NESTING OF THE BLACK SWIFT IN MONTANA

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IN recent decades it has been fully realized that the Black Swift (*Cypseloides niger*) occurs regularly in mountainous northwestern Montana during the summer months. Saunders (1921) did not list this bird among those known for Montana as late as 1919, yet the Black Swift has been known since the 1940's at Avalanche Creek in Glacier National Park and in the Mission Mountains, about 90 miles to the south. During the latter period, the species was occasionally seen in summer at lower elevations, as at Coram, at Yellow Bay on Flathead Lake, and at the National Bison Range by several persons from the staffs of the Montana State University Biological Station and Glacier National Park. An adult specimen was collected at Coram, Flathead County, by P. L. Wright in July 1954.

Despite this information on its occurrence, no nests or breeding colonies of the Black Swift were on record from Montana. However, parties from the Biological Station on occasion had noticed birds flying into waterfalls in the southern part of the Mission Range, and this suggested the possibility that swifts could be found nesting there. In 1960, a brief effort was made, without success, to see Black Swifts around waterfalls of the high cliffs above Avalanche Lake in Glacier National Park; at that time plans were made for an investigation of the Mission Range the following summer. In 1961, Hunter, working at the Montana State University Biological Station, with the aid of National Science Foundation Grant Number 71,200, searched for colonies of Black Swifts in the southern part of the Mission Mountains, assisted by R. L. Anderson, who roped over the falls several times to visit a swift's nest and obtain and return the nestling, and by L. W. Mottus and P. T. Baldwin. Dr. P. L. Wright and Dr. R. B. Brunson told us of sightings of the Black Swift at waterfalls in the Mission Range.

The most complete description available of high-mountain nesting of the Black Swift is given by Knorr (1961), who visited numerous colonies in Colorado; the nestings in Montana reported below differ in certain particulars from those in Colorado.

Our field work began on 20 June, and three canyons were explored during the first week without encouraging results, but on 28 June, several Black Swifts were seen flying in the Mission Creek canyon east of St. Ignatius. By following the suggestions of Knorr (loc. cit.), we located a colony on 25 July 1961.

The colony was situated at a waterfall (Fig. 1) about four miles up the canyon. The falls was on a nameless tributary which plunged down a gorge in the sedimentary rock of the steep south wall and entered the main stream

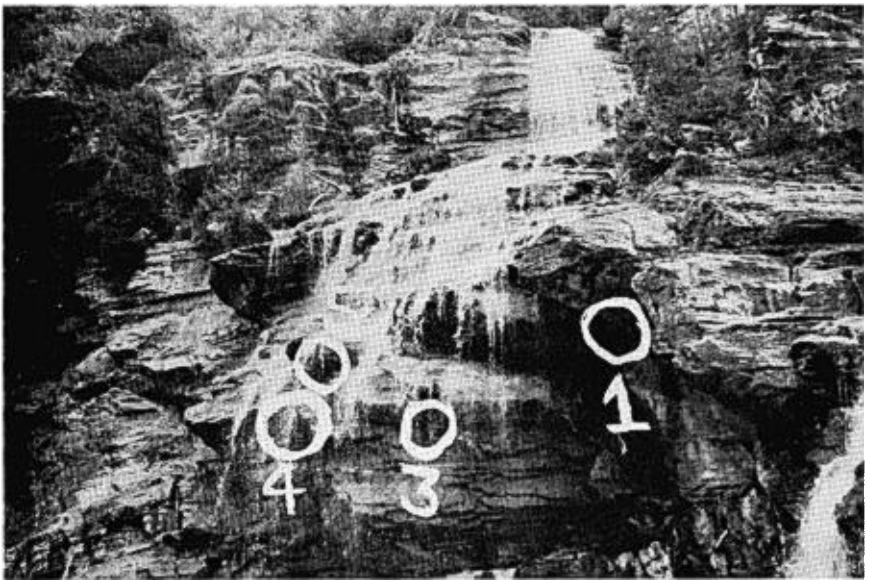

FIG. 1. Enlarged view of waterfall showing sites of four nests of Black Swifts (30 July 1961).

immediately below Lower Mission Falls. The falls was at approximately 4,700 feet elevation; it had an interrupted fall of 200 feet and was 150 feet wide, including all rills and cascades. The part occupied by the swifts was 75 feet wide. The transition-zone vegetation on adjacent slopes was primarily lowland fir (*Abies grandis*) and Douglas fir (*Pseudotsuga menziesii*) but also included Engelmann spruce (*Picea engelmanni*), mountain maple (*Acer glabrum*), willow (*Salix* sp.), alder (*Alnus tenuifolia*), dogwood (*Cornus stolonifera*), and juniper (*Juniperus scopulorum*).

A moss (*Leptodictyum riparium*) grew luxuriantly on the rocks behind the falls and invaded the clefts and crannies containing swift nests or roosting sites. A grass grew on several ledges, and a fern (*Asplenium* sp.) occurred sparingly about the falls. Currant (*Ribes* sp.), blue aster (*Aster* sp.), saxifrage (*Saxifraga oppositifolia*), and bluebells (*Companula rotundifolia*) were also present on various niches of the falls.

Five active nests, each containing one downy young, were discovered in this colony along with what appeared to be three older nests, possibly used the previous year. Adult birds were observed entering crypts where other nests were probably present, which could not be seen or reached at this time; also, as many as 10 adults were counted leaving the waterfall. The five nests were on a southwestern exposure and secluded from the rays of the sun until late afternoon, at which time four of the nests came into direct sunshine.

Nest 1 was found on 25 July near the top of the falls beneath an overhang about 8 feet from the torrent. The nest was on a small mossy ledge just at the edge of rock wet by spray or trickles. The nest itself looked dry, and the materials composing it appeared from a distance like liverwort and other brownish materials. One young occupied the nest and from time to time would move around exposing its wing feathers, still sheathed. Adult birds had been observed the evening of 24 July entering this grotto. At 5:55 PM on 25 July, an adult perched on the outside of the nest, its body vertical. It bobbed its head frequently, apparently feeding the young while the latter held its mouth open. The two birds remained there quietly until 6:15 PM, when the adult left not to return at least before dark. We did not see either of these birds again, although the nest was still intact during all later observations.

Nest 2 also was found on 25 July and the downy young was seen on that date. The nest was reached on 30 July by roping over the top of the main falls to the triangular nesting cavity (21 inches long, 9 inches wide at its maximum point, and 7 inches high) 15 feet below. The cavity was covered with moss, except for the vertical rear wall, and it was completely moist from water rushing on both sides of the opening and trickles pouring over the entrance a mere 3 or 4 inches from the nest itself. It was necessary for birds entering or leaving to go through the water. The nest itself, composed of moss, stood up plainly above the floor near the center of the cranny, leaving enough room behind and on the sides for adult birds to perch. Swifts were observed doing this in both places, sometimes crouching in the moss slightly below the level of the nest so that one could not see them with a 20× spotting scope. Although the rim and body of the nest were of fresh green moss, scrapings from the bottom of the nest cup included one broken pine needle and several fibrous twigs. There was no other lining material. The outside diameter of the nest was 14.7 cm, the inside diameter, 9.1 cm, and the depth of the cup, 4.2 cm. The nest was marked with a piece of yellow plastic for identification in the future.

The nestling of Nest 2 was measured twice during the summer and banded. On 30 July it weighed 38 grams, had its eyes open, and was covered with dark slate-gray down feathers. Contour feathers of the spinal tract were breaking sheaths but had not yet emerged through the dense down which originated in the dorsal apteria. These white-tipped contour feathers of the pterylae were the first feathers of their follicles and were not preceded by neossoptiles. Above the bill a triangular area with its point extending back on the crown between the eyes was studded with tiny white pins of contour feathers, whereas gray down covered adjacent areas of the crown. The primaries were pins with brush tips, Primary 10 measuring 8 mm, Primary 9,

13 mm, and Primary 2, 14 mm. The rectrices were 6-mm pins; the tarsus was 12 mm. The young bird was sluggish in its actions, although it did try to crawl away while in the hand. Its claws were dull and the foot showed little grasping ability as compared to the sharp claws and strong toes of the nestling Vaux's Swift (*Chaetura vauxi*) of comparable developmental age (Baldwin and Hunter, MS). On 6 August, the nestling was obtained again and measured. Primary 10 had increased to 42 mm, Primary 9 to 45 mm, and Primary 2 to 36 mm; the rectrices had grown to 19 mm; the tarsus was 13 mm. Most of the inner primaries were edged with white. The front toes of each foot had been injured, as the terminal phalanx of each was bulbous, soft and bloody, and the claw missing. The cause of this was unknown. The hind toes showed normal development. It was estimated that this nestling was not more than one quarter through its nestling developmental period on 30 July, which would place the probable hatching date at about 16 to 19 July. Legg (1956) found the nestling period of the Black Swift to be 45 days, and on this basis the nest-departure date could be predicated as around 30 August to 2 September.

An adult was seen at Nest 2 on six out of seven days of observation between 25 July and 7 August. It seemed to spend most of its time either brooding on the nest or perching in the nest cavity, and once it probed and pecked at length at the moss beside the nest. Its absences from the nest were brief. On two evenings it left the nest and its return was not observed before dark. Delayed feeding of the young was witnessed on 25 July, after the adult had perched behind the nest for at least two hours. At 3:58 PM the adult moved up on top of the nest, whereupon, with its tail and wings sticking out through the water, it stuck its bill down the nestling's mouth, which was open and waiting. After three minutes of this the adult returned to its perch behind the nest, and the young disappeared in the nest bowl.

Nest 3 was located on 30 July, at 2:15 PM, when an adult entered a small ledge rimmed with grass and *Campanula rotundifolia*. The young bird became active immediately and pecked vigorously at the chin of the adult. Soon the adult settled next to the young. The sun reached Nest 3 by 5:30 PM; as the nestling warmed it became quite active, sunbathing and preening; also the wings were stretched and held out so that they were plainly visible through the spotting scope. This nestling showed more advanced growth of the primaries than the young of Nest 2, the vanes being broken out more and the primaries seeming to be about 10 mm longer; hence, the probable hatching date for Nest 3 would have been a few days earlier than for Nest 2, perhaps around 13 to 16 July, and nest departure might have been expected around 27 to 30 August.

Nest 4 was discovered on 30 July by watching an adult cling on the dry

wall under a cascade for a moment before crawling onto a nest and settling down beside a downy young (4:30 PM). The nest site was a crypt, and the nest consisted of dried yellow-green moss. The adult moved frequently and would gape now and then, showing a pink lining to the wide mouth. A slight overhang of the roof of the crypt kept the sun from shining directly on the nest until 6:30. At 6:50, the adult leaned down over the nest rim, slid off, and swooped deep down the gorge into the main canyon; the nestling remained humped up in the nest. The sun left the nest at 7:10 PM. On 7 August, we found this nest gone—it had been constructed on a rounded part of the ledge and it must have slipped off, perhaps as a result of drying, jostling, or the weight of adults perching on its side.

Nest 5 was located on 7 August (6:45 PM) at a spot where two adult swifts had perched on the previous evening. While searching the area with a binocular, we saw a young bird in a nest on a ledge immediately under a small cascade, about 4 feet above Nest 4. A broken screen of water flowing in front of the nest made it difficult to see. The nest appeared to be in the grass with large basal leaves of *Campanula*, and with the top of the cascade serving as a roof. This nest would not have been observed without the illumination of sunshine on it. It was judged that the rays appeared on this nest for about 15 minutes daily. The nestling showed white-tipped body contour feathers along with its deep gray down and long primaries. An adult bird entered the niche at 7:00 PM, flapping its wings until it could get a hold on the side of the nest. It then mounted the nest and stretched out one wing.

DISCUSSION

Previous descriptions of nesting of the Black Swift (northern race) have concerned nests in California and Colorado. New nest records from Montana permit certain comparisons to be made.

The availability of several nesting dates from the three separate localities makes possible a preliminary examination and comparison of the timing of nesting in these localities. With the duration of the incubation period (24–27 days) and nestling period (45 days) being known (Murphy, 1951; Legg, 1956), approximate dates can be extrapolated for such events as start of incubation, hatching, and nest departure for nearly all the nests reported in the literature. The following summary of phenological relations is based on the inferred dates for start of incubation for 11 nests in California, 10 nests in Colorado, and 5 nests in Montana (Table 1). The earliest date for each locality is used. The basis for comparison of the dates among the three geographic areas is Hopkins' Bioclimatic Law, which describes a lag of four days for a given vital event with a progression of each 1° of latitude to the

TABLE 1
RETARDATION OF INCUBATION INITIATION OF THE BLACK SWIFT BASED ON HOPKINS' BIOCLIMATIC LAW

Area	Location	Early date for start of incubation	Days retardation	
			Actual	Expected
South-central California	37°N, 119°W (sea level)	23 May	–	–
Northwestern Montana	47°N, 114°W (4,700 feet)	15–18 June	23–26	48–62
Colorado	39°N, 107°W (9,300 feet)	8 July	48	36–46

north, with each 5° longitude to the east, and with each 400 feet of rise in altitude (Hopkins, 1938; also see Johnston, 1954, for a carefully worked-out example in the Song Sparrow, which conforms quite well to the law).

The base reference date of 23 May for coastal California is based on Dixon's (1935) earliest nest at Sequoia National Park, with hatching date approximately 2 July, corrected for elevation and longitude. This procedure necessitates the assumption that the Black Swift could arrive early enough from its winter home to breed by that date; indeed, Grinnell and Miller (1944:214) state that the Black Swift is a summer resident in California from May to October. If these assumptions and inferences are permitted for a preliminary comparison, then it may be noted further that nesting in the Montana colony started only 23–26 days later than the base reference date, although the expected delay would have been about 48–62 days. The Colorado nests, on the other hand, appear to have been started some 48 days after the base reference date, with an expectation of about 36–46 days.

It cannot be said from these preliminary indications that the geographic progression of an equivalent nesting event in the Black Swift follows closely the expected progression to be inferred from Hopkins' law. The Montana dates appear especially divergent. Again, the small sample size should be noted, as well as the need for firmer data for all localities.

The question as to just when the nestling Black Swift acquires its coat of down is not yet settled. Legg (1956) and Dixon (1935) reported that the just-hatched young was naked; Wetherbee (1961:87) suggested that the down described on two-week-old nestlings is "*not* natal down, but emerging teleoptiles." What is not apparent from previous accounts is that the down and the contour feathers arise from separate areas of the skin, at least as observed on dorsum and crown. It is remarkable that the downy teleoptiles grow abundantly and rapidly on the "apteria," while pins of the contour feathers form slowly in the pterylae. It appears that the down, once acquired, would function as an effective adaptation to the cool and moist nesting niche

(Legg, cited in Wetherbee, 1961). The downy coat developed in the apteria could be a primitive feature retained in this swift, or more likely, after loss of neossoptiles by cavity-dwelling ancestors, it was acquired as a secondary adaptation when the swift took up its unusual nesting niche.

The Black Swift in Montana nested in a situation which conformed to all of Knorr's (1961:168–169) physical ecological factors: water, high relief, inaccessibility, unobstructed flyways, and darkness. Yet our nests were in less darkness than is typical. Knorr states that he has never found an occupied nest upon which the sun shone, and other authors have stressed the darkness of the nest site (Michael, 1927:97) and avoidance of light by the young (Dixon, 1935). Four of the five active nests seen in the Mission Valley colony in Montana had sunshine directly on them during the late afternoon; in the fifth nest the sun reached the nest rim but did not actually enter the nest. One nest received sunlight for as much as an hour and a half a day in late July and early August. The nestlings did not seem distressed at the sunlight; in fact, they exercised, preened, and exposed feathers to the sun. Smith (1928) tells of the filtered sunlight shining into Black Swifts' nests in the early morning in California. Nevertheless, the Montana nests were in deep shade most of the day, and at the start of nesting they may have been in shade the entire day.

In California the nest sites ranged from sea level to 6,000 feet (Grinnell and Miller, 1944:215), in Montana the colony studied was at 4,700 feet, while in Colorado the lowest site found was 7,200 feet (Knorr, 1961). The difference between Montana and Colorado is probably due to the different base level of the mountain masses (Montana, 3,000 feet; Colorado, 5–7,000 feet) whose steep canyons provide suitable conditions for nesting.

In reviewing the existing accounts of nesting, one cannot avoid noting the rather large proportion of nesting failures. This seems strange for a nest in such an inaccessible place and containing only one egg; furthermore, the low reproductive rate would seem to suggest a high degree of success. The usual failure involves a mysterious disappearance of the young long before normal nest departure could have been expected; also, young have been found in the nest dead (Bent, 1940:261). In both the California and Colorado nest records quite a number of such vanishings are to be found; Knorr (1961: 168) states that he observed at least one young fall out of the nest. In the Montana colony reported here, two of the five nests failed during the early nestling period: in Nest 1, the downy young simply vanished, and in Nest 4, both nest and nestling disappeared. Vertebrate predators have not been detected, and it has been felt by those who have commented on the matter that only winged predators could get to the nests; yet there are no observations of raptorial birds at the nest colonies, either elsewhere or in Montana.

SUMMARY

Nesting of the Black Swift in northwestern Montana was established with the finding of a colony in the Mission Valley of the Mission Range, where five active nests at a waterfall were studied. The presence of adults elsewhere in the Mission Range and in the Glacier Range strongly suggests that other colonies remain to be discovered.

The nestings studied in Montana were started earlier than those reported in Colorado, contrary to expectations based on Hopkins' Bioclimatic Law.

The downy covering developed early in the nestling period may represent a secondary adaptation to the semiexposed nesting niche.

Nestings in Montana differed from those in Colorado in their greater exposure to sunshine and lower elevation. Nesting failures appear to be common in the Black Swift.

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