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BREEDING DISTRIBUTION OF THE BLACK SWIFT IN SOUTHERN CALIFORNIA

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The Black Swift (*Cypseloides niger*) is sparsely distributed over wide portions of western North America from British Columbia and southwestern Alberta south to southern California and east to Colorado (A.O.U. 1983). Elsewhere its range includes Mexico, Central America south to Costa Rica, and the Greater Antilles. Within this range, it has a discontinuous distribution, with nests found on sea cliffs (Vrooman 1901), in sea caves (Legg 1956), behind mountain waterfalls (Smith 1928, Knorr 1962), on moist inland cliffs (Michael 1927), and in limestone caves (Davis 1964). The winter range of the migratory population in western North America is presumed to be southern Mexico (Friedmann et al. 1950).

The nest and egg of the Black Swift were discovered by A.G. Vrooman (1901) along a sea cliff west of Santa Cruz, California. Vrooman, an amateur egg collector, was searching for cormorant eggs along the cliff when "suddenly, right from under the pole and not more than three or four feet from my hand, a Black Swift flew out and down toward the water and passed around the angle toward the ocean." The nest was situated in a small crevice lined with mud and tufts of grass. Even though a second nest was found four years later (Vrooman 1905), the record was subject to widespread skepticism from within the ornithological community. It was not until 1915 that the record was widely accepted, following a visit to the site and a subsequent apology from W. L. Dawson (1915) in an article entitled "The Nesting of the Black Swift—A Vindication." Subsequently, Black Swifts were also found breeding inland behind waterfalls (Michael 1927, Smith 1928).

Knorr (1961) conducted a 10-year survey of the geographical distribution of Black Swifts in Colorado and proposed a set of ecological requirements for Black Swift breeding. Even so, there has been a notable absence of surveys in other parts of the species' range of the distribution of nest sites and comparisons with Knorr's proposed nest-site requirements. In this study we examine the characteristics of breeding sites and the population size of Black Swifts breeding in southern California.

METHODS

Field work was conducted from March to early September in 1985 and from late April to early September in 1986, which included the period of residency of Black Swifts in the area. Black Swifts occur in southern California between April and October with the extreme dates representing the passage of migrants (Garrett and Dunn 1981). The breeding period, from egg laying to fledging, is from May to September (Foerster 1987, Collins and Foerster unpubl. data). We conducted our field surveys in the San Gabriel, San Bernardino, and San Jacinto Mountains of southern California (Figure 1). Each potential nesting site was rated according to the presence or absence of Black Swifts and Knorr's (1961) ecological criteria. Detailed descriptions of all confirmed nest site localities examined in this study, along with their elevations and ecological features are presented below. The locations of all potential nest sites where Black Swifts were not detected during this study are listed in Appendix 1.

RESULTS AND DISCUSSION

Distribution

Within southern California, the Black Swift is a local and restricted breeder. Hall (1948) reported the first Black Swift nest in southern California near Hemet, Riverside County. Other previously known nesting sites are Sturtevant Falls in the San Gabriel Mountains (McCaskie 1974, Remsen 1978), Big Falls in the San Bernardino Mountains (McCaskie 1969, Remsen 1978), and on the lower North Fork of the San Jacinto River (Collins and Sheppard unpubl. data). Over the two seasons of this study, we surveyed 50 separate waterfalls and found Black Swifts nesting at six sites (Figure 1). All sites were located in mountain canyons with riparian habitat along the streams. The sites are as follows:

1. Sturtevant Falls—The falls are located in Santa Anita Canyon at a top elevation of 645 meters, approximately 15 km northeast of downtown Los Angeles. Water flows year round over the 20-meter falls. The plant communities in this area are Chamise Chaparral and Scrub Oak Chaparral (Hanes 1976). A single nest was situated on the south side of the falls, approximately 7 meters above the base. Since the early 1970s, periodic surveys have revealed from one to three pairs of swifts present during the nesting season, although only a single nest was located in any of these years (Collins unpubl. data).

2. Wolfskill Falls—This site is located in Wolfskill Canyon within the San Dimas Experimental Forest at a top elevation of approximately 550 meters. This area is protected and regulated by the Forest Service of the United States Department of Agriculture. Water flows year round over a series of three waterfalls. The largest (20-meter) and highest upstream fall served as the nesting site. A single nest was located on the north side of the fall, about 4 meters above the base. The major plant communities in the area are Chamise Chaparral and Scrub Oak Chaparral. The herbaceous vegetation in the immediate vicinity of the site consists primarily of monkeyflower (*Mimulus*

cardinalis). A freshwater alga, *Vaucheria* sp., dominates the rock surfaces of the waterfall.

3. Big Falls—This site is located about 2.5 km northeast of Forest Home in the San Bernardino Mountains at a top elevation of 1950 meters. The water flows year round, as this stream is a major snow melt drainage for the southwest side of Mount San Gorgonio. The plant communities in this area are Western Coniferous Forest and Mixed Chaparral (Minnich 1976). Hazardous falling rock and sheer inaccessibility limited the study to the lowest of five waterfalls that drop 150 meters into Mill Creek Canyon. The single nest found was located in a small crevice 10 meters high on the east side of the falls.

4. Lawler Falls—These previously unnamed falls are located 150 meters downstream from the crossing of Highway 243 over the North Fork of the San Jacinto River. The elevation at the top of the falls is approximately 1620 meters. The water flows year round over and behind several large boulders

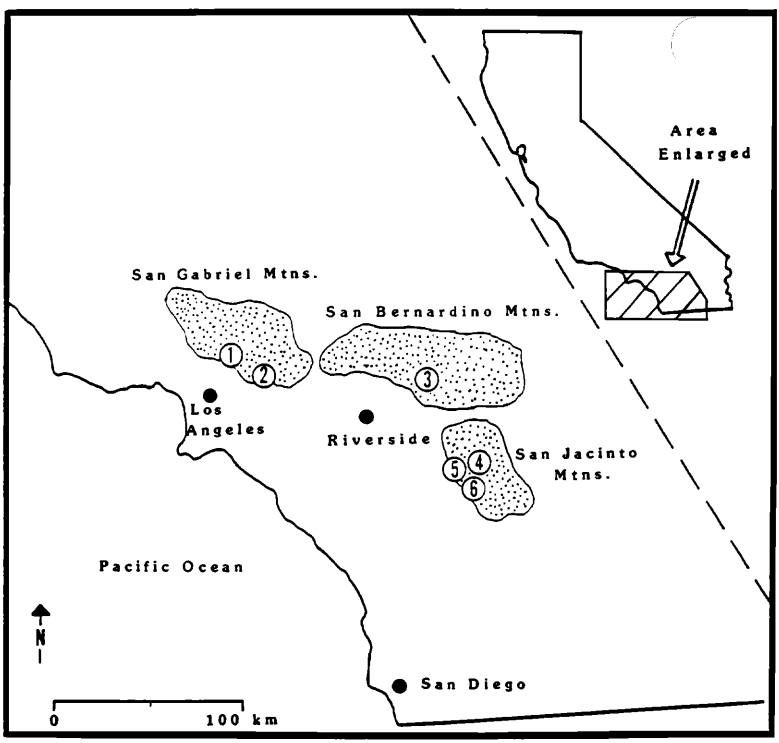

Figure 1. Locations of Black Swift breeding sites in the southern California mountains. 1, Sturtevant Falls; 2, Wolfskill Falls; 3, Big Falls; 4, Lawler Falls; 5, Four Falls; 6, Strawberry Grotto. The stippled area indicates the general outline of the mountain ranges.

wedged into the bottom of the canyon. The placement of the boulders creates a waterfall 8 meters high with a cave 10 meters deep. A minimum of seven pairs of Black Swifts nested in 1985 and again in 1986. The surrounding vegetation is Mixed Conifer Forest dominated by Coulter Pine (*Pinus coulteri*) and Ponderosa Pine (*P. ponderosa*).

5. Four Falls—This site is located on the North Fork of the San Jacinto River approximately 8 km downstream from Lawler Falls at a top elevation of 755 meters. It consists of a series of four waterfalls on property of the Lake Hemet Municipal Water District. The falls range in height from 3 to 15 meters. The one probable nest site was located near the upper falls in 1971 (Collins and Sheppard unpubl. data) and in 1985 (this study). The plant community near this west-facing slope is Chamise Chaparral (Vogl 1976). A large grotto with numerous ferns can be found near the middle falls. This may be the same area described by Hall (1948). Several nests were photographed here in the 1950s (D. Bleitz pers. comm.).

6. Strawberry Grotto—This site is located 1.5 km downstream from the crossing of Tollgate Road over Strawberry Creek in Idyllwild. The top elevation of the falls is approximately 1402 meters. The water flows through a hole between two overhanging boulders that create a small cave. This fall is subject to wide fluctuations in water quantity, but generally the flow is year-round (M. Hamilton pers. comm.). The plant community in this area is Manzanita Chaparral (Vogl 1976). We found single nests in two different locations in 1985 and 1986. Grinnell (1908) first reported seeing Black Swifts flying in Strawberry Valley in the early 1900s. However, no nests were located in the area until our study. Strawberry Grotto is the southernmost known breeding site of Black Swifts in California.

Habitat Characteristics

We surveyed a total of 50 waterfalls in southern California for the presence or absence of five ecological features. These are summarized from Knorr (1961) as follows:

1. Water. Water is present at every nesting site, varying in degree from a rushing torrent to a mere trickle.
2. High relief. The nesting site must have a commanding position above the surrounding terrain so that swifts flying out from the nest are automatically at potential foraging altitude above the surrounding valley.
3. Inaccessibility. The site must be inaccessible to terrestrial marauders and accessible only to winged animals or humans with climbing gear.
4. Darkness. The nest is in a position such that the sun will not shine on an occupied nest.
5. Unobstructed Flyways. The flyway in front of the nest must be free of obstructions.

All six nesting sites had the five ecological requirements. Fifty-six percent of all the waterfalls surveyed had all five requirements (Table 1).

While all of Knorr's five ecological requirements were met by the southern California nest sites, these requirements do not completely describe all nest sites throughout the range of the Black Swift. The presence of water may be the most crucial feature, as no nests are known from intermittent streams. Knorr (1961) suggested the high relief requirement because all of the nesting

Table 1 Number of Ecological Requirements[a] Met at Sites Searched for Nesting Black Swifts

	Number of Requirements Met				
	5	4	3	2	1-0
Unoccupied sites $n=44$	22	10	4	1	7
Occupied sites $n=6$	6	0	0	0	0
Total	28	10	4	1	7
Percentage of total	56%	20%	8%	2%	14%

[a]From Knorr (1961); see text.

sites within his survey were above 7200 feet (2000 meters) in the Colorado Rockies. The high relief requirement may not apply to coastal sea cave nests, but was more typical of the mountain sites examined in this study. Inaccessibility of nests varied from some being reachable only by a high-exposure rappel, to others being within an arm's reach of the base of the falls. The absolute darkness requirement may be less important, as some nests in Montana were in direct sunlight during part of the day (Hunter and Baldwin 1962). However, all the nests in southern California were shaded from direct sunlight, although at least two were only lightly shaded and therefore not in deep darkness. An unobstructed flyway, other than in the immediate vicinity of the nest, appears to be the least important requirement. Black Swifts at Lawler Falls and Sturtevant Falls routinely flew through a maze of tree branches when approaching or leaving the vicinity of the waterfalls.

Many of the falls surveyed in this study (Appendix 1) did not appear to have nesting Black Swifts present even though the majority met the ecological requirements of Knorr (1961). Some clearly lacked a suitable ledge or shelf to support a nest, and this most likely contributed to the absence of nesting at these sites. It was not always obvious why others were not utilized. Even so, potential waterfall nest sites are not abundant and may represent a limiting resource for this species in this part of its range.

Breeding Population Estimates

We found that Black Swifts forage on the wing all day and return to the nest at dusk. By standing at the base of the waterfalls, we could count the number of arrivals and departures. Through numerous early evening waterfall watches and direct observation of nests, we were able to obtain an estimate of the breeding population. The number of adults seen in the survey area was 30 in 1985 and 32 in 1986. However, these population estimates span the entire length of the breeding season and may include counts of some migrating swifts. For example, nine adult swifts were seen during the early season (May) at Sturtevant Falls. A mid-season census (July) revealed only four swifts present on two occasions. Therefore, only adults present dur-

Table 2 Estimated Population of Black Swifts at Southern California Sites

Location	Adults		Nestlings[a]	
	1985	1986	1985	1986
Sturtevant Falls	4	4	0	1
Wolfskill Falls	2	2	1	1
Big Falls	4	4	*b*	*b*
Lawler Falls	14	14	7	6
Four Falls	2	*b*	*b*	*b*
Strawberry Grotto	2	2	1	0
Totals	28	26	9	8

[a]Black Swifts lay a single egg per nesting attempt.
[b]Nest or nest site inaccessible.

ing the mid-season censuses are included in the breeding population estimates (Table 2). The breeding population remained constant during the 2-year study with over 50% of the adults nesting within the San Jacinto Mountains.

The breeding success of the nesting pairs surveyed in this study appeared to be very high (Foerster 1987, Collins and Foerster unpubl. data) even when there was substantial human activity nearby. Therefore, it seems unlikely that the Black Swift population in southern California is only marginally successful and thus unable to increase through natural recruitment. The alternative explanation for the low population size of Black Swifts in southern California is a lack of suitable nesting sites. Our continuing monitoring of the population size and reproductive success of these swifts will help to test this hypothesis.

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APPENDIX 1. Survey sites where Black Swifts were not detected in the southern California mountains during 1985 and 1986. The format is as follows: waterfall name, location, top elevation, height, falls direction, and notes if any; n/a, not available.

San Gabriel Mountains

(1) Bonita Falls; 2 km SW of Lytle Creek Ranger Station on an unnamed creek; 1030 m; 25 m; N.

(2) Bouquet Canyon Falls; 2 km SW of Bouquet Reservoir on Bouquet Canyon Creek; n/a; 3 m; SW.

(3) Castaic Creek Falls. 7 km NW of Castaic Lake on Castaic Creek; n/a; n/a; n/a.

(4) Cooper Canyon Falls; 2 km N of Kratka Ridge on Cooper Canyon Creek; 1725 m; 10 m; NE.

(5) Cucamonga Canyon Falls; 3.5 km SW of Cucamonga Peak; 1300 m; n/a; SW.

(6) Daggar Falls; 3 km S of Magic Mountain in Daggar Canyon; n/a; n/a; n/a; flows only after a storm.

(7) Lower Devils Canyon Falls; 4.5 km N of Cogswell Reservoir in Devils Canyon; 1000 m; n/a; S.

(8) Upper Devils Canyon Falls; 2 km S of Waterman Mountain in Devils Canyon; 1750 m; n/a; S.

(9) Devils Gulch Falls; 2 km NE of Rattlesnake Peak on Devils Gulch Creek; 910 m; 10 m; E.

(10) Eaton Falls; 1 km NE of Altadena in Eaton Canyon; 420 m; 10 m; N.

(11) Fall Creek Falls (Big Tujunga); 2 km NE of Big Tujunga Dam; 745 m; 18 m; E.

(12) Fall Creek Falls (Occidental Peak); 0.5 km NE of Occidental Peak in Falls Canyon; 1525 m; n/a; NE.

(13) Fish Canyon Falls; 3.5 km W of Morris Reservoir on Fish Canyon Creek; 425 m; 35 m; SE.

(14) Fox Creek Falls; 1.5 km NE of Big Tujunga Dam; 710 m; n/a; SE.

(15) Lewis Falls; 1 km SE of Crystal Lake on Soldier Creek; 1325 m; 10 m; SE.

(16) Little Santa Anita Canyon Falls; 1 to 5 km N of Sierra Madre in Little Santa Anita Canyon; variable; variable; variable; several waterfalls that flow for a few days following a storm.

(17) Millard Falls; 1.5 km N of Altadena in Millard Canyon; 670 m; 15 m; SW.

(18) Monrovia Falls; 2 km N of Monrovia in Monrovia Canyon; 550 m; 10 m; S.

(19) San Antonio Falls; 2 km SE of Mount San Antonio. 2010 m; 40 m; SE.

(20) San Dimas Canyon Falls (East Fork); 3 km NE of San Dimas Reservoir on the East Fork of the San Dimas Creek; 610 m; n/a; W; 2 falls.

(21) San Dimas Canyon Falls (North Fork); 3 km NE of San Dimas Reservoir on the North Fork of San Dimas Creek; 550 m; 12 m; SW.

(22) Switzer Falls; 5.5 km N of Altadena in Switzer Canyon; 885 m; 15 m; W.

(23) Unnamed falls; 2 km SE of Lytle Creek Ranger Station; 850 m; less than 15 m; E.

(24) Unnamed falls (Waterman Mountain area); 0.5 km W of Kratka Ridge; 1895 m; 20 m; NE.

San Bernardino Mountains

(25) Cold Creek Falls; 1 km NE of Angelus Oaks on Cold Creek; 1730 m; 10 m; N.

(26) High Creek Falls; 2.5 km SW of San Gorgonio Mountain on High Creek; 2740 m; 7 m; S.

(27) Monkeyface Falls; 1.5 km NW of Forest Falls on Monkeyface Creek; 1490 m; 50 m; S.

(28) Mountain Home Creek Falls (East Fork); 3 km S of Angelus Oaks on the East Fork of Mountain Home Creek; 1825 m; 3 m; S.

(29) Unnamed falls; 6.5 km N of Highway 10 in a side drainage to the Whitewater River; 730 m; n/a; SW; flows only after a storm.

San Jacinto Mountains

(30) Falls Creek Falls; 5 km N of San Jacinto Peak on Falls Creek; 730 m; greater than 50 m; N.

(31) Fuller Mill Creek Falls (Lower); 3.5 km N of Pine Cove on Fuller Mill Creek; 1680 m; 10 m; SW.

(32) Fuller Mill Creek Falls (Upper); 3.5 km N of Pine Cove on Fuller Mill Creek; 1735 m; 3 m; SW.

(33) Marion Mountain Creek Falls; 4.5 km SW of San Jacinto Peak; 2170 m; 15 m; W.

(34) Oasis de los Osos Falls; 8 km N of San Jacinto Peak on Oasis de los Osos Creek; 670 m; 15 m; N.

(35) Strawberry Grotto (Lower); 2.5 km W of Idyllwild on Strawberry Creek; 1300 m; less than 5 m; W; 3 separate falls.

(36) Tahquitz Falls; 1.5 km W of Palm Springs on Tahquitz Creek; 270 m; 10 m; E.

Northern Saw-whet Owl

Sketch by Cameron Barrows