 1938, and on May 2 and May 14, 1939; (3) four swifts captured as a group on May 15, 1938, on Sept. 11, 1938, and on May 14, 1939;

and (4) the most striking example, is of nine swifts which were captured as a group in Charlottesville on May 15, 1938, on Oct. 1, 1938, and on May 14, 1939. As shown on the accompanying map, our records, when coordinated with those of Green and Coffey, seem to indicate a merging of the birds that have utilized the Piedmont Flyway with those that have used the Mississippi Flyway for their southward migration. This merging of units probably takes place in Louisiana and eastern Texas.

A brief summary of the above data is presented here: The northward spring migration of swifts which passes through Charlottesville is mainly limited to the region lying between the 500 foot and the 1,000 foot lines of elevation. It is for this reason that this flyway is here called the Piedmont Flyway. In the lower Hudson valley the Piedmont Flyway divides. Part of the spring migrants continue northeastward between the coast and the mountains through Connecticut, Massachusetts, Vermont, New Hampshire, and Maine between the coast and the mountains. The remainder pass through the Hudson and Mohawk valleys where they spread northeastward along the St. Lawrence to its mouth and northwest along the Great Lakes to Blind River on the North Channel of Lake Huron. In the fall the majority of these swifts retrace the route of their spring migration. As they reach the southern tip of the Appalachians in Georgia and Alabama they swing west through Louisiana and Texas. However, many of the northern resident swifts, instead of again traversing the above mentioned valleys to enter the Piedmont Flyway, turn southwest where they use the eastern stretches of the Mississippi Flyway. The two groups of swifts again merge in Louisiana and probably in eastern Texas. Due to the paucity of spring swift banding operations west of the Appalachians it is not known whether any of the northern resident swifts, which used the Mississippi Flyway in the spring, utilize the Piedmont Flyway in the fall.

The 1,276 Chimney Swifts, which were captured in Charlottesville at a later season than the one during which they were banded, give abundant data to show that there is considerable permanence to the flyway used by the swifts which pass through Charlottesville. We have records of 73 birds that returned twice or more. This means that each of these was handled in at least three different seasons. In addition some of these swifts repeated again during the season of their return. Seven were captured during three spring seasons, fifty-one during one fall and two spring seasons, three during two fall and one spring season, nine during one fall and three spring seasons, and one during two fall and three spring seasons (five consecutive seasons).

During each season of banding there were returns from all the previous seasons of banding. However, due to the fact that different

numbers were banded or handled during each season, it would not be legitimate to make direct comparison of return records for one season with those of another. To make such comparisons the return records must be reduced to a common denominator, which for convenience is here designated the *Return Index.*[5]

ANALYSIS OF RETURN RECORDS[6]

TABLE 2. RETURN DATA

Season of Banding	*Number of Returns, with Return Index by Season of Recapture Shown in Parenthesis*				
	Spring of 1938	*Fall of 1938*	*Spring of 1939*	*Fall of 1939*	*Spring of 1940*
Spring of 1936.....	3(6.5)				
Fall of 1937.....	64(3.7)	31(1.1)	31(0.7)	14(1.2)	4(0.5)
Spring of 1938.....		101(1.1)	605(4.3)	35(0.9)	24(0.8)
Fall of 1938.....			101(0.6)	97(1.9)	12(0.3)
Spring of 1939.....				36(0.5)	52(0.9)
Fall of 1939.....					25(1.7)

TABLE 3. RETURN INDICES[7]

	Fall banded swifts		*Spring banded swifts*	
	Returned in Fall	*Returned in Spring*	*Returned in Fall*	*Returned in Spring*
	1.1	3.7	1.1	6.5
	1.2	0.7	0.9	4.3
	1.9	0.5	0.5	0.8
		0.6		0.9
		0.3		
		1.7		
Total	4.2	7.5	2.5	12.5
Average	1.4	1.25	0.83	31.3

It is shown in Table 3 that the average Return Index for the fall banded swifts is nearly the same in both subsequent spring and fall seasons. For this group the Return Index is slightly higher in the fall due to the fact that fall trapping was always conducted from mid-September to mid-October, while the period of spring banding operations varied considerably. In contrast to this it will be noted that the average Return Index for spring banded swifts is much less in the fall than in the spring. At first glance, it might be assumed that just the opposite would be true, since those spring

[5] This index is derived by dividing the number of returns per season per 1,000 birds banded, by the number of birds handled during the season of return in terms of the percentage (see Table 1) of the total number of birds handled for all seasons during which banding operations were conducted.

[6] A *return* is a bird captured or found dead at the same locality where it was banded, but at a different season. Some writers have used the term, *local recovery*, synonymously with return. In contrast to a return a *repeat* is a swift which is captured again during the same season and at the same locality that it had already been caught previously.

[7] For the specific season that each Return Index refers to see Table 2.

banded swifts recovered in a subsequent spring must have undergone the dangers of a long migration to unknown regions of Central or South America. However, a more careful consideration of the data shows that this small Return Index of spring banded birds in the fall is just what should be expected, due to the fact that many of the spring banded swifts were residents at the time of their banding, but by the time fall banding operations were started they had already begun their southern migration. It may also be pointed out that the fall Return Index of spring banded swifts is further reduced, due to the fact that some of the swifts, which nest in the northern part of their range, return south in the fall by the Mississippi Flyway. It may also be noted that the Return Index for spring banded swifts recovered in the spring is nearly three times as large as for fall banded swifts recovered in the spring. This discrepancy seems to be due to: (a) the large number of resident swifts banded in the spring, and (b) the fact that swifts nesting farther north (*i.e.* those which are more often banded in the more leisurely southward fall migration) do not linger long in the northward flight and thus would not have as great a chance of being trapped for banding in the spring as the resident swifts.

In brief the Return Index data indicate that (a) the majority of the Chimney Swifts migrating through Charlottesville, Virginia follow a definitely limited path (the Piedmont Flyway) in both their fall and spring migrations, (b) the spring migration is a hurried one with the main mass of migrants arriving at once, from which the resident swifts remain and the more northern nesters immediately move on, and (c) the fall migration is a more leisurely one in which by mid-September the majority of the resident swifts have already moved to more southern regions.

WINTER HOME

Considering the nearly total lack of information concerning the winter home of the Chimney Swift or even concerning the migratory habits in Central America and southward, it may be well to bring to attention some field observations of Wenzel (1928). During a stay at El Zapote coffee plantation at an elevation of 1,500 feet in the Escuintla Mountains on the west coast of Guatemala, Wenzel observed winter flocking of the Chimney Swift. On the plantation there was a thirty foot chimney on an abandoned sugar factory. In its vicinity he says that there annually appear from the north, toward the end of December or the beginning of January, migrating Chimney Swifts, which remain for a very long time. He gives an excellent account of their evening drill. At the beginning of January the flock is small, but it increases in number from day to day until the flock reaches an estimated 20,000. It was not determined how many weeks they remained in this locality.

SUMMARY

Data: During the six seasons from the fall of 1937 through the spring of 1940 in which intensive banding operations were conducted at Charlottesville, Virginia, 20,851 Chimney Swifts were banded. Of these 1,276 were later recaptured during another season at Charlottesville and 95 were recovered at points varying from 5 to 700 miles from Charlottesville. Captured at Charlottesville were 54 chimney swifts that had been banded in various places over the United States and Canada.

Migration routes: The Chimney Swifts which pass through Charlottesville follow a route which seems to be limited on the east side of the Appalachian Mountains to the Piedmont Region lying at an elevation between 500 and 1,000 feet. This flyway between Alabama and southern New York is designated the Piedmont Flyway. In New York the migration route bifurcates. Part of the swifts continue northeast between the Atlantic Ocean and the Appalachian Mountains, while the remainder pass through the valleys of the Hudson and Mohawk rivers into the drainage basin of the St. Lawrence River. Part of these latter migrants may use the Mississippi Flyway in the fall migration, but they nearly always use the Piedmont Flyway in the spring.

Stability of routes: Despite the fact that individual swifts show a tendency to use now the Mississippi and then the Piedmont Flyway, the great number of local returns (many returned several times) in both fall and spring clearly shows that as a population Chimney Swifts do adhere to definite migratory routes.

EXPLANATION TO PLATE 1

FIG. 1. Trap and cage in place on 60 chimney at the heating plant, University of Virginia.

FIG. 2. Cage being pulled to the top of the chimney with rope attached to the bottom to keep it from hitting the chimney.

FIG. 3. Same cage lowered to the roof and birds being removed for banding.

FIG. 4. Trap and cages in place on the University of Virginia Gymnasium, to show platform.

FIG. 5. Banding operations on the Baptist Church, Charlottesville, to show cover that induced the birds to stay in the top of the cage.

FIG. 6. Same cage, with cover lifted to show the effect of the cover.

Photographs by Dickinson

LITERATURE CITED

CALHOUN, JOHN B. 1938. Swift Banding at Nashville and Clarksville. *The Migrant*, 9: 77–81.

COFFEY, BEN B., JR. 1938. Swift Banding in the South. *The Migrant*, 9: 82–84.

GREEN, WYMAN R. 1940. Banding of Chimney Swifts (*Chaetura pelagica*) In the Region of Chattanooga, Tennessee. *Bird-Banding*, 11: 37–57.

PETERS, HAROLD S. 1937. Chimney Swift Banding in Alabama During the Fall of 1936. *Bird-Banding*, 8: 16–24.

POND, JOHN. 1940. A review of Green, 1940. *The Migrant*, 11: 38–44.

STODDARD, HERBERT L. 1926. Methods of Banding Chimney Swifts in the South. *Wilson Bulletin*, 38: 122–123.

WENZEL, WALTER. 1928. Uberwinternde Massen von *Chaetura pelagica* (L.) in Guatemala. *Ornith. Monatsber.*, 36: 76–77.

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