

SOME OBSERVATIONS OF THE NESTING AND MIGRATION OF THE
BANK SWALLOW (Riparia riparia riparia)

by

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A report of an original field study conducted
as a requirement for Advanced Ornithology
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ACKNOWLEDGEMENTS

Man's scientific knowledge has been gained through a process of evolution, step by step, in a manner similar to that of the development of the plant and the animal kingdoms. One scientist has learned something new because he has had the work of another to help him get started. With rare exceptions this always has and always will be true.

For this reason I am very grateful to the men whose publications I shall frequently cite: to Dr. Olin Sewall Pettingill, Jr. of Carleton College, Northfield, Minnesota and the University of Michigan Biological Station, primarily for his encouragement of my study of the Bank Swallows and also for many helpful suggestions; to Dr. Theodora Nelson, Hunter College, New York City, and the University of Michigan Biological Station, for her helpful suggestions; for meteorological information to Dr. Frank C. Gates of Kansas State College, and the University of Michigan Biological Station; for information pertaining to entomology to Dr. Herbert Baker Hungerford of the University of Kansas and his assistant at the Biological Station, Reece I. Sailer, who also forwarded an interesting theory to explain a flight observation of mine.

I am grateful to Oscar M. Root of Brooks School, North Andover, Massachusetts, for the banding work done in connection with this study, and also to my wife for her very able assistance in making observations and for work done in the construction of this report.

PART I

BANK SWALLOW NESTING STUDIES

THE NESTING SITE

This study of some of the habits of the Bank Swallow (*Riparia riparia riparia*) was made at the suggestion of Dr. Olin Sewall Pettingill, Jr. in charge of the ornithological work at the University of Michigan Biological Station, as part of the requirement for the completion of the course in advanced ornithology.

The Bank Swallows were found to be nesting in a recently cut bank about 80 feet south of Blanchard Laboratory. It was the first time the birds had been found to be nesting here since 1929, the last occurrence of excavations into this bank according to Dr. Nelson. The bank was concave, almost semi-circular, in shape, about 60 feet in height and all but the top four to six feet were steeply sloping loose sand and gravel. At the top was a sheer drop into which the swallows had dug burrows in which to nest.

The width of the area at the top of the bank into which the swallows burrowed was limited not only by the loose material of which the lower portion of the bank was composed, but also by stratifications of small rock particles and sand at the bottom of the sheer drop and overlaid by a stratification composed of sand heavily filled with stones. Above this was the area in which the burrows were constructed varying in width from 18 to 48 inches depending upon the contour of the surface of the ground above the bank.

THE BURROWS

All together there were 82 burrows and at the time my observations began 25 were occupied by families of young birds. They varied from one to five in number and averaged between three and four in a nest. All but one of the burrows were occupied by Bank Swallows, the other housing a family of Belted Kingfishers.

The size and shape of the burrows varied greatly. This was caused by the fact that the ground was very dry as compared with normal conditions. Daily, small rock-sand slides occurred causing a gradual and continuous backward movement of the face of the cliff. This, combined with the continuous use of the passages from the face of the cliff to the nests, caused some abnormal erosion of the sand from the burrow entrances.

Dimensions were taken from a group of 54 nests in the central left location of the bank. This group was the most accessible of the nests and was reached by walking in the loose sand and gravel at the base of the sheer drop, the observer being fastened by a rope to a tree or stake over the top of the bank to prevent his accompanying the frequent sand-rock slides.

Unoccupied burrow entrances were found to be ovular, the longer dimension on the horizontal. Those that were occupied varied from ovule, with the greater dimension being horizontal to that being vertical. In the second case the entrances were always much enlarged. As a result the horizontal-vertical dimensions varied from 2 x 1 inches to 3 x 7 inches. Only three of the 54 burrow entrances measured were circular in shape.

The depths of the burrows varied from two inches to 39 inches. In the latter, strangely enough, no nest was ever built or apparently ever begun. Some burrows were never completed due to the fact that rocks barred the way preventing further digging. Two burrows over 30 inches in depth and two others of more than 20 inches were apparently deserted before any attempts at nest building had begun. Unless the swallows were frightened into desertion by the receding bank, I can forward no possible reason for the desertion.

Those that were occupied ranged in depth from 12 to 36 inches. Originally they must all have been deeper, for the last burrow probably was constructed no later than June 1, and the bank has been gradually and steadily receding.

The passages into the inner parts of the burrows with few exceptions, arched uphill and then leveled off approximately two-thirds of the way in. They were always larger in the back where the nest was located. All but one of the burrows were built perpendicular to the face of the cliff. One exception veered off at an angle of about 45 degrees.

BANK SWALLOW NESTS

The nests found in the burrows studied were constructed from small twigs and the tendrils from grape vines growing up the sides of some of the buildings housing laboratories. Frequently needles of the Red Pine (*Pinus resinosa*) and grasses were found, and in every case where the nest bore a lining it was constructed of a number of white feathers. No other color feather was ever used. No nest was found with either eggs or

young in it that was not lined with feathers although Stoner (1936, page 191, 192) has found some nests where this occurred. It is an interesting fact that these feathers were not from the swallows themselves but from domestic fowls, located at least three miles away. The usual flying range of the Bank Swallows was rarely observed to be more than a quarter of a mile from the burrows.

In some cases nests were found in an apparently incomplete state of construction and in which eggs were never laid. They were in burrows deeper than many found occupied, yet they were deserted.

At the time I began my observations of the nesting Bank Swallows, July 3, there was only one occupied nest with eggs in it. In that nest the eggs never hatched. Two nests were found with eggs, one with four and the second with five, but continuous observation proved these to be deserted. (The size of these eggs varied from 17.5 x 13 mm. to 19 x 13 mm.) A third burrow was found caved in and was excavated. In it was discovered an adult bank swallow killed by the collapsing bank while incubating five eggs. According to Stoner (1936, page 224) Bank Swallows will desert nests if disturbed to any excess unless the young have hatched or are about to hatch.

The extent of development of the young birds in the burrows varied. In three burrows nests well lined with feathers were found indicating that the nest had been occupied but that the young had already left. In the nests occupied at the

beginning of the observations there were birds ranging from those completely feathered and ready to leave in a few days to some no more than two to three days old.

STUDY OF A PARTICULAR NEST

To simplify the studying of the group of 54 burrows stakes were placed in the ground just above the edge of the bank at either end of this large group and at more conspicuous breaks between the smaller groups. In this manner the one large group was broken up into five smaller groups. Each nest was numbered depending upon its position from left to right and from top to bottom. The groups were numbered 100 to 500 and the numbers in the largest group ranged from 101 to 117.

Nest 505 on the extreme right appeared to have the youngest birds and to be one of the easiest to enter, so this one was chosen for a study of the habits of a particular family. In it were three young determined by the date the nest was deserted to be about one or two days old (on July 5).

Nest 505 was located in a burrow 29 inches deep with an opening of $2\frac{1}{2}$ x 1 inches (horizontal-vertical) and about eight inches down from the top of the bank. To open the burrow large enough so that I could get a hand in to reach the young meant possible desertion of the nests by the adults. For this reason I used Beyer's method (1938, page 127) of going into the nest from the back and then completely closing up the hole when observations were not being made.

Observations of the feeding habits of this family were easily made from the base of the hill with the aid of a pair of binoculars.

WEIGHTS: My observations of these three young Bank Swallows began when I first observed them to be in the nest on July 5 and lasted until July 26. Beginning on July 11 when the three were about eight days old, I had my first opportunity to weigh them. A table of their weights for this period is located on the next page. The weights varied from 9.64 grams to 13.66 grams. On the two following days they gained on an average of 1.33 and 2.54 grams respectively. After the second day, probably their tenth day, the gain tapered off so that by the time the birds were about 14 days old they had reached their maximum weights of 19.46 to 19.89 grams. This is about five grams heavier than the average adult Bank Swallow according to Stoner, (1936, page 158).

From the time the birds reached a weight of over 19 grams until their last weighing seven days later, at an age of probably 22 days, they lost continually from .23 to .97 grams a day. On July 25 they weighed between 14.42 and 15.84 grams. It was noted that the lightest bird on July 11 was the heaviest on July 25 and the reverse was true of the heaviest on July 11, the more advanced bird. These figures agree with Stoner's (1936, page 158) including the slightly heavier weight of the young swallows over adults at the time they leave the nest.

FEATHER DEVELOPMENT: Feather development as well as their weights showed that the three birds were not of the same age, the heaviest bird on July 11 being covered with the heaviest layer of down. The feather tracts of the young Bank Swallows were definitely defined after seven days, and, although Beyer (1938, page 131) reports that the feathers were bursting their sheaths at the end of the seventh day, I found that the sheaths were not appearing in my young birds until they were at least 10 days old.

About a day after the shafts appeared through the skin and had come almost completely through, the feathers began to break from them. The breaking out process continued for four days and by the time the primaries and secondaries of the wings were fully developed the coverts were completely developed. By the next day the young appeared to have acquired their complete juvenal plumage.

In their juvenal plumage the young Bank Swallows bore out the rule that, if the parent birds look alike, the young will closely resemble them. To distinguish a male from a female adult bank swallow dissection is necessary; there are no external differences. The dark feathers of the head, back, rump, and coverts of the wing of the young bird differ primarily from the adults in being margined with a dusky tan. This margin is wider towards the posterior end of the bird. The flight feathers of the wings and tail are dark as in the adults but margined with white. The chin and throat are white, the breast has the typical dark band and the belly and under

tail coverts are white. The wings are lighter below than above. The lores are black, forehead slightly dusky tan, iris of the eye dark brown, and the mandibles black with yellow tomia.

DESERTION: Four days after the birds were completely feathered, one of the three was flying from the burrow but was there when the burrow was entered to weigh the young on that morning and the next (July 24 and July 25.) Sometime on July 25, probably in the evening when a large number of people including many strangers were on the hill, the top of burrow 505 was crushed in. Fortunately when I discovered it early the next morning and excavated the burrow I found that it had been vacated sometime the day before.

The three young in 505 were not the last to leave their homes. Two families in the 300 group remained until July 29. Of the 27 families of Bank Swallows observed nesting or whose homes were found after the young had left, 25 families were observed to leave between July 3 and July 29. The other two probably did not leave sooner than July 1. If this assumption is correct, it is probable that the birds began to lay eggs about the beginning of the last full week in May and that they began to hatch at the end of the first week in June. According to Stoner (1936, page 195) the incubation period of Bank Swallows is from 14 to 16 days and the time spent in the nest (1936, page 196) ranges from 18 to 22 days.

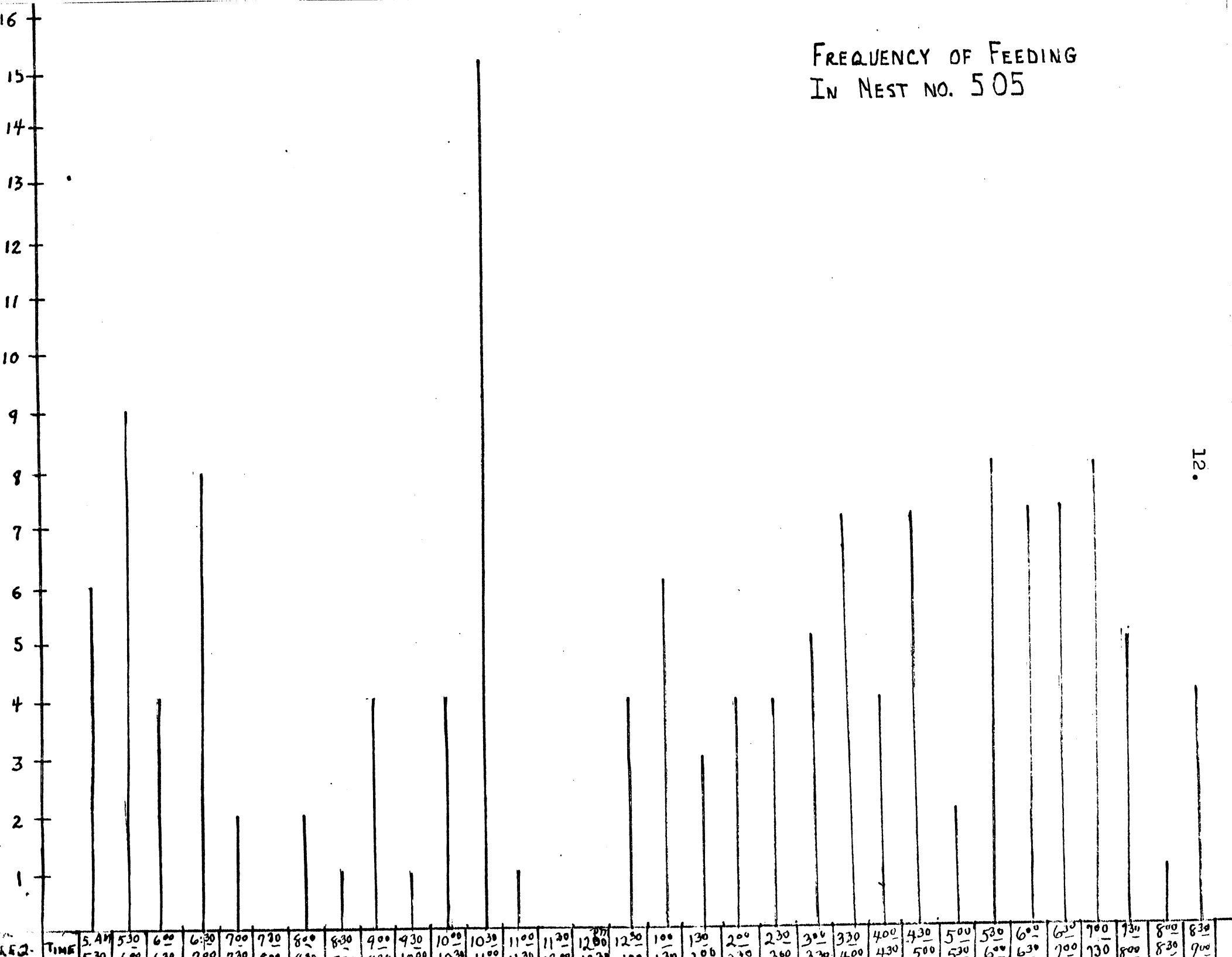
FEEDING HABITS: A record was made of the feeding of the young from the time the adult birds appeared in the morning

until the time that all was quiet in the Bank Swallow colony in the evening. All of the records were made from the burrow 505 and were taken after the young were at least two weeks old. With the exception of about four hours during the afternoon and evening only one record was made for each half-hour period. A bar graph for the number of times the adult birds fed the young has been constructed using half-hour periods as a unit of time. This may be found on the following page. (Both adults take part in the feeding of the young according to Beyer (1938, page 129).

It was found that after the adults entered the nest three times between 5:20 and 5:22 A. M. to remove a fecal sac each time, feeding began. In the next eight minutes the young were fed six times, probably one each time and in regular order so that each one was fed twice. The young were fed relatively frequently up until seven o'clock. After that there was a lull in the activity until noon with the exception of one spurt between 10:30 and 10:52 when each bird was fed a total of five times.

This observation was one of the most interesting made during the Bank Swallow studies. On this particular occasion the young were lined up at the opening of the burrow and were fed consecutively and consistently from left to right five times. One break in the activity was caused by the flying of a Kingbird overhead whereupon one of the adults gave a warning call and the three young swallows scurried backwards into the nest. A minute later feeding was resumed in the usual manner, the adult perching on a projection at the mouth

FREQUENCY OF FEEDING IN NEST NO. 505



of the burrow a few inches away from the young. Sometimes the one to be fed, with coaxing, came forward to take the food, but usually the parent went to the young with it. (I have observed on other occasions that the adult bird paused for a few seconds at the entrance of the burrow as though it were trying to coax the young to come forward from the interior to take food. On occasions this actually occurred and frequently after a few seconds it would enter the burrow, remain there from two to six seconds and then leave.)

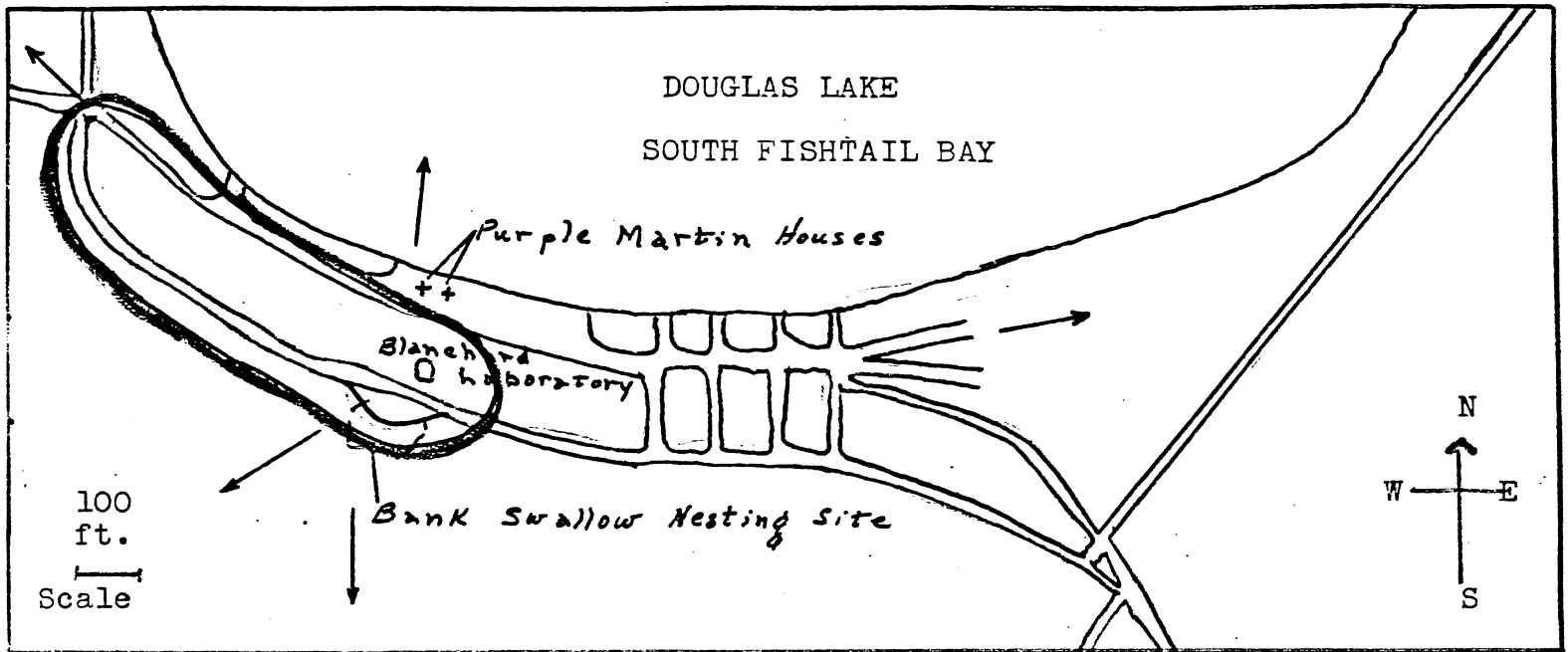
My observations showed that feeding slackened towards noon. No records were made from 12:00 noon to 12:30, but from then on it continued moderately averaging a total of four to five times each hour until it reached a peak between 5:30 and 7:30 of seven to eight times in a half an hour. Feeding slackened after 7:30 but continued right up until the time that activity ceased entirely, about 8:30 P. M. on July 17 and 8:02 on July 23. No young were ever observed to be fed outside of the burrow.

FLYING RANGES

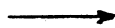
The study of the territory over which this nesting group of Bank Swallows ranged for food was an interesting one. A description of the areas in the vicinity of the bank first of all will help you to picture them. A map of the area appears on the next page.

The bank in which the swallows were nesting was located on the side of a hill parallel to and rising for more than 100 feet above the south shore of South Fishtail Bay on Lake Douglas. The hill continued to the east and west of the

PLAN OF THE BIOLOGICAL STATION, UNIVERSITY OF MICHIGAN



Usual Range of Swallow Flight



Directions of Flight an Occasional Individual or Pair of Swallows

nesting site leveling off a quarter of a mile to the east and continuing for about that distance to the west. To the north the lake was 300 feet away and just over the edge of the bank to the south was a level area, wooded except for a ball diamond to the near south-west, extending for one-eighth of a mile before sloping downward in the direction of Burt Lake.

Directly below the bank on the shore of South Fishtail Bay were two occupied Purple Martin houses which appeared to establish a northern boundary for the Bank Swallows. An occasional individual flew out over the lake, and although I never observed the Martins disturbing the Bank Swallows, few swallows ventured more than 250 feet north of the nesting area.

Usually they flew in groups of a half dozen and more, yet those that ventured to the east more than 100 feet seldom exceeded a pair or sometimes an individual. These appeared to fly off for distances greater than a quarter of a mile. The same was true of flight to the south; never more than an occasional pair or an individual ventured in that direction and then at least to the opposite slope.

The great majority of the flying was either in the close vicinity of the nest just north of the embankment or else to the west for a distance of seldom more than 775 feet, again with a few exceptions as mentioned above. More frequently they would return after flying 300 to 350 feet westward.

These ranges immediately aroused a number of questions which I believe can be quite satisfactorily answered.

Since insects that make up the food of these birds are primarily borne up by rising currents of air the swallows

would naturally be found along the north embankment of the hill where winds coming off Lake Douglas would be thrown upward. That there must be a large quantity of insect life borne up by the rising air currents over the top of the hill was indicated by the numbers of Nighthawks feeding there, yet the Bank Swallows ignored that feeding ground. A logical explanation of this fact was suggested by Reece I. Sailer in that the swallows preferred to fly in rising currents of air. It certainly would be much easier for them which should make this an important point to consider. If this theory be correct, the lack of rising currents to the south and to the east would limit those directions of flight for the swallows.

Varying weather conditions did not noticeably affect the altitude or numbers of swallows flying. During two hard but brief rain storms observations were made but they were considered too brief to allow any decisive conclusions. Any difference that might have occurred was not easily recognized.

BANDING

As the opportunities presented themselves I banded a total of 19 Bank Swallows. All were juveniles but one. In some cases birds that were about to fly but under normal circumstances would not have left the nest were frightened out by my daily inspections. These birds were frequently captured in various parts of the camp after having flown a few hundred feet and then plopped down unable to continue further. They were banded and returned to a burrow, their own when possible to determine it. No birds were ever found dead in the burrows but one was found dead on one of the camp roads.

Two banded juvenile birds were found hopping around camp after they had been returned to the bank, so an attempt was made to raise these in captivity. They thrived well for two days on a combination of hard boiled egg yolk and rice crispies, well moistened with water. One of the young had to be force-fed but the other ate the food from the tip of the finger and tried to eat the finger too. On the second night the weather became too cool for them in their improvised nest and they died of exposure.

Another young bird captured on July 19 was returned to a nest which I was quite sure was his own, number 214. This nest was found empty two days later with three inches of entrance caved in. On the last morning that I weighed the young in 505, July 25, I found four young birds there instead of three and it was the fourth. It was observed to fly from 505 late the morning before. His weight was 12.14 grams on July 25, low for a juvenile, so he probably had a difficult time getting food until he made his home in 505. He left the burrow with the others that same day.

Two interesting and similar observations were made on some unbanded juvenile birds. While checking the nests one afternoon a young bird left a burrow and flew off toward the west. When about 200 feet away a Kingbird darted from a near-by tree, caught the bird in its claws and dived to the ground with it leaving it immediately. When I found it three minutes later it was hopping around on the ground apparently unharmed. It was too young to be able to fly further.

Two weeks later a young bird was found that had been severely pecked on the head destroying one lobe of the brain and causing it loss of its sense of balance. It seems very possible that this bird suffered a fate similar to the one some days earlier.

HOMING EXPERIMENT

Dr. Pettingill was very much interested in an experiment to test the "homing instincts" of these Bank Swallows. To do this required first of all capturing the birds, then marking them, and finally taking them some distance before setting them free.

To trap the birds a trammel net five feet wide and twenty feet long was used. This net was made up of a series of three meshes side by side. The middle portion was made of a strong, light weight black thread with a mesh about three-fourths of an inch square. On either side of this was a net made of heavy black cord in squares three inches across.

On July 12 the trammel net was placed in front of the nests of the 100 and 200 series. In a period of five minutes four adults and one juvenile were caught. Many others were flying back and forth in front of the net obviously wanting to get through to the burrows but too wary to try to fly through it.

One adult escaped when untangling those caught in the net. The remaining four were marked in a manner similar to the Tree Sparrows marked by Marguerite Baumgartner (1938, page 124.) It was varied slightly by gluing a conspicuous white feather

to the tip of the swallow's tail rather than to the upper tail coverts. Fastened in that way I could pick out the bird from below when it was flying in the air.

An hour after trapping the four birds they were taken in pairs in two closed boxes four miles by road toward the east. Here the juvenile and one adult were freed. The adult left my hand with a desperate jerk leaving the white feather and two tail feathers behind. It started off directly in a westerly direction. The vanes to which the white feather was attached in the juvenile were pretty well broken. The lack of returns from this pair are probably explained for these reasons.

The second pair of swallows, both adults, after flying around for a minute or two from a spot ¹¹eleven miles from the nesting site by road headed toward the west. The time was 2:45 P.M. Back at the nesting site at 5 P.M. when I first looked to see if the birds had returned one of this pair was observed flying with the flock. It flew around in a normal fashion occasionally being pursued by one or two other swallows. I watched until 6:15 P. M. but did not see the second. However, at 6:35 when I returned both swallows of this second group were flying around in search of food.

A week later I again put up the trammel net. The sum total catch after twenty minutes was four juvenile birds. All were caught trying to leave the burrows. This fact parallels Stoner's experiences that once a Bank Swallow is trapped it becomes a very difficult task to trap it again within a short period of time. Many adults flew about in front

of the nest this second time, but would not try to go through the net.

Of the four young captured one was banded and returned to his burrow. He was too weak to fly very far. This bird was the one found in 505 six days later. The other three were marked with feathers, two having feathers that were relatively short and broad, the other one which was long and slender. These birds were taken west in covered boxes, and two of them were released about five miles away by road. The third swallow was released about one mile away from camp "as the crow flies." The return of these birds was watched for upon immediate arrival at the Biological Station at 3:00 P. M. Nothing was seen of any of them that day or the next. At 1:12 P. M. almost two days later, while an observer taking notes on feeding saw one of these birds fly over the hill from the south. The binoculars were not available so it could not be determined from which of the two distances the juvenile swallow returned. From a number of descriptions it was suspected to be the nearer of the two. From the time of its return until 1:45 P. M. the young bird was pursued mercilessly. It found rest only by flying into a burrow. When it flew out and away it soon returned pursued by at least eight to ten other Bank Swallows. It was last seen flying away at 1:45 P. M. Nothing was seen of the other birds.

Due to the advancement of the season and the late date at which the observations and experiments were begun there was little opportunity for further study in this field. Before any

conclusions from such an experiment can be drawn a number of experiments with more varied conditions will have to be made.

MISCELLANEOUS COMMENTS

An inspection of the burrows late one evening showed that only juvenile birds were occupying them so that apparently the adults pick out some spot to roost as do Robins and some other birds. Observations made in the early morning showed that the adults were noticed first of all when they were already flying around. They could not have left the burrows without having been seen. Observations made a few days later of swallows collecting before migration led me to believe that they pick out some trees in a wooded area near at hand.

I never observed adult Bank Swallows perching in the vicinity of the burrows except to feed the young. Young birds, though, were regular customers of a pair of electrical wires that ran directly up over the hill at the nesting location and also of plant roots projecting from the bank.

An unusual observation was made in regard to burrows 105 and 107. Originally there was one bird in the first and three in the second, yet one afternoon I found that the sand partition had crumbled away between them and there were two birds in each burrow. While I watched for a few seconds one bird moved from 105 back into 107.

It was obvious during the feeding of the young that Bank Swallows are colonial in their feeding habits as well as in their nesting habits. It was a general rule that the adults

would feed their young at one time, all leave, and then return as a group, some arriving a little ahead and behind the peak of activity with an occasional individual coming in between times. But feeding seemed to be carried on in regular cycles.

The only enemy of the Bank Swallows which I observed, excluding the Kingbird incident, was the collapsing bank. Of all the Bank Swallows nesting in the area I have records of only three that met death by being buried. One was the incubating adult already mentioned.

It is impossible to tell whether the swallows will return and nest there next year. The bank is falling away to a much greater extent in some areas than in others. If any sheer drops remain next year I would not be surprised to see the swallows again.

PART II

BANK SWALLOW MIGRATION

THE FLOCKING AREA

On July 29 the last two of the Bank Swallow burrows were vacated, and on the morning of July 30 the swallows were all gone. Not one of probably 150 adult and juvenile swallows remained. These birds did not leave all at once but rather, a few at a time. On Monday, July 28, ten birds were observed flying around excluding the young in the burrows.

On July 23 a collecting place for swallows about to migrate, with about 500 swallows already there, was accidentally discovered. It was located $3\frac{3}{4}$ miles by road to the south and east of the University of Michigan Biological Station on the east shore of Burt Lake. The birds were collecting out on a southward projection into Burt Lake called Greenman's Point. It was learned that swallows had been collecting at this place just previous to their fall migration for many years.

The area where these birds gathered was quite open for 500 feet to the north, 2,000 feet to the east, 1000 feet to the south and to the west 120 feet was the shore of Burt Lake. In all directions but west were wooded lands of varying densities. Two large trees, an Elm and an Oak, stood out alone about 100 feet either side of the wires on which the birds were first observed to be perching. The wires ran slightly north-west by south-east, parallel to the lake shore, and from 20 to 25 feet above the ground.

SPECIES OF SWALLOWS PRESENT

Although the numbers of birds there varied, the proportions

of species were nearly always the same. Bank Swallows heavily predominated, making up at least 70% of the total number of birds. The majority of the rest were Rough-winged and Tree Swallows equally proportioned, and there were ~~always~~ a few juvenile and adult Purple Martins present.

I watched very carefully expecting to find some other species of swallows with the group. On the very last day the birds occupied the area a juvenile Cliff Swallow was found among them. On another occasion a pair of Barn Swallows were found there. They were frequently seen in the neighborhood so it was doubtful that they would continue south with them. Although Purple Martins were always present, they seemed to remain as a group separate from the others.

NUMBERS OF SWALLOWS

When I first discovered the gathering of these birds I learned that they had already been there for two or three days, since July 20 or July 21. They increased in number to a maximum of about 1100 on July 26 and gradually tapered off until the last that were seen on August 9 numbered about 125. The birds used this area for approximately three weeks.

The numbers of swallows varied from day to day. The observations were taken at a time of the day when the birds usually stayed fairly close to the flocking area. This was from 10:00 A. M. to about 5 P. M. Although I have no definite proof, I am led to believe that there was a regular turnover in the birds I found there.

DAY BY DAY WEIGHTS OF THE BANK SWALLOWS NEST 505

(Showing individual gains and losses)

| DATE | 41-45166 | | 41-45167 | | 41-45168 | | |
|------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|----------------------------|
| JULY | WEIGHT IN GRAMS | GAIN OR LOSS | WEIGHT IN GRAMS | GAIN OR LOSS | WEIGHT IN GRAMS | GAIN OR LOSS | AVERAGE GAIN OR LOSS |
| 11 | 9.64 | | 12.10 | | 13.66 | | |
| 12 | 11.06 | 1.42 | 13.60 | 1.50 | 14.74 | 1.08 | 1.33 |
| 13 | 13.74 | 2.68 | 15.99 | 2.39 | 16.89 | 2.15 | 2.406 |
| 14 | * | | * | | * | | * |
| 15 | 16.78 | 3.04 | 18.40 | 2.41 | 19.05 | 2.16 | 2.54 |
| 16 | 18.17 | 1.39 | 19.09 | .69 | 19.15 | .10 | .726 |
| 17 | 19.46 | 1.29 | 19.89 | .80 | 19.75 | .65 | .91 |
| 18 | 19.22 | -.24 | 19.52 | .37 | 18.92 | -.83 | -.23 |
| 19 | 18.70 | -.52 | 18.17 | -1.35 | 17.88 | -1.04 | -.973 |
| 20 | 18.82 | /.12 | 18.00 | -.17 | 18.17 | /.29 | /.08 |
| 21 | * | | * | | * | | * |
| 22 | 17.30 | -1.52 | 16.74 | -1.26 | 16.25 | -1.92 | -1.567 |
| 23 | 17.00 | -.30 | 16.23 | -.51 | 15.77 | -.48 | -.43 |
| 24 | 16.48 | -.52 | 15.65 | .58 | 15.20 | .57 | -.557 |
| 25 | 15.84 | -.64 | 15.34 | -.31 | 14.42 | -.78 | -.557 |

25 Banded Swallow No. 41-45169 12.14

DAILY ROUTINE

By accident I discovered that the swallows did not spend 24 hours a day at this flocking area, Purple Martins excepted. As I have just indicated, by 10:00 A. M. in the morning all the birds that would be there for the day were perched on the telephone wires or flying within a radius of an eighth of a mile. On the wires, almost without exception, they always faced west. Occasionally a large part of the flock would leave the wires with a great deal of chattering and flapping of small wings. They would feed for a minute or return and settle on the wires again. This would last until five or six o'clock in the afternoon when the great majority would fly out over the fields to the east and occasionally over the lake to the west to search more diligently for food. Every once in a while some would return to the wires to perch for a short time.

On July 24 the swallows were watched from about 7:30 P. M. until dark. Over 1,000 swallows were there at 7:30 P. M. but by 7:40 some had already begun to fly off towards the east, the neighborhood of the most heavily wooded area which borders Fontinalis Run, half a mile away. In the two large trees beside the road some began to look for perching places. The Elm towards the lake seemed to be pretty well controlled by the Purple Martins, so few sought out perches there and many that did left later. It was observed that those settling in the trees near at hand would perch a while accompanied by a great deal of chattering especially on the part of the Purple

Martins. After a few minutes all would leave the tree in a burst and begin the settling procedure all over again. This continued from the time the birds began searching for perches until 8:09 when it happened for the last time. By 8:22 the last Purple Martin had quieted down and the last of the swallows was seen when three flew chirping overhead to the southeast. Toward the east before the swallows settled down in the neighborhood of Fontinalis Run I could see them flying around high in the air apparently after food.

The appearance of the birds in the morning was probably the reverse of the procedure of the night before. When they were first observed at 7:30 A. M. the majority of the swallows, excluding the Purple Martins, were found flying low, usually lower than three feet, over the fields to the east of the wires, again in search of food. By 8:30 and 9:00 A. M. the appetites of most of them had been satisfied and they could be found in the usual place.

MISCELLANEOUS OBSERVATIONS

When perching the birds seemed to have territories of their own and they would squabble violently at an intruding neighbor. This area usually extended two inches either side of the birds, but sometimes I saw them perched with an inch and less between them. Although a large number of the Bank, Rough-winged and Tree Swallows were juveniles, I never observed them being fed by adult birds. I did observe, however, during the first couple days of observations that some juvenile Purple Martins were being fed by adult birds.

Had I thought it to be possible one of my observations would have lead me to believe that many of the swallows had been exercising the right of their name at a nearby tavern. On more than one hot day when I came upon the birds I found them sitting tilted over on their sides at a precarious angle with beaks open and wings and tail outstretched. It is the closest thing to inebriation in animal life that I have ever seen. Dr. Pettingill suggested that the birds were probably sunning themselves. Judging from the fact that this occurred on the much warmer days I would guess that it was either that or an attempt to keep cool. In regard to this latter theory, though, I did not observe a ruffling of the feathers.

Another interesting observation was made one afternoon when at least 200 Bank, Tree and Rough-winged Swallows accompanied by the two Barn Swallows previously mentioned (adults, I believe) were observed down in the dirt road leading out onto Greenman's Point. This road is parallel to the wires running out onto the point and just beneath them. The birds appeared to be feeding but investigation could not find a single trace of animal life, not even the birds foot prints. The swallows must have been picking up tiny stones and particles of sand.

According to Stevens (1932, page 39) some very similar observations were made on July 23, 1931, of some southward migrating Bank Swallows at Pelican Rapids, Minnesota and on another occasion in North Dakota. In the former case it resulted in the death of about 1000 of the swallows by automobile traffic passing along the road.

DESERTION OF GREENMAN'S POINT

The numbers of the swallows flocking at Greenman's Point began to decrease after July 26. On July 31 a report was brought in of a flock of over 1000 swallows perching on telephone and electrical wires over Nigger Creek, a distance of about $3\frac{1}{2}$ miles ~~due~~ east of Greenman's Point. Two days later those swallows were gone. On August 8 a similar report from near the town of Afton, Michigan, approximately 12 miles, on a line southeast of Greenman's Point, was made. It might be guessed, although there is no way of substantiating it, that this was the flock from Greenman's Point, slowly beginning its move southward.

SUMMARY

From the study of the nesting and migration of the Bank Swallow at the University of Michigan Biological Station on Douglas Lake, Cheboygan County, many interesting observations and conclusions were made.

1. The Bank Swallow nested in a perpendicular bank of well-packed earth.
2. Bank Swallows were colonial in their nest habits.
3. Bank Swallow burrows originally were ovular in shape and the depths of the burrows varied in depth from $2\frac{1}{2}$ to 39 inches, the occupied burrow averaging about 22 inches.
4. The construction of many burrows was never completed due to obstacles, (rocks) in the way of the digging swallow.
5. Bank Swallows apparently began incubating when the first egg was laid. By July 5, 1941, all of the eggs were hatched.
6. The feather shafts first appeared through the skin after about 10 days. In seven days more a young Bank Swallow completely changed from its natal down to its juvenal plumage.
7. Young Bank Swallows left the nest after approximately 21 days.
8. Bank Swallows are colonial in their feeding habits as well as nesting habits.
9. Adult Bank Swallows removed the fecal sacs from the nests in the morning before feeding.
10. There are two peaks of frequency of feeding the young, one before 7:30 in the morning, the other between 5:30 and 7:30 in the evening.
11. The young Bank Swallows were observed being fed in regular order.
12. Feeding Bank Swallows seldom flew further than a quarter of a mile from the nesting site.

13. When feeding they probably preferred areas where the food was most abundant and where the rising currents of air made it easier for them to fly.
14. Young Bank Swallows were in danger of attack if territorial rights of other birds were infringed upon.
15. Nesting adults and juvenile Bank Swallows will return to the nesting area if taken 11 and one mile respectively from it blindfolded.
16. Adult Bank Swallows, after their young are completely feathered, do not spend the nights in the burrows, they probably roost in trees.
17. When the young are capable of flight or nearly so they may not remain in their own burrow but may "move in" with another family.
18. Three swallows met death by the frequent collapse of small portions of the bank.
19. Bank Swallows from many nesting areas flock together at a common point in preparation for migratory movements.
20. The prerequisites for such area are probably an abundance of food and a good perching place.
21. Tree, Rough-winged and Bank Swallows and Purple Martins are commonly found in such a group. One Cliff Swallow and two Barn Swallows were also observed in the group.
22. The numbers of swallows in this area varied from day to day either more or less.
23. The particular flocking area observed was used for approximately 21 days.
24. The flocking area was used only from the later part of the morning until early evening.

25. The evenings were spent in a roost a half a mile away.
26. Feeding took place most intensively in the early morning and early evening.
27. By the time the juvenile Bank Swallows took their place in the flocking group they were completely able to feed themselves. This is not always true of Purple Martins.
28. Bank Swallows had their individual territories on perches during the day and in the roosts at night.
29. The Bank, Rough-winged and Tree Swallows had a peculiar habit of spreading their wings and tail, opening their beaks and sitting at precarious angles under the influence, in all probability, of intense sunlight, possibly also the intense heat.
30. Bank, Barn, Rough-winged and Tree Swallows pick up tiny stones and particles of sand just preceding fall migration.

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APPENDIX

DATA ON BANK SWALLOW NESTS

| NEST NUMBER | DEPTH | HORIZONTAL DIAMETER OF ENTRANCE | VERTICAL DIAMETER OF ENTRANCE | OCCUPIED |
|-------------|-----------------|---------------------------------|-------------------------------|--------------|
| 101 | 22 | 4 | 2 $\frac{1}{2}$ | Occupied |
| 102 | 24 | 2 $\frac{1}{2}$ | 1 | Occupied |
| 103 | 22 | 3 | 1 $\frac{1}{2}$ | Occupied |
| 104 | 15 | 2 $\frac{1}{2}$ | 1 $\frac{1}{4}$ | |
| 105 | 12 | 3 | 2 | Occupied |
| 106 | 19 | 3 | 2 | Occupied |
| 107 | 18 | 3 | 2 | Occupied |
| 108 | 20 | 2 | 1 | |
| 109 | 18 | 3 $\frac{1}{2}$ | 3 $\frac{1}{2}$ | Occupied (?) |
| 110 | 9 | 4 $\frac{1}{2}$ | 3 | Eggs (4) |
| 111 | 25 | 3 $\frac{1}{2}$ | 3 $\frac{1}{2}$ | |
| 112 | 9 | 2 | 1 | |
| 113 | 2 | 2 | 1 $\frac{1}{2}$ | |
| 114 | 24 | 3 | 7 | |
| 115 | 15 | 1 $\frac{1}{2}$ | 1 | |
| 116 | 6 | 2 $\frac{1}{2}$ | 1 | |
| 117 | 5 | 2 $\frac{1}{2}$ | 1 | |
| 201 | 16 | 4 | 3 | |
| 202 | 6 | 2 $\frac{1}{2}$ | 1 $\frac{1}{2}$ | |
| 203 | 12 | 3 | 1 $\frac{1}{2}$ | |
| 204 | 20 | 4 | 3 | Occupied |
| 205 | 14 | 4 | 2 $\frac{1}{2}$ | Eggs (5) |
| 206 | 2 $\frac{1}{2}$ | 2 | 1 $\frac{1}{2}$ | |
| 207 | 26 | 3 | 2 | |
| 208 | 10 | 2 $\frac{1}{2}$ | 1 | |
| 209 | 23 | 3 | 1 $\frac{1}{2}$ | |
| 210 | 18 | 2 $\frac{1}{2}$ | 2 | Occupied |

DATA ON BANK SWALLOW NESTS

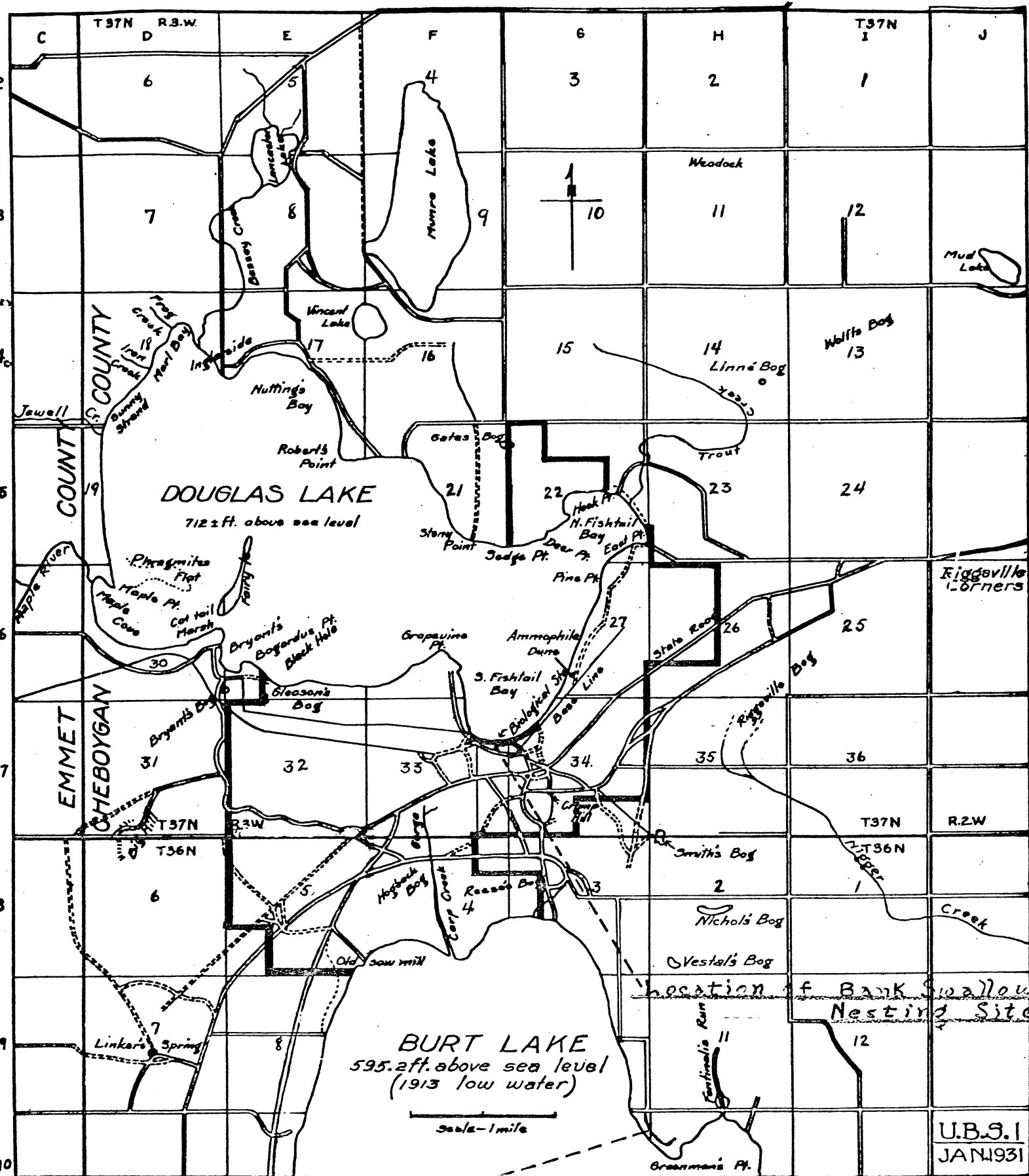
| NEST NUMBER | DEPTH | HORIZONTAL DIAMETER OF ENTRANCE | VERTICAL DIAMETER OF ENTRANCE | OCCUPIED |
|-------------|-------|---------------------------------|-------------------------------|-------------------------|
| 212 | 3 | 2 | 1½ | |
| 213 | 4 | 5 | 4 | Occupied when collapsed |
| 214 | 32 | 3½ | 2 | Occupied |
| 215 | 10 | 3 | 1½ | |
| 301 | 4 | 4 | 2 | |
| 302 | 22 | 3 | 2 | Occupied |
| 303 | 29 | 3 | 1½ | |
| 304 | 17 | 4 | 2½ | Occupied |
| 305 | 7 | 3 | 1¼ | |
| 306 | 36 | 3 | 1½ | Occupied |
| 307 | 8 | 2 | 1½ | |
| 308 | 20 | 3 | 1¼ | |
| 401 | 5 | 3 | 1 | |
| 402 | 30 | 4 | 3 | Occupied |
| 403 | 13 | 6 | 3 | Occupied |
| 404 | 15 | 5 | 3 | Occupied |
| 405 | 33 | 2½ | 2 | Occupied |
| 406 | 22 | 3 | 3 | |
| 407 | 10 | 2½ | 1¼ | |
| 408 | 33 | 3 | 1 | |
| 409 | 13 | 2 | 1½ | |
| 501 | 17 | 2½ | 1½ | Occupied |
| 502 | 39 | 2½ | 1 | |
| 503 | 6 | 2½ | 1 | |
| 504 | 11 | 3 | 1½ | |
| 505 | 29 | 2½ | 1 | Occupied |

DATA ON OCCUPIED BANK SWALLOW NESTS

| <u>NEST NUMBER</u> | <u>NUMBER OF YOUNG</u> | <u>DATE OF DEPARTURE</u> |
|--------------------|------------------------|--------------------------|
| 101 | 4 | July 16 |
| 102 | 5 | July 17 |
| 103 | 2 | July 20 |
| 105 | 3 | July 12 |
| 106 | 2 | July 13 |
| 107 | 4 | July 16 |
| 204 | 1 | July 21 |
| 210 | 3 | July 21 |
| 214 | 3 | July 21 |
| 302 | 4 | July 29 |
| 304 | 3 | July 17 |
| 306 | 4 | July 29 |
| 402 | 5 | July 20 |
| 403 | 4 | July 17 |
| 404 | 5 | July 16 |
| 405 | 3 | July 24 |
| 501 | 5 | July 13 |
| 505 | 3 | July 25 |

BANDING OF BANK SWALLOWS

| <u>NUMBER</u> | <u>DATE</u> | <u>NEST</u> | <u>REMARKS</u> |
|---------------|-------------|-------------|--|
| 41-45147 | July 9 | | |
| 41-45148 | July 10 | 102 | |
| 41-45149 | July 10 | 501 | |
| 41-45150 | July 10 | 403 | Found 7-14 put back 403 |
| 41-45151 | July 10 | 403 | |
| 41-45152 | July 10 | 403 | |
| 41-45153 | July 10 | 403 | Found 7-14. Fed on egg yolk and rice crispies Died 7-16. |
| 41-45154 | July 12 | | |
| 41-45155 | July 13 | | Found 7-14, put in 403 |
| 41-45156 | July 13 | | Found Blanchard Lab. returned to nest 214 |
| 41-45158 | July 15 | | Found dead on West State Street July 16. |
| 41-45159 | July 14 | | Found 7-14, fed, died of cold, 7-16. |
| 41-45166 | July 16 | 505 | |
| 41-45167 | July 16 | 505 | |
| 41-45168 | July 16 | 505 | |
| 41-45169 | July 19 | | Found in 505, weighed when banded 7-19. Found 7-25 in 505. |
| 41-45161 | July 19 | | Used in homing experiment. Banded after being caught in trammel net |
| 41-45170 | July 19 | | |
| 41-45171 | July 19 | | |



DOUGLAS LAKE, MICH. AND VICINITY
 COMPILED BY F. C. GATES

← location of Swallow Flocking Point

U.S.G.I
 JAN 1931