

LIFE HISTORY OF THE BLUE AND WHITE SWALLOW

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THE attractive little Blue and White Swallow, *Pygochelidon cyano-leuca*, is well described by its name. Its upper plumage is dark, violaceous steel-blue; the under parts are pure white except for the blue-black under tail-coverts, the grayish-brown sides and flanks, and a few dusky spots in the center of the chest, which are lacking on some individuals. The tail is short and slightly forked. The bill is black, the eyes brown, and the feet dark. The sexes are alike in appearance.

The species is distributed over almost the whole of South America, but in Central America its range extends only as far north as Costa Rica. It exhibits so little geographical variation that individuals from Costa Rica and from northern Argentina are placed in the same subspecies. Yet the Blue and White Swallows adapt themselves in amazing fashion to extremes of temperature and rainfall. In western South America I found them on the rainless guano islands off the coast of Perú, where in the evening they flew about catching insects above the guanayes which in their thousands had settled in compact masses to pass the night on the bare ground. They were the common swallows of the Ecuadorian Andes, present in the high, cold *hoyas* nearly 10,000 feet above sea-level, and over the excessively rainy eastern foothills. Voyaging over the upper Amazon and its great tributaries, I occasionally watched them skimming over the turbid water in company with White-winged Swallows (*Iridoprocne albi-venter*), White-banded Swallows (*Atticora fasciata*), and wintering Barn Swallows (*Hirundo rustica*); but they were far less numerous here than in the mountains.

In Costa Rica, at the northwestern extreme of its vast range, Carriker (Ann. Carnegie Mus., 6 (4): 789, 1910) considered this to be the "most abundant resident swallow;" but my own experience has been that it is less abundant and widespread than the Rough-winged Swallow, *Stelgidopteryx ruficollis*, which in the lowlands at least is the more common species. In this country, the Blue and White Swallow is found chiefly in the sections where the human population is fairly dense and where there are plenty of buildings in which the birds can nest and open fields above which they can forage. It is abundant in the central plateau and the surrounding mountains. At Vara Blanca, on the northern slopes of the Cordillera Central, I found it nesting freely in clearings in the heavy forest of this extremely wet and stormy

region, between 5000 and 6000 feet above sea-level. In the southwestern section of the country it is well established in the T erraba Valley, especially about the villages, such as San Isidro (2200 feet) and Buenos Aires (1400 feet); in the wilder parts of the valley it is less often seen. It appears to be absent from the coastal lowlands and from the Province of Guanacaste.

In its manner of life the Blue and White Swallow differs little from other members of the family. It subsists largely, if not wholly, upon insects which it catches in the air as it weaves back and forth over the open fields, the house-tops, and bodies of water. When tired it rests in company with swallows of its own and other species upon exposed perches—leafless branches of trees in the wilder country, telegraph and electric wires by preference when these are available. Its song is a thin, weak, long-continued trill which slides upward at the end. In Costa Rica it is delivered more or less frequently at all seasons, but chiefly from March until June, when the swallow nests. Apparently over its immense range the Blue and White Swallow varies as little in voice as in plumage. Hudson (*Birds of La Plata*, 1920: 40), who knew it in the La Plata country, describes its song as "a single weak trilling note, much prolonged, which the bird repeats with great frequency when on the wing. Its voice has ever a mournful, monotonous sound, and even when it is greatly excited and alarmed, as at the approach of a fox or hawk, its notes are neither loud nor shrill." This description would apply equally well to the utterances of the Blue and Whits Swallows of Costa Rica. When alarmed they voice full, plaintive monosyllables and when angry, as when disturbed at their nest, low harsh notes.

NEST-BUILDING

The Blue and White Swallow builds its nest in a closed space of some sort. As to the nature and position of the cavity it is, if possible, even more tolerant than the Neotropic House Wren, *Troglodytes musculus*, with which it associates over much of its vast range, the two species often nesting in the same building. At Vara Blanca, within a distance of half a mile, I found these swallows nesting in positions so diverse as—a cavity formed by decay in a dead trunk standing in a pasture; tunnels in roadside banks, made by other birds or left by the disintegration of a stout root; and upon the ridgeplate of a cottage, beneath the sheet-iron roof. The two nests in burrows were, respectively, 10 and 23 inches back from the mouth. In other parts of the country nests are built beneath the unglazed roof-tiles of farmhouses. Thatched roofs also provide acceptable nest-sites (Carriker, *loc. cit.*).

One pair fed nestlings in a cranny above the lintel of the doorway of a lawyer's office, opening directly upon the narrow sidewalk of a busy street in the heart of the city of San José, Costa Rica. Several pairs appeared to be feeding nestlings in crannies in the masonry abutments of the highway bridge over the Río Verde, in the Pastaza Valley of eastern Ecuador. Hudson (*op. cit.*), who called this species the "Bank-Martin," found it nesting in holes in the banks of streams, in the sides of artificial ditches, and even in the walls of wells. But on the open pampas of Argentina its favorite nest-site was a hole which the Miner or Little Housekeeper, *Geositta cunicularia*, had bored into the wall of one of the great burrows dug by the viscacha, *Lagostomus*, and which the swallow claimed after it had been abandoned by the bird that made it. Hudson states that "Bank-Martins," or Blue and White Swallows, never dig into the earth themselves, which agrees with my experience in Costa Rica. In wild mountainous regions, our swallow nests in inaccessible crannies in cliffs (Todd and Carriker, *Ann. Carnegie Mus.*, 14: 436, 1922).

At Vara Blanca, 5500 feet above sea-level, the Blue and White Swallows began to build in March; a completed nest was found on March 28, 1938, and another was started about March 31. In the basin of El General, 2500 feet above sea-level, a pair began on February 15, 1944, to carry straws beneath the roof-tiles where they had long been sleeping, but during the next fortnight they worked in an exceedingly desultory fashion, and did not build with zeal until about the first of March.

Four nests of which I watched the construction were built by male and female working together. The swallows prefer to gather their straws and grass-blades from bare ground, such as a roadway, path, or cultivated area, where they are scarce, rather than from neighboring grassy fields where such material is more abundant. This is probably because the birds find it easier to alight on and take off from the bare earth than from the uneven and yielding grass. Some of the pieces which they select are very long and trail far behind them as they fly. Once they have taken a piece of material in the bill, they set a fairly direct course to the nest, not circling around with their burden as I have seen Cobán Swallows, *Notiochelidon pileata*, do. But in the intervals between their journeys to the nest, they gyrate tirelessly around in their usual fashion. One pair built chiefly during the early morning, and for a short period in the late afternoon just before they retired early to sleep in their nest-space. During the middle of the day they were often out of sight of the nest, but sometimes brought material more or less assiduously.

One pair of Blue and White Swallows built its nest in about a week; but the pair which was first seen carrying material on February 15 did not finish its work until about March 13, and one member was even seen bringing a feather on March 16. It was only toward the end of this long interval, however, that they worked with a degree of diligence. The completed nest is a loosely made, shallow bowl composed of straws, grassblades, and similar material and warmly lined with downy feathers, often those of domestic fowl.

THE EGGS

Male and female swallows continue to sleep on or beside the nest during the period of construction and during the interval between the completion of their work and the beginning of egg-laying. Indeed, they will as a rule continue this custom until their nestlings are feathered, if not longer. The earliest eggs of which I have records were laid in El General on March 19, 1944, and at Vara Blanca on April 2, 1938. Usually, an egg is deposited daily until the set is completed, but at one nest two days elapsed between the appearance of the first and second eggs. From Costa Rica I have records of two sets of two eggs, four sets of three eggs, and one set of four eggs. Both sets of only two eggs were laid by the same pair of swallows, and those in the first and apparently also the second of these small sets were infertile. Beyond the tropics in Argentina, where the Blue and White Swallow is migratory, it lays sets of five or six eggs (Hudson, *op. cit.*). The glossy, pointed eggs are pure white, without markings. The measurements of six eggs from Costa Rica averaged 16.6 by 12.2 millimeters. Those showing the four extremes measured 16.7 by 12.7, 16.3 by 11.9 and 16.7 by 11.5 millimeters.

INCUBATION

The eggs are incubated by both sexes. At various times during the period of incubation, I watched for a total of nine hours a nest situated on the ridgeplate of a cottage. Twenty-five periods of incubation, sometimes by the male and sometimes by the female, ranged from 3 to 50 minutes in length and averaged 18.6 minutes. The eggs were neglected for 11 periods ranging from 1 to 14 minutes and averaging 6.9 minutes. They were covered for 85.9 per cent of the 9 hours. During the early morning and in rainy weather they were constantly incubated by both members of the pair sitting alternately; but later in the day, when the sun heated the iron roof close above the nest, they were left for brief periods while both swallows flew around together catching insects. When ready to return to the

eggs, a swallow would often fly up in front of the entrance to the niche as though about to go in, only to veer aside at the last moment and continue to circle in the air a few times more, catching additional insects before it resumed brooding. Usually the new arrival would enter the niche, then almost immediately a swallow would dart out. More rarely the two stayed in the nest together for a few minutes before one flew away. I could not watch the birds change places on the nest in its dark cranny, but once I clearly saw the swallow which had been sitting brush past the other on its way out, leaving the new arrival to take charge of the eggs. In the evening both members of the pair retired early to the niche, where one slept upon the eggs, the other on the rim of the nest in close contact with its mate.

One morning while I watched these swallows, the green lizard which dwelt in the wall of the cottage climbed up to the end of the ridgeplate and started in toward the nest. But after a few seconds it scuttled out and hurried down the wall, evidently driven away by the swallow in charge of the nest. Then the swallow moved forward to a point near the end of the beam where I could watch it. It stretched up its neck and opened wide its mouth, probably at the same time emitting some hissing or rasping sound too slight for me to hear. It repeated these motions a number of times and then withdrew into the dark cranny.

At another nest which I studied five years later, the swallows incubated more constantly. During 4 hours of watching I timed 4 completed sessions by both sexes, which lasted, respectively, 34, 59, 48, and 81 minutes. The nest was left unattended only twice, for periods of 1 and 14 minutes. Possibly this pair took longer sessions because these birds usually foraged out of sight, and the sitting partner was not distracted by its mate's calling as it foraged near the nest. Since this nest was beneath a roof of tiles rather than one of corrugated iron plates, it did not become so strongly heated by the mid-day sun and the swallows could incubate in greater comfort.

At two nests the period of incubation was 15 days. At one nest, infertile eggs were incubated for at least 26 days before they were found on the ground below the nest.

THE NESTLINGS

Newly-hatched Blue and White Swallows are pink-skinned, with sparse, light gray down and tightly closed eyes. The interior of the mouth is a pale flesh-color. When the nestlings are four days old the rudiments of the feathers are visible as dark points beneath the skin; when nine or ten days old they begin to acquire a covering of feathers.

They are fed by both parents, and remain in the nest until they are well feathered and can fly well. Those of one brood took wing when 26 and 27 days of age. In their juvenal plumage the Blue and White Swallows are dark gray instead of deep blue above, and their under parts are clouded with gray instead of being pure white like those of the adults. Their remiges and rectrices are black.

THE SECOND BROOD

At Vara Blanca, a pair of Blue and White Swallows whose last nestling of the first brood took wing on May 30 began to renovate the old nest on June 10. They covered it with fresh straws and grass-blades, gave it a new lining of feathers, and laid a second set of three eggs on June 17, 18 and 19.

At Baños, Ecuador, less than two degrees south of the equator, Blue and White Swallows were feeding nestlings in October. Whether these were early or late broods I do not know.

SLEEPING HABITS

In Costa Rica, the Blue and White Swallow is non-migratory and remains paired at all seasons, possibly mating for life. After the members of a pair have selected a suitable cranny, it becomes their permanent home where they sleep, take shelter from the rain, and bring up their families. By day they may forage in company with other swallows beyond sight; but the approach of night, or a hard shower, brings them back to their domicile. Trespassers of their own kind are not tolerated in the home precincts; their presence gives rise to excited pursuits, sometimes ending in a struggle in which the contestants clinch and fall to the ground, to rise in a few moments apparently none the worse for their encounter.

Family I.—During the year I dwelt at Vara Blanca in the Costa Rican highlands, I had as neighbors a pair of Blue and White Swallows that slept and nested under the roof. The original pair, appearing toward the end of January, was to be found day after day circling on tireless wings about the cottage standing in the midst of pastures on the back of a narrow ridge. Often the birds fluttered up beneath the eaves, apparently seeking a nest-site so early in the year. Sometimes a third swallow arrived or rarely a fourth and then there was animated aerial pursuit, accompanied by sharp, loud calls. At times pursuer and pursued struck momentarily in the air. After a while, the visitors would withdraw, leaving the two who claimed the house to gyrate in peace around their chosen shelter.

By early March, the pair had still not begun to build; nor had I discovered where they slept. On the evening of March 6, they continued to fly around the house on the hilltop until after sunset, and I thought that at last they would roost under the roof. While I stood waiting to see them enter beneath the eaves, a little White-throated Falcon, *Falco albigularis*, swooped down, seized one of the swallows in its talons, and carried it off to devour it high up in a dead tree in the pasture. The survivor of the pair flew off over the deep wooded gorge of the Río Sarapiquí and vanished through the dusk. Next morning, a swallow made a brief visit to the scene of the tragedy. Three days passed before I again had a pair of Blue and White Swallows flying about the house. I think that the survivor of the earlier pair had returned with a new mate.

Late in the afternoon of March 12, one of the pair, which had been winging together about the house, entered the narrow space above the ridgeplate and beneath the corrugated iron sheets at the northern end of the roof. Here it chirped loudly, while its mate continued to circle about outside. After an interval, the second swallow fluttered up to the cranny in a tentative fashion several times over, then at last entered. The two rested side by side upon the two-inch-wide top of the beam, twittering softly. The white breast of one shone out from the dusky nook. While they lingered here, a third swallow, that had been flying about the vicinity, darted up to the entrance as though to join them. But it immediately dropped away again and continued its untiring flight. Several times, as the day waned, the pair sallied forth for an excursion over the mountain-side, then returned to the nook; several times the third swallow fluttered up under the peak of the eaves as though to join the two who rested there, yet did not. As the light grew dim, rain began to fall, and the third swallow vanished, leaving the two together on the ridgeplate. I felt sure that they would at last sleep beneath my roof, but suddenly, in the deepening dusk, one darted forth and vanished through the gloom, leaving its mate alone in the niche.

The following morning was darkly overcast, and the lone swallow lingered on the ridgebeam, its white throat gleaming in the narrow cranny, while other birds flew and sang and foraged. Half an hour after daybreak, two swallows flew up from the east and joined the one in the niche. All three promptly flew out and circled around; then two returned to the nook, but stayed less than a minute.

This play continued for about a week. One of the pair slept on the ridgeplate, its mate apparently used a distant shelter and the situation was complicated by the intrusion of a third individual. In the late

afternoon, the pair would enter the nook and rest close together, the male sometimes singing his fine, sharp trill with a rising inflection at the end. After a while, one would fly out and the mate would call with loud, full-toned, chirps; then either the second would follow the first into the open, or the latter would rejoin the other in the niche—a reunion followed by contented chirpings. Finally, dusk falling, one would fly away out of sight, leaving its mate alone on the ridgeplate. Here it remained until the next morning, when its mate flew back across the ravine and entered beside it. Sometimes the third swallow would follow. Soon the two would fly out together to feed. Before the end of the month, the one that slept beneath the roof abandoned this dormitory. Yet both continued to rest on the ridgeplate in the late afternoon, sometimes at the northern end, sometimes at the southern.

Thus it happened that this pair had not settled upon the niche above the ridgebeam as a dormitory when they began to build there on the last day of March, at the more sheltered southern end. Male and female shared the task of nest-construction, picking up bits of straw from the bare ground of the flower-beds. Much of this material fell from the sides of the two-inch beam; and the swallows probably would not have completed their nest had I not given them a broader support by closing off with cardboard the spaces between the ridgeplate and the underside of the roof. Soon they had straws scattered along the length of the long beam. In the afternoon, the pair rested side by side on the beam, often creeping along until they were above the center of the house, far inward from their nest. They appeared to be indifferent when I climbed up into the dark attic to look at them from below with an electric torch. Often the male would sing, his minutely trilled song penetrating the thin ceiling above me as I wrote up my notes on rainy afternoons. Before the nest was completed, the pair began to sleep on the middle of the ridgeplate, behind it.

After a week's work, the shallow cup of straws and dry herbaceous stems was finished. Now the swallows slept upon the nest, or close beside it. Another week passed before the female laid the first of her four white eggs. Evidently it was she who covered them by night, while her mate slumbered upon the rim of the nest, his white breast resting upon her dark blue shoulder. Both sexes incubated, sitting very constantly in cool and cloudy weather, but when the sun shone and the iron plates above them became hot they stayed on the eggs for brief periods only. I tried to make them more comfortable by draping a thick coffee sack over the ridge of the roof. After 15 days of incubation, the eggs hatched. When two weeks old, one of the little birds

fell from the nest and, before I found it, died on the floor below; the other three were successfully reared. While the nestlings were young, their parents slept in the same manner as during incubation, one brooding in the nest and the other resting upon the rim. When the young swallows were two weeks old and well clothed with feathers, their sharp cries resounded through the whole cottage each time they were given food, and they were no longer brooded. One of the parents now roosted on the ridgeplate behind the nest, the other in some undiscovered situation.

When 20 days old the nestling swallows began to wander along the beam and at night rested on the bare wood behind the nest rather than in it. Now the second parent deserted them in the evening, flying away with loud cries through the dusk. During the day, both parents brought abundant food to the nest, but they began feeding very late, an hour after most birds had begun their day's activities.

The young swallows flew into the open when 26 and 27 days of age. During their last week in the nest they slept alone. After their departure from the nest, the parents led them to rest on the ridgeplate, but at the northern end rather than by the nest at the opposite extremity. At this season—the end of May—the afternoons were usually rainy, and the youngsters retired at an early hour. On the day the last fledgling departed, they took shelter in the nook at 3:30 p. m. The next day a hard shower fell early, and they entered at 1:20 in the afternoon and remained until nightfall. While they rested here, warm and dry, their parents flew about in the rain to catch insects for them. Each return of a parent with food was greeted by a chorus of loud chirrups. At times the adults would rest for 15 or 20 minutes beside their young, the male sometimes singing his high-pitched trill and also a low, bubbling note. Then the two would dart forth into the rain together, to collect more insects for the youngsters. As evening approached, they rejoined the fledglings for the night. The five slept pressed close together in single file on the ridgeplate, the three young swallows farthest in. Their slumber was not sound and, being somewhat wakeful myself, I repeatedly heard their weak chirps above me during the night. In the morning, the whole family lingered late, not leaving the roof until a few minutes before sunrise. The young swallows were not given food before they left their sleeping nook, but they sallied forth after their parents had been circling about the house for five minutes or less and flew swiftly out of sight with them.

After they had been three days in the open, the young swallows formed the habit of going to rest between four and half past four in the

afternoon, depending upon whether it was raining hard or only drizzling. Ten days after their departure from the nest, they no longer received food from their parents after their early return to their sleeping-nook. A day later, the adults began to renovate the nest, carrying up bits of grass from the yard to cover over the old structure with a layer of fresh material. Then the parents slept upon the reconditioned nest, leaving their young to slumber alone at the opposite end of the long ridgeplate. The 39-day-old swallows already appeared to be quite independent of parental care, for in the morning, while the parents lingered upon the nest, they flew out and winged rapidly away. When at length the adults emerged, they did not go off in search of their offspring but circled around the house hawking for insects. Two hours later, the three young swallows returned and joined in these aerial gyrations, catching their own food, and receiving none from their parents.

Eighteen days after the departure of the first brood, the female swallow began to lay a new set of three eggs in the refurbished nest. Soon after this, two of the young birds ceased to sleep under the roof, but the third continued to pass the night alone at the northern end of the beam until early July, when it, too, vanished, aged a little over two months. The parents were not so fortunate with their second brood as with the first; two of the nestlings succumbed at an early age during a long-continued rainstorm and the third, when half grown, died as a result of the invasion of the cottage by a horde of army ants that ransacked it from foundation to rooftree. Yet despite their loss, the pair of Blue and White Swallows, now thoroughly attached to the house, continued to sleep side by side upon the ridgeplate, until August when my sojourn in this rainy region came to an end.

On an evening a short while before my departure, when it was already nearly dark, I heard a commotion above my head, and went up into the attic with a light to investigate. During the day a number of bats, hanging head downward, slumbered in this dark space beneath the roof. One of these bats tried to reach the outer air by working along the ridgeplate, but it found its passage blocked by the two swallows who had long since retired and were reluctant to fly forth into the gathering darkness. They firmly held their ground, uttering the harsh note they emitted only when angry or frightened, while the bat protested with a sharp, rapid chittering. The birds and the bat were almost in contact when I arrived, but upon the approach of the light the swallows withdrew to the outer end of the beam, beyond the wall, while the bat moved inward toward the center of the house. Later it must have found another mode of egress, for when I went up

at the end of the night, I found the swallows sleeping in their usual position and the bat gone.

Other Blue and White Swallows in the vicinity behaved in much the same fashion as the pair that nested on the ridgeplate. A pair which built in a burrow, which they found ready-made in a bank, slept together on the nest, one in the cup and the other on the rim, before they had eggs, during the period of incubation, and while the nestling was growing up. They continued to use the burrow as a dormitory after the disappearance of their newly-emerged fledgling. Another pair, which reared three fledglings in a natural cavity in a decaying trunk in a pasture, led the newly-departed youngsters back to sleep in the hollow with them. Two of these disappeared early, but the third continued to spend the night in the same hole with the parents, even after it had become otherwise independent of them. One of the family would depart alone in the morning, and two, doubtless the mated pair, together. Sometimes the pair, sometimes the young bird, would emerge first and fly away without waiting for the others. The first might leave from eight to ten minutes before the last.

Family II.—For a little over two years, a pair of Blue and White Swallows made its home under the roof-tiles at the rear of my house in the valley of El General, and in three consecutive breeding-seasons they tried in vain to rear a brood there. Appearing first about the end of March, 1942, they slept together in various of the innumerable nooks which the roof of rustic, unglazed tiles provided for them. About the first of May they began to build in a cavity which was difficult for me to reach, and I did not attempt to examine their nest. Although their effort to raise a brood was unsuccessful, the two swallows continued to sleep together under the tiles through the remainder of the year and the early months of the following year. After their morning exit they would fly rapidly out of sight and remain away all day. By the middle of February, 1943, they began to spend more time in the vicinity of the house, and on February 27 one was seen to pick a straw from the roadway and carry it up beneath the tiles where they slept. This revealed a growing interest in a nest-site, although building was not yet undertaken in earnest.

Early in April, before the nest was finished, one of the pair vanished. The other lingered a few days longer, but on the morning of April 8 it was not seen to emerge from its usual sleeping-place beneath a tile. That same evening two swallows arrived together. One of them without hesitation darted up under the lowest tile of the end row, the usual point of entry. The other flew around and around, clinging to the walls of the house or beneath the eaves here and there, unable to

find its way in. Meanwhile the first, unseen beneath the tiles, sang again and again. At last it darted out and joined the other. After winging around the house, both returned to the sleeping-place together, the first entering easily, the second after a moment's confusion. On previous evenings, the swallows had gone to rest in a more direct manner. I think it a fair inference that the male of the pair which had already slept in my roof for over a year had lost his mate, stayed alone for a few nights, was absent for a night or so while he sought a new partner, then returned with another mate. Since she was not familiar with the roof with its hundreds of entrances leading into as many narrow passageways which did not communicate one with another, he sang at first to guide her to him, then, voice proving a poor guide in so bewildering a situation, came out to show her where to enter.

The next morning, April 9, the pair flew about the eaves examining the many crannies available to them as nest-sites. By April 15 they were actively building under a tile of the outside row at the rear of the house, and here they slept. In due course the nest was completed, and in early May two eggs were laid. These were incubated for nearly a month and turned out to be infertile. Then early in June they were found on the ground, one broken but the shell of the other merely perforated by a little hole which apparently had been made by the bill of the small bird which removed it. At the end of a week the swallows had relined the nest with dark-colored, downy feathers, and the female had laid two more eggs. Before another week had passed, these also were found lying broken on the ground beneath the eaves. Apparently they contained no yolk. I was not sure what had removed the eggs, but I strongly suspected the Neotropic House Wrens which at the ridge of the roof were bringing forth their broods in regular sequence, without mishaps.

When the second set of eggs was lost, it was only June 12, and many birds of other species were still nesting, but the swallows apparently made no further attempt to rear a brood that year. In spite of their failures to rear a brood, the two swallows continued for more than four months to sleep on or near their nest.

In early November, first one and then the other swallow disappeared. For two weeks I failed to see a swallow fly up beneath the tiles in the evening or dart out in the morning. Then, late on the rainy afternoon of November 26, while removing some stored lumber from above the rafters at the back of the house, I became aware of a pair of swallows flying around in the gloom outside. After I descended to the floor they soon entered a nook beneath the tiles—the same one in

which the swallows had slept for so long. The fact that the pair went to roost in this particular spot, instead of in some other of the many spaces available beneath the tiles, was for me conclusive evidence that at least one of the two had already slept there. The following afternoon this one entered its dormitory without difficulty, but the other appeared confused and continued to fly up to neighboring parts of the eaves, unable to find its mate until the latter came out and led it back to the proper row of tiles. Since the first to enter sang while awaiting the other, I believe that again it was the male which had lost his mate, and I was witnessing a repetition of the act I had seen the preceding April, when the male had brought back a new mate who needed to be led into his customary sleeping-place.

On subsequent evenings, the female swallow repeatedly entered the channels beneath tiles one, two, three, or even four tiers removed from that where her mate had gone to rest. Then sometimes she would complain in clear notes that sounded mournful to me, while the male answered with his fine trill from beneath the marginal row of tiles. Since there was no passageway connecting the channels beneath the different longitudinal rows of tiles, she had no recourse except to fly out from the lower end and try again and again to strike the proper space. The male would continue to sing and she to call until the two were united in their sleeping quarters; then both became silent. A week passed before the female was able to enter without mistakes.

During the long period between nesting seasons, I gave much attention to the swallows' times of leaving the roof in the morning and returning in the evening. Long after practically all their bird neighbors had become active and only 10 or 15 minutes before the sun flamed up above the crest of the forest on the eastern ridges, they would dart out from beneath the tiles. Usually they would emerge almost together, but on some mornings, especially as the subsequent nesting-season approached, one would linger for a minute or two, rarely for as much as five minutes, after its mate had darted out and winged away beyond sight. On clear, cool mornings they would sometimes show themselves beneath the edge of a certain misshapen tile that did not lie flat and stand here looking out for several minutes before they flew forth. Usually as soon as they came into the open they would turn their courses up the valley of the Río Peña Blanca, that flowed in front of the house, and fly toward the high craggy summits of the Cerro Chirripó until lost to view. Then they would stay away all day. How far they went I could never discover.

The hour of the swallows' return to their sleeping-place depended largely upon the weather, but at the latest it was earlier than that of

nearly all other birds in the vicinity, including both their relatives, the Rough-winged Swallows that roosted in a nearby cane field, and their neighbors the House Wrens who also slept beneath the tiles. On clear evenings they might on rare occasions remain out until half past five, but usually, especially about the time of the winter solstice, it was five o'clock or even earlier when they went to rest. On the rainy afternoons so frequent during the second half of the year they would seek shelter far earlier. On some dark, wet afternoons they went into their nook soon after three o'clock, but if the rain abated before sunset they might come out again and circle around catching insects for a while before their final return for the night. If the rain continued to come down hard until nightfall, they would stay beneath the tiles. In this region, rain in the forenoon is infrequent and almost never hard, and I did not see the swallows take shelter from a morning shower. But a slow rain at daybreak sometimes delayed their departure for from 10 to 15 minutes beyond their usual time for emerging.

In the middle of February, 1944, the pair began to take straws into the niche beneath the tiles. Now they began to linger near the house during the day instead of remaining out of sight, and they sat together in their nook or in other spaces beneath the tiles for many minutes while the sun was high. The male often sang while the pair rested side by side under a tile. By the end of February they were building actively, by March 13 had practically completed their nest, and on March 19 the female laid the first of three eggs. This year the swallows got farther than in the two preceding years. They hatched three nestlings and attended them until they were a week old. Then the three young swallows mysteriously vanished. After three seasons of failure to rear offspring, the Blue and White Swallows deserted my roof. During seven subsequent years a pair of these swallows has from time to time arrived to investigate the crannies under the tiles, but they have never successfully nested here, nor again slept here for many consecutive nights.

SUMMARY

1. The Blue and White Swallow is an exceptionally adaptable species. Its range stretches from Costa Rica to Argentina, and within this vast area it is at home in habitats as varied as the open pampas, the Amazon and its tributaries, the high Andes, the desert guano islands of Perú, and the rain-drenched Costa Rican mountains.
2. In its habits of catching insects on the wing and resting on exposed twigs or wires, it scarcely differs from other swallows. The song, a thin, weak, long-continued trill, is in Costa Rica delivered more or less frequently throughout the year.

3. Almost any covered nook or cranny is acceptable as a nest-site. Nests have been found in cavities in trees, holes in banks, niches in masonry bridges, crevices in house walls, and beneath roofs of thatch, tiles, or sheet-iron. Both sexes join in building the shallow structure of straws and the like, lined with downy feathers.

4. In Costa Rica, two to four white eggs form the set, with three the most frequent number. Laying begins in March and second sets are laid in June. The eggs are usually deposited on consecutive days.

5. Both sexes share incubation, sitting from three to 81 minutes at a stretch. At two nests the incubation period was 15 days. One pair attended infertile eggs for at least 26 days.

6. The nestlings are fed by both parents and remain in the nest-space until they can fly well. Those of one brood took wing when 26 and 27 days old. At about 40 days of age they became independent of parental care, but continued to roost in the nest-space with their parents.

7. The roosting habits of one family were followed for over six months, of a second for over two years, and less extended observations were made on other pairs. The pair of swallows remain together throughout the year and use the nest-cranny as a fixed abode, the two sleeping here each night, and sometimes entering by day to take shelter from heavy rains. During the course of incubation one, probably the female, sleeps on the eggs, while the other roosts on the rim of the nest, in contact with its mate. The fledglings return to sleep in the nest-space with their parents, and may continue this habit until two months old, although the old birds no longer attend them and may proceed to rear a second brood.

8. Within this general pattern individual variations were observed. With one pair, only one bird slept in the nest-space before building began, and this one not consistently. During incubation, and while the nestlings required brooding, the parents slept together at the nest. But after the nestlings were older, one and then the other parent chose a distant roost. During their second nesting this pair followed the normal pattern and always slept together on or by the nest.

Finca 'Los Cusingos,' San Isidro del General, Costa Rica, July 17, 1951.