Body weights of the Santa Cruz Island Scrub Jay

Jonathan L. Atwood

The highly distinctive Santa Cruz Island Scrub Jay, *Aphelocoma coerulescens insularis*, is entirely restricted in its geographic distribution to Santa Cruz Island, Santa Barbara County, California. Located approximately 18 miles from the nearest mainland point, Santa Cruz Island has probably been separated by at least a narrow water barrier from the southern California mainland since at least early—mid Pleistocene times (Wenner and Johnson, *in press*). Although the history of *A. coerulescens* on Santa Cruz Island is uncertain (Atwood, 1978), the rather pronounced morphological differentiation of *insularis* from mainland Scrub Jay forms suggests a considerable period of genetic as well as geographic isolation for the island population (Johnson, 1972). Differentiation of *insularis* has occurred primarily in the characteristics of size and plumage coloration. Pitelka (1951) found that bill length of the Santa Cruz Island Scrub Jay averaged 20.7% larger than that of the adjacent mainland subspecies, *A. c. californica*, with similar size increases being found in measurements of wing, tail, and tarsus. In plumage characteristics, *insularis* is much darker than *californica*, with more intensely blue coloration being found in the island population (Pitelka, 1951). The selective factors responsible for the Santa Cruz Island Scrub Jay's plumage differentiation appear unclear at present (Atwood, 1978); however, the subspecies' size differentiation is likely due to an ecological shift resulting from the depauperate insular avifauna (Pitelka, 1951; Yeaton, 1974).

Thorough morphological comparisons of the Santa Cruz Island Scrub Jay with mainland jay populations were presented by Pitelka (1951). Only recently, however, have long-term field studies of *insularis* provided specific data on the breeding biology and social behavior of the subspecies (Atwood, 1978). In conjunction with these ongoing behavioral studies of the Santa Cruz Island Scrub Jay, considerable body weight data were obtained and are summarized here.

Methods

A total of 248 Santa Cruz Island Scrub Jays were marked with unique color band combinations between January 1975 and November 1977. Eleven of these individuals were banded as nestlings; the remainder were captured using simple wire mesh ground traps baited with peanuts and sunflower seeds. Captured birds were aged according to the criteria established by Pitelka (1945); especially useful were the characteristics of color and shape of the greater primary coverts and shape of the rectrices. While actively breeding females could be sexed by the presence of a brood patch, the cloacal protuberance of known breeding males was so slight as to render this character useless in sex identification. Therefore, the sex of most individuals was determined by the behavior of pairs at nests and by sexual differences in vocalizations (Atwood, 1978; Barbour, 1977). Body weights were measured to the nearest gram with a 300-gram Pesola balance calibrated in 2-gram increments.

Results and discussion

Published data on the body weights of the Santa Cruz Island Scrub Jay are limited to a sample of 37 (20 males, 17 females) provided by Pitelka (1951). Substantial amounts of live body weight data were obtained in the present study, and provide new information concerning 1) physiological effects on this species of capturing and handling, 2) sexual dimorphism in body weight, and 3) seasonal variation in body weight.

Weight data from 25 individual Santa Cruz Island Scrub Jays which were recaptured within two days of a previous capture are available in 29 instances. Of these closely spaced recaptures, 52% showed a decrease in weight (mean decrease = 4% of initial body weight), 27% increased in weight (mean increase = 2% of initial body weight), and 21% experienced no weight change. Although these data are too limited to permit a rigorous statistical analysis, there appears to be a general trend of

Table 1. Body weights of selected U.S. subspecies of Aphelocoma coerulescens.

Subspecies	Distribution	Body Weight (mean (range, sample size)) Males	Females
californica[1]	coastal central California	94.2 (84-107, n-29)	85.5 (80-93, n-18)
oocleptica[1]	San Francisco Bay region, California	103.2 (90-112, n-14)	96.0 (80-107, n-11)
caurina[1]	coastal northern California	98.4 (87-111, n-29)	87.7 (80-97, n-9)
obscura[1]	coastal southern California	78.6 (70-93, n-57)	70.8 (59-76, n-26)
insularis[1]	Santa Cruz Island, California	124.7 (100-147, n-20)	111.2 (100-117, n-17)
insularis[2]	Santa Cruz Island, California	120.6 (110-127, n-22)	107.5 (99-115, n-27)
superciliosa[1]	interior Calif, south central Oregon	93.8 (76-108, n-85)	81.2 (61-98, n-74)
nevadae[1]	Great Basin and Arizona	80.3 (69-98, n-56)	73.8 (65-83, n-37)
coerulescens[1]	Florida	78.3 (76-80, n-2)	70 (n-1)

[1]Data from Pitelka (1951).
[2]Data from this study.

slight, short-term weight loss following the experience of being trapped and handled. Such a physiological reaction to handling has been described for a number of migratory passerines (Mueller and Berger, 1966; Leberman and Stern, 1977); the data from the Santa Cruz Island Scrub Jay suggest that the phenomenon of "handling shock" may also occur in permanently resident species. In the following analysis of sexual differences in body weight and seasonal variation in body weight, only initial values were utilized in the calculations for those instances in which individual jays were recaptured several times during a two or three day period. Mean weight values were used in the analysis of sexual dimorphism in body weight when data for a given individual were available from several widely separated dates.

Pitelka (1951) found that in all Scrub Jay populations males averaged larger than females in all morphological characters, including body weight (Table 1). In the present study, the mean weight of known males was 120.6 grams (n=22), and the mean weight of known females was 107.5 grams (n=27). The difference between these values is statistically significant at the 95% confidence level. However, there is considerable overlap in the weights of males and females (Fig. 1); this fact, coupled with seasonal body weight variations described below, makes it difficult to sex with confidence most individuals by weight alone. Pitelka's (1951) mean weights for *insularis* were 124.7 grams (males) and 111.2 grams (females); these higher values probably reflect the fact that Pitelka's sample was composed mostly of specimens collected during the fall months, when both sexes show a tendency to increase slightly in weight.

A total of 16 individuals (7 known males, 5 probable males, 1 known female and 3 unknown sex) were captured at least once during each of the four seasons (spring, March—May 15; summer, May 15—July; fall, August—November; winter, December—February). The mean weight values for this sample during each of these periods are presented in Table 2. While the differences are not statistically significant at the 95% confidence level due to the small sample sizes and the minor weight variations involved (less than 5% of the mean weight of the individual), the mean values do suggest that maximum body weights occur during the fall and minimum body weights occur during the winter. These trends are more clearly evident from Figure 2, in which the pattern of weight variation has been evaluated individually for each of these 16 repeatedly recaptured jays; 56% of the individuals showed their maximum weight during the fall months and 56% were at their minimum weight during the winter months. I suspect that these relatively minor weight variations, if in fact real and not merely an artifact produced by small sample size, mainly reflect the availability of food during each of these periods. The dates of maximum body weights coincide with the presence of an abundant food supply in the form of the fall acorn crop; similarly, the minimum body weights of the winter months would appear to follow the period of maximum acorn supply and precede the period of maximum arthropod abundance in the spring (Atwood, 1978).

I have presented elsewhere data indicating the presence of a non-breeding component in the Santa Cruz Island Scrub Jay population (Atwood, 1978). These non-breeding individuals, which in-

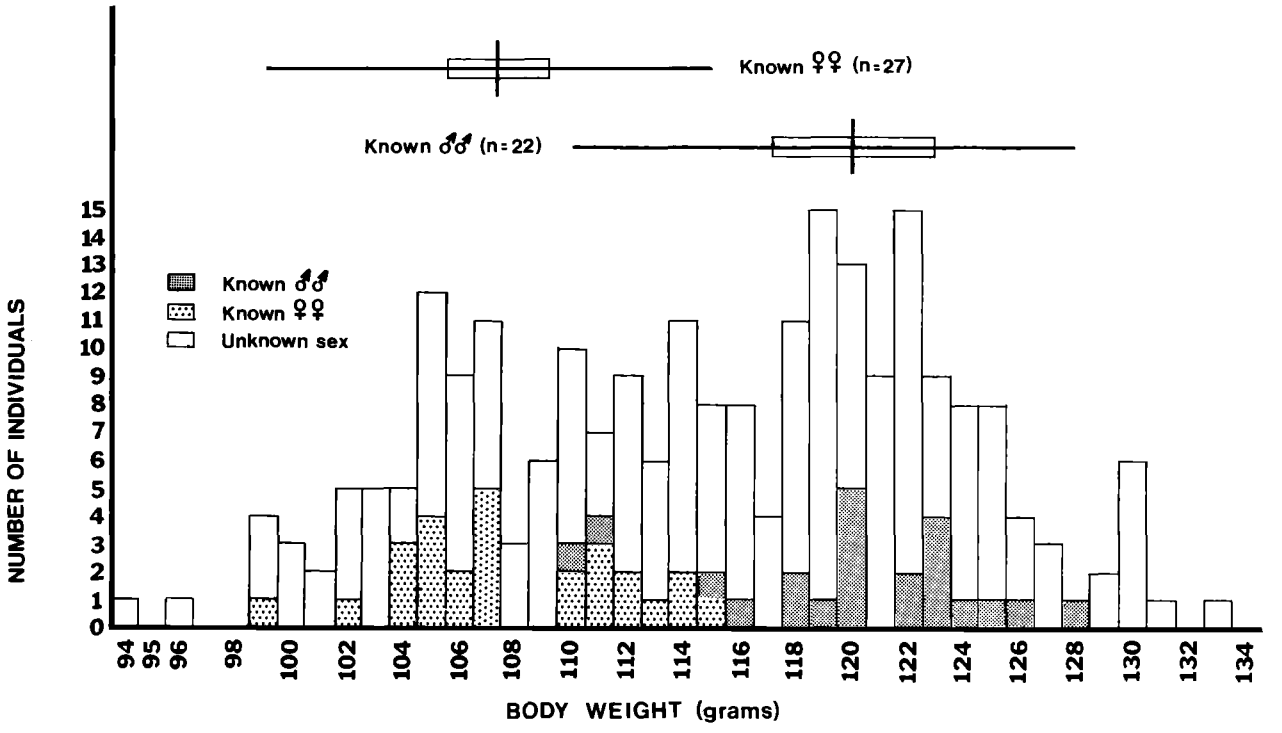


Fig. 1. Body weights of the Santa Cruz Island Scrub Jay (n=236). Sex indicated where known on the basis of breeding characters, vocalizations, and/or behavior. For individuals of known sex, sample range (horizontal bar), mean (vertical bar), and 2 standard errors of the mean (open rectangle) are indicated.

clude birds ranging from 1 to at least 3 years of age, form loose groups or flocks which forage throughout the year in habitat which appears to be marginal, at least in terms of available territories with suitable nesting sites. Presumably this social system is associated with the limited insular environment, the low mortality rate of fledged jays, and the stability of breeding pairs and territories; some birds may simply be unable to obtain a suitable breeding territory in the packed insular environment. Although resembling the Florida Scrub Jay, *A. c. coerulescens*, in the presence of non-breeding individuals older than 1 year of age, the Santa Cruz Island Scrub Jay does not have the well-developed helper system which characterizes the Florida subspecies (Woolfenden, 1975; Woolfenden and Fitzpatrick, 1978). In apparent contrast to the poorly studied western mainland Scrub Jay populations, in which yearling birds breed at least occasionally (Ritter, 1972; Verbeek, 1973), I obtained no evidence of breeding 1-year-old Santa Cruz Island Scrub Jays.

Although data correlating breeding status with body weight in the Santa Cruz Island Scrub Jay are very limited, certain interesting questions are raised by the information which is available. In comparing the body weights of 9 known non-breeders with those of known breeding individuals on 4 widely separated dates, the weight values of non-breeders frequently appear to be less than those of breeders (Fig. 3). Conclusive analysis of these data is impossible because of the small sample sizes involved, the weight variation exhibited by a given sex, and the uncertain sex determination of many of the non-breeding birds included in the sample. However, several observations raise

Table 2. Annual variation in body weight of Santa Cruz Island Scrub Jays.[1]

Capture Dates	Mean Weight (g)	95% Confidence Interval
March-May 15	116.3	113.0-119.6
May 15-July	116.6	114.1-119.1
August-November	119.5	116.4-122.6
December-February	115.5	113.3-117.7

[1] Based on a sample of 16 individuals captured at least once during each of the four time periods.

potentially significant questions. Of 3 non-breeding females older than 1 year of age, 2 were exceptionally light weight individuals (96 and 99 grams); 97% of the total sample of 236 body weights obtained during the study were greater than the weights of these 2 birds. Furthermore, 1 of these small jays is known to have been a non-breeder for at least 3 consecutive breeding seasons, making it the oldest known non-breeder (at least 3 years of age in 1978) I have yet encountered. Of the 4 non-breeders of unknown sex and older than 1 year of age, all weighed less than comparable mean values of known breeding males, and 3 of these birds were furthermore at the low end of the weight range of all known males. These facts suggest that these unknown sexed birds were either small males or females. Of the five yearling non-breeders (all of unknown sex), all weighed less than the comparable mean values for known breeding males; however, this is perhaps less significant than the other observed trends, since Pitelka (1951) presented evidence suggesting that yearling Scrub Jays of both sexes regularly weigh slightly less than older birds.

These data suggest two possible interpretations. First, the lack of non-breeders with heavier weight values could suggest that most of the captured non-breeders were females. The substantiation of this hypothesis would require proof of either a) an in-balance in the sex ratio of the population, or b) a trapping bias resulting in the capture of more females than males. I feel that both of these possibilities are very unlikely (in fact, if any trapping bias was observed during my study, it was in favor of males being captured more readily than females). The second possible interpretation is that non-breeders do, in fact, average less in body weight than established breeders. This might result from a) small (as well as young) jays being unable to obtain breeding territories or b) non-breeders being undernourished as a result of being restricted to marginal habitats with less than optimal food resources. The 2 small, known female non-breeders discussed above were characterized by overall below-average body measurements (bill, tarsus, wing); rather than being "average-sized" birds with below-average body weights, these individuals were small in all body characters, including weight. I suspect that some non-breeding Santa Cruz Island Scrub Jays (especially those older than 1 year of age) may be unable, because of their small size, to obtain and defend, successfully, suitable nesting territories. The second hypothesis, that non-breeders weigh less as a result of poor food availability in the marginal habitats where they forage, seems less likely to me. Finally, it should be underscored at this point that relevant data concerning body weights and the individual's breeding status in the population are so limited that any of the observed patterns shown by the presently-available information should be considered as tentative suggestions only. They do raise some interesting speculations as well as indicate the need for additional conclusive evidence.

Summary

As a result of banding operations conducted as part of an ongoing behavioral study of the Santa

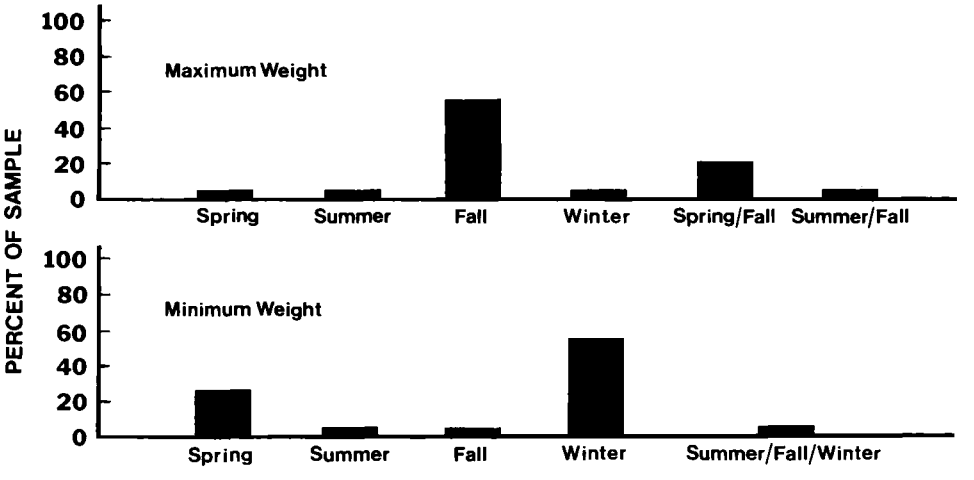


Fig. 2. Seasonal variation in body weight of the Santa Cruz Island Scrub Jay. The occurrence of maximum and minimum body weights is shown for individuals captured during each of the four seasons (n=16). Slashed lines (e.g. Spring/Fall) indicate that identical maximum or minimum weight values occurred during the periods shown.

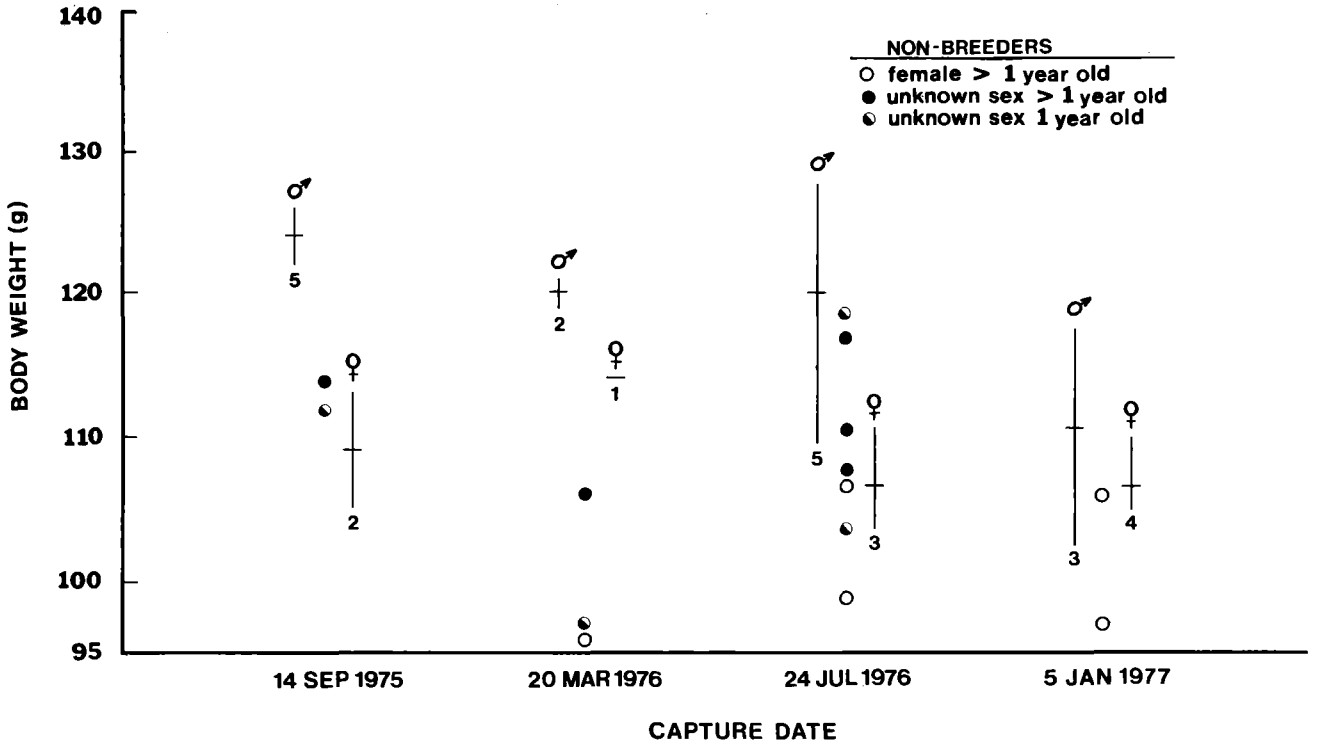


Fig. 3. Relationship between body weight and breeding status in the Santa Cruz Island Scrub Jay. Range of weight values for known breeders is indicated with vertical bars for each sex, and horizontal bars indicate mean values; sample size (n) is provided underneath vertical bars. Weight values for known non-breeding individuals are given by indicated symbols.

Cruz Island Scrub Jay, large amounts of data were gathered concerning live body weights of this isolated subspecies.

The mean weight of known male Santa Cruz Island Scrub Jays was 120.6 grams, and that of known females 107.5 grams. Although the difference between these values is statistically significant, considerable overlap in the body weights of males and females, coupled with minor seasonal variations in body weight, make it impossible to sex many individuals by weight alone. Santa Cruz Island Scrub Jays appear to lose small amounts of weight temporarily as a result of being captured; such a response resembles the phenomenon of "handling shock" which has been described in several migratory species. Santa Cruz Island Scrub Jays show limited seasonal variation in body weight; both sexes appear to be at their maximum weights during the fall months (August—November) and at their minimum weights during the winter months (December—February).

Although far more study is needed, limited data suggest that non-breeding Santa Cruz Island Scrub Jays may, on the average, weigh less than comparably sexed breeding birds. If true, body weight (size) may prove to be one of the factors involved in determining the non-breeding status of these individuals.

Acknowledgements

I wish to express my gratitude to Drs. Charles T. Collins, Stuart L. Warter, and Glen E. Woolfenden for their valuable insights and assistance during this study. Field aspects of this research would have been impossible without the cooperation of Dr. Carey Stanton of the Santa Cruz Island Co. and Dr. Lyndal L. Laughrin and Ms. Marla Daily of the University of California Santa Cruz Island Reserve. Special thanks are due my wife, Judy, for her patient support throughout this study.

Financial support was partially provided by the Frank M. Chapman Memorial Fund of the American Museum of Natural History, the El Dorado Audubon Society, the Pasadena Audubon Society, and Mr. William R. Atwood.

Literature cited

Atwood, J.L. 1978. The breeding biology of the Santa Cruz Island Scrub Jay, *Aphelocoma coerulescens insularis*. Unpublished M.A. thesis, California State University, Long Beach.

Barbour, D.B. 1977. Vocal communication in the Florida Scrub Jay. Unpublished M.A. thesis, Univ. of South Florida, Tampa.

Johnson, N.K. 1972. Origin and differentiation of the avifauna of the Channel Islands, California. *Condor* 74:295-315.

Leberman, R.C. and M.A. Stern. 1977. Handling-induced shock in migrant songbirds. *North Amer. Bird Bander* 2:50-54.

Mueller, H.C. and D.D. Berger. 1966. Analysis of weight and fat variations in transient Swainson's Thrushes. *Bird-Banding* 37:83-112.

Pitelka, F.A. 1945. Pterylography, molt and age determination of American jays of the genus *Aphelocoma*. *Condor* 47:229-260.

Pitelka, F.A. 1951. Speciation and ecologic distribution in American jays of the genus *Aphelocoma*. *Univ. of California Publ. Zool.* 50:195-464.

Ritter, L.V. 1972. The breeding biology of Scrub Jays. Unpublished M.A. thesis, California State University, Chico.

Verbeek, N.A.M. 1973. The exploitation system of the Yellow-billed Magpie. *Univ. of Calif. Publ. Zool.* 99:1-58.

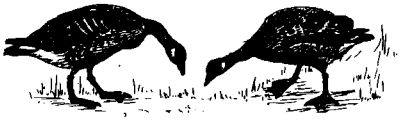
Wenner, A.M. and D.L. Johnson. *In press.* Land vertebrates on the islands: sweepstakes or bridges? *In* Power, D.M. (ed.), The California Islands: A Multidisciplinary Symposium. Santa Barbara Natural History Museum.

Woolfenden, G.E. 1975. Florida Scrub Jay helpers at the nest. *Auk* 92:1-15.

Woolfenden, G.E. and J.W. Fitzpatrick. 1978. The inheritance of territory in group-breeding birds. *BioScience* 28:104-108.

Yeaton, R.I. 1974. An ecological analysis of chaparral and pine forest bird communities on Santa Cruz Island and mainland California. *Ecology* 55:959-973.

Dept. of Biology, Calif. State Univ., Long Beach, CA 90802. Present address: Dept. of Biology, Univ. of Calif., Los Angeles, CA 90024.



Another round-trip journey of a banded bird

Ralph W. Dexter

Robert A. Montgomery reported (1979) banding a Brown-headed Cowbird *(Molothrus ater)* on 9 June 1971 near Dundee, Illinois, which was retrapped at Horicon, Wisconsin on 30 August 1971 by Harold Mathiak. Subsequently, it was retrapped again by Montgomery on 27 June 1972 at the original banding site. He also reported knowing of only one other similar record, that published by Amelia R. Laskey on the round-trip of a Purple Finch *(Carpodacus purpureus)* (see Montomgery's note for details). However, another such record was overlooked.

Dexter and Hight (1954) published an account of a banded Chimney Swift *(Chaetura pelagica* L.) which made a round-trip between Rome, Georgia, and Kent, Ohio (some 840 km apart). Gordon L. Hight, Jr. banded a swift with #51-88053 at Rome, Georgia, on 27 September 1953. It was retrapped as a foreign recovery by me at Kent, Ohio, on 14 May 1954 and retrapped again by Gordon Hight on 19 September 1954 at the original banding site in Rome, Georgia. Details of the banding and recoveries of this swift and the other swifts associated with it will be found in our note published in *Bird-Banding.*

Literature cited

Dexter, Ralph W. and Gordon L. Hight, Jr. 1954. Reciprocal Ohio-Georgia recoveries of banded Chimney Swifts. *Bird-Banding* 25:150-151.

Montgomery, Robert A. 1979. Round-trip journey of a Brown-headed Cowbird. *N. Amer. Bird Bander* 4:109.

Department of Biological Sciences, Kent State University, Kent, Ohio 44242.