

sidered as absolute, but only as indicative of the general prevalence of the species and the larger taxonomic groups. At the very least, the results of using this method are certainly more accurate than relative abundance determinations based on general observations alone.

U. S. Fish and Wildlife Service
Patuxent Research Refuge
Bowie, Maryland

A STUDY OF THE VIOLET-GREEN SWALLOW

BY J. M. EDSON

FOR many years I have been observing the habits of the Violet-green Swallow, *Tachycineta thalassina lepida*, in the vicinity of Bellingham Bay, western Washington. During that time a considerable volume of notes has been accumulated, from which I have endeavored to epitomize the significant facts.

Of the five species of swallows common to this region, the Violet-green is first to arrive in spring, although the Tree Swallow, *Iridoprocne bicolor*, is scarcely later. The earliest appearance is ordinarily in the latter part of March. The three other species arrive considerably later. The Violet-green likewise is first to leave when nesting is over, taking its departure in late July or early August. My records of first arrivals during 35 years range in date from February 25 to April 7; March 21 is about the average. February 25, 1906, the earliest spring date, was quite exceptional; the next earliest was March 12. The latest arrival date recorded was April 7, 1917. Of course it is quite possible that previous arrivals escaped observation. That no doubt did happen in numerous instances. The first appearance in March seems often to be followed by an interval before others of the species are seen. Following the second wave they become common. The earlier birds sometimes appear in considerable flocks, quickly passing on, likely destined for some habitat farther north.

Upon arrival, the local birds promptly visit their last year's nesting quarters and perch on wires at accustomed places. By the middle of April, on the average, the birds commence to evince an interest in nesting. However, activities are not usually started in earnest till about the second week in May. The eggs are laid usually late in May or early in June. In ten nestings the earliest hatching date was June 6, the latest July 11 (a second effort). The average date is June 20. The average date of leaving the nest is July 13. The incubating period is approximately fifteen days, and the brooding period twenty-

three or twenty-four days, sometimes even longer. These periods seem to be somewhat variable, the process being sometimes retarded slightly.

For nesting quarters they readily accept a bird house or a box attached to a building. An aperture in a cornice or a wall is satisfactory, or even a hole in a tree. A crevice in a stone wall or rocky cliff is sometimes used. An apparently open nest on a ledge beneath a cornice was once observed. In building the nest, small twigs and grass stems or rootlets are used and the cavity chosen is well filled. It is finished with a copious dressing of hen's feathers. Sometimes it is a sort of double nest, with a second compartment in another corner. This is sometimes occupied by the parent when nights are warm. The time taken for nest construction is variable, being sometimes a few days and again many. Occasionally eggs are laid before the nest is completed, and the feathers are added while laying is in progress. An egg a day is laid in most cases till the clutch of five is complete. In one instance there were six eggs; in another, four. One nest contained but two, and at another time there were only three. In these latter instances broken shells were found below the nests as evidence that they had been pillaged by some marauder, likely a wren. It is not unusual for incubation to be commenced before the clutch is complete. Seldom are all the young hatched on the same day. In one case hatching required five days.

The only enemies that have interfered with the nesting are the English Sparrow, *Passer domesticus*, and the Western House Wren, *Troglodytes aëdon parkmani*. Cats have sometimes watched the birds and made futile attempts to reach the nests. The sparrows, while often very annoying, have not done material harm when the entrance to the nest has been properly proportioned. The wrens are more difficult to circumvent. Jealousy is their outstanding characteristic, and they are likely to destroy eggs in any nest in proximity to their own, not excepting those of their own species. In latter years I have kept nesting boxes duly separated, and the swallow nestings have been successful. Once a wren's egg, ironically, was added to the swallow's clutch.

The particular nesting box which has been a source of information of recent years is suspended with a northwest exposure from a peg beneath the eaves of a sleeping porch. The lid is removable. In size it is $4\frac{1}{4}$ by $4\frac{1}{2}$ by 6 inches. The somewhat elliptical entrance is $1\frac{1}{4}$ inches in width by $1\frac{1}{8}$ high, and is located near the top of the front side. Often the birds hole up in the box for the night before eggs are laid. Occasionally one bird spends the night on top of the

box while the other is inside. Following completion of the nest, commonly little is seen of the birds during the laying and incubating periods unless there happen to be meddlesome sparrows or wrens about. However, as soon as the eggs are hatched the birds begin their activities, and there is much going and coming. During the daytime the birds are off the nest much of the time in the incubating period. With a maximum temperature of 72° F. they remain off nearly all day. When a morning temperature was 58° F. a bird was found in the box but off the eggs. The case often was the same at 10 P. M. In one instance no swallow came to the nest in all the afternoon till 8:33 P. M. The infant birds sometimes broke from their shells in the absence of the parent, although usually the parent was present at such times. On cloudy and cool days the birds were more likely to be at home. When hatched, the young require very little brooding, and none at all after the feather growth is well started. Once about mid-day, when sparrows were haunting the neighborhood, a swallow sat tight on the nest and refused to budge even when I tried to remove it, taking no chances on sparrow behavior. Ordinarily, I could take a swallow off the nest with scarcely any resistance.

One day in 1929 there was strife for choice of nesting boxes among sparrows, wrens and swallows. The eggs of the swallows had been destroyed. Thereupon the sparrows were condemned and duly executed—possibly a perversion of justice. Then the swallows transferred their endeavors to the box in which the sparrows had left a nearly completed nest of coarse construction. They merely added a lining of feathers, and then three eggs were promptly laid. A brood of three was successfully reared. In 1934 a clutch of four eggs was destroyed (likely by wrens), yet the swallows maintained possession of the nest and four days later a second clutch was commenced with ultimately five eggs, followed by successful incubation. Once while the swallows were building and a week before the first egg was laid the sparrows attempted a conquest. A swallow defender would maintain possession by sitting patiently on the empty nest for long periods. The swallows rarely showed pugnacity or any violent propensities, yet have been seen to pursue a bothersome sparrow hotly.

The swallows show little fear of me, perhaps regarding me as somewhat of a protector. On one occasion, following the desecration of one of their nests, I decided to take a hand in the battle against the attacking sparrows. The combatants were milling about the nest as I arrived with the .22-rifle. A swallow came and perched on a wire near me. Then a cock sparrow settled on the same wire scarcely more

than a foot from the swallow. As the weapon went into action the sparrow dropped to earth, quite dead. The swallow surprisingly did not dart away in fright but sat placidly surveying the fallen enemy.

At hatching, the delicate skin of the tiny swallows is of a pale pinkish color. There are slight wisps of creamy down on the back, crown, and scapulars. The gape is margined with a whitish, lip-like roll, and the dark eyeballs are visible through the skin. In the succeeding days the skin color soon deepens and the down becomes darker and more prominent. By the fifth day the developing feather follicles of ashy color show plainly through the skin of the upper parts, giving them a much darker appearance, while the down is diminishing. At seven days old the upper parts appear uniformly ashy gray. At eight or nine, a small horizontal slit at the center of the eyeball precedes opening of the eyes, which are completely open about two days later. The remiges are now about to break through their epidermal sheaths. At ten days they project an eighth of an inch and white feathers along the side of the body appear. Blackish speckling shows amongst the expanding gray feathers of the back. At thirteen days old the nestlings have primaries an inch long and half out of the sheath, with rectrices half as long. The sides are well covered with silky white feathers. By the thirteenth day the plumage is taking on a mature appearance, black replacing the ashy gray. The primaries lap half down the tail. By the eighteenth day the young have almost the appearance of adults, except for prominence of the abdomen, which has heretofore been very conspicuous but now is declining. With the twenty-second day the abdomen is well reduced and some signs of violet and green coloring appear above, while down has become very scanty. The wings and tail have about reached their full development. Henceforth, a careful look is needed to distinguish the young from the old birds.

Soon after the young have broken from their shells their little wide-open mouths are upstretched, and the parents are promptly responsive to the appeal. For two weeks they keep up diligent pursuit of gnats and flies from sunrise to sunset. The morning awakening comes at 4 A. M. or a bit earlier. Often there is an audible stir in the nest box some minutes before the birds emerge. When timed in the feeding period it was found that the parents arrive at the nest every two minutes or oftener during the morning hours. There is a slackening of activity at times, particularly in the afternoon. Frequently a little troupe of visiting swallows from nearby localities circles about to inspect the situation. Their interest always seems

friendly and with the acquiescence of the home birds. After the lapse of about sixteen days the nestlings, well clothed and with bulging bellies, commence a reducing process. The original ravenous appetites have been appeased and food supplies much reduced. When the box is opened there appears a galaxy of suspicious little eyes intently fixed upon the intruder where before were the gaping mouths. They resent attempts to handle them, and shortly will be alert to escape from the box when disturbed. For hours at a time the old birds remain absent, while the young like to sit before the opening and gaze out upon the world they are soon to explore. The nest is kept wholly clean while the nestlings are small, but after their eyes are open the surroundings become progressively foul. Sometimes a remote corner of the box is used as a latrine.

A few times in different years, botflies have victimized the nestlings and they were relieved of a number of large maggots. No fatalities resulted but it was detrimental to health and growth. Sometimes the old birds, or perhaps the young ones, will occupy the second nest compartment heretofore mentioned, especially if the first has become markedly unclean. At the age of ten days the youngsters are too lively to be weighed without being enclosed in a paper sack. At twenty-one days they are alert to fly if allowed an opportunity, and they are capable of very good performance. When ten days old the little ones are able to give voice to a faint, wheezy peeping; the notes perhaps may be represented approximately by the syllables, *chip-py*. The voices of the adults are heard but little, for they are a very quiet species.

When the young are fully matured the coming-out event is an important occasion, and takes place when the young are twenty-three or twenty-four days old or rarely even a day or two later. Often visiting swallows are in attendance. It may happen at any hour of the day except a late one. The youngsters make their take-off one at a time, at irregular intervals. Sometimes not all of them venture out the first day, some waiting till the next. Commonly there is no returning to the nest once it is vacated, but again some have returned for a night or two. When all are finally out they depart at once for new fields, perhaps for a time to patrol some nearby valley or lake. By the end of July they have practically disappeared from this vicinity. I have a few August records but none later than the 12th. In the latter half of July they may be seen flocking with Barn Swallows and others on wires and roofs. However, the Barn Swallows remain with us much later.

With a view to ascertaining the daily growth of the young swallows, a series of measurements of their length was attempted in 1932, but after the thirteenth day the effort was abandoned on account of growing resistance on the part of the subjects. The first day's measurements of the four in millimeters were 40, 41, 42, 45. The thirteenth day gave 93, 93, 95, 98. The tenth day showed an excessive growth for all, it being 9, 9, 10, 11 millimeters for the one day. The average during the period was 4 millimeters per day, although it was unequally distributed as between individuals. Adults average about 127 millimeters in length.

A better and more illuminating method of ascertaining the daily development was by recording the weights of the nestlings each day as nearly as practicable at a definite hour. This plan brings out some interesting facts concerning the recession in weight which these swallows undergo when their development is about two-thirds advanced (see Edson, Condor, 32: 137-141, 1930).

AVERAGE DAILY WEIGHT IN GRAMS OF NESTLINGS

<i>Days Old</i>	1929	1930	1932	1937
1		1 $\frac{2}{3}$		
2	2 $\frac{3}{4}$	2 $\frac{2}{3}$	2	2 $\frac{4}{5}$
3	4	4 $\frac{1}{3}$	3 $\frac{2}{5}$	4 $\frac{2}{5}$
4		6 $\frac{2}{3}$	5 $\frac{2}{5}$	5 $\frac{2}{5}$
5	7	8	7	8
6		10 $\frac{2}{3}$	9	8 $\frac{1}{5}$
7	10 $\frac{2}{3}$	12 $\frac{1}{3}$	11 $\frac{1}{5}$	11
8	13 $\frac{1}{3}$	13	14 $\frac{2}{5}$	
9		15 $\frac{1}{3}$	14 $\frac{4}{5}$	12 $\frac{4}{5}$
10	16 $\frac{1}{3}$	16 $\frac{2}{3}$	14 $\frac{1}{2}$	14
11	16 $\frac{1}{3}$	19 $\frac{1}{3}$	16 $\frac{1}{2}$	14 $\frac{4}{5}$
12	18 $\frac{1}{3}$	20	17 $\frac{1}{4}$	14 $\frac{2}{5}$
13	19 $\frac{2}{3}$	20	18 $\frac{3}{4}$	13 $\frac{4}{5}$
14	19 $\frac{2}{3}$	21	20	15 $\frac{4}{5}$
15		21	20	17 $\frac{1}{5}$
16		21 $\frac{2}{3}$	17 $\frac{3}{4}$	18
17	20 $\frac{2}{3}$	20 $\frac{2}{3}$	17	18 $\frac{3}{5}$
18	20 $\frac{1}{3}$	20 $\frac{1}{3}$	17	18 $\frac{4}{5}$
19	20	19 $\frac{1}{3}$	18 $\frac{1}{2}$	19
20	19 $\frac{2}{3}$	18 $\frac{1}{3}$	18	18 $\frac{2}{5}$
21	19 $\frac{1}{3}$	18 $\frac{1}{2}$	17 $\frac{3}{4}$	17 $\frac{3}{5}$
22		17 $\frac{2}{3}$	16 $\frac{3}{4}$	17 $\frac{2}{5}$
23	17	17	16 $\frac{1}{4}$	17
24	17 $\frac{1}{3}$	17 $\frac{2}{3}$		16 $\frac{1}{5}$
25	16 $\frac{2}{3}$			
26	15 $\frac{3}{4}$			

It will be observed that in different years weights at a particular age corresponded only approximately. In fact, there is a noticeable variation in the progress of development in different years. In 1930, with a brood of three, the maximum weight was reached on the sixteenth day, and was $21 \frac{3}{5}$ grams. In 1932, with five young birds, the maximum came on the fifteenth day, with 20 grams. With five young in 1937, the high point was not reached till the nineteenth day, and was only 19 grams. The average weight of adult swallows I have found to be not quite 16 grams, which also is close to the maximum. Hence, in those cases where the young have left the nest at a weight greater than 16 grams it is logical to conclude that the reducing process was incomplete at that time. There is also much variation in the development of individuals of the same brood. This in part is accounted for by irregularity of hatching, though not wholly. In one case the last bird hatched was four days younger than the oldest, and too far behind to keep up with its mates—it lived only five days, an instance of submergence of the weakest. Again, with only one day's difference in age a nestling exhibited unusual precocity. Its wings and tail were much the longest of the brood, with generally more advanced development and diminished weight. In the evening of the twentieth day, on being disturbed, it suddenly flew from the nest, and its flight was about as steady and efficient as that of an adult. It continued in the air till lost to sight. The evening of the twenty-second day this bird was found again in the nest with the others after an interval of 48 hours. On the twenty-third evening it took off for another absence, and the following evening it was back once more. Early on the twenty-fifth morning the entire brood departed.

There are a number of factors that seem likely to have contributed to the disparity of the recorded weights: varying abundance of food in successive years, the number of nestlings to be fed, stormy weather preventing the flying of insects, persistent annoyance at times by English Sparrows, difficulty of exactly checking the time of hatching of each bird and maintaining identification, and occasional irregularities of intervals between weighings.

Weights usually were taken near the close of day. One on the eleventh day at 4:10 A. M., to test the nightly loss of weight, showed a reduction of 0.9 gram, which, however, was more than recovered before nightfall. Everything considered, there is nothing to obscure the interesting facts that these young swallows, when nest life is about two-thirds complete, attain a weight far above that of adults of their species, and that this is followed by a period of progressive reduction.

The year 1936 brought a story of unprecedented disaster to the early flight of Violet-green Swallows. March 22 was a sunny spring day and numbers of these swallows were to be seen skimming over the lowlands. But a northeast wind came that night, and morning found the air filled with snowflakes which soon whitened the ground. It grew still colder and on the 24th there were three inches of snow. The freezing mountain breeze continued for several days, and by the 29th the mercury had reached 23 degrees above zero. On the 30th, as the weather moderated, reports were received of the finding of dead swallows at various points. A friend brought me the bodies of five that he had found in one locality. The birds had sought shelter under the eaves of a building near the foot of Lake Whatcom. There they had remained till starvation impelled them to feeble attempts at flying, which were of brief duration, ending with a fall to the snowy shroud that awaited them. The normal weight of sixteen grams had dwindled to eleven as the end came. I heard reports of many others being found where they had perished at various concentration points. That storm extended throughout a long stretch of the Pacific Coast region and the destruction of these swallows must have had proportions of a major disaster. When another week had passed, our local Violet-greens arrived for the summer, apparently scarcely reduced in numbers.

Bellingham, Washington

THE 1940 NESTING POPULATION AT PLEASANT VALLEY SANCTUARY, LENOX, MASSACHUSETTS

BY GEORGE J. WALLACE

So many comments, both verbal and in print, have been made regarding the shortage of birds following the almost unprecedentedly severe winter of 1939-40, that 1940 nesting records in comparison with those of previous years should lend needed statistical support to more casual observations. Birds of passage are difficult to estimate accurately, especially when migratory flights are coincident, as they were in the spring of 1940, with extremely unfavorable conditions for observations in the field; but records of summer residents kept at one station over a period of years should be a more dependable measure of the changed or changing status of certain forms. Figures for the 1940 nesting season at Pleasant Valley Bird and Wild Flower Sanctuary in Lenox, Massachusetts, compared to those of 1938 and 1939, rather vividly disclose the reduced status of many species—changes