Latitudinal variation in length of Barn Swallow tails in North America

Robert M. Patterson

Introduction

During the summer of 1981 I studied the breeding biology of Barn Swallows *(Hirundo rustica)* at the Merkle Wildlife Management Area at Croom, Prince George's County, Maryland. I mist netted, banded and measured all adults, noting the richness of breast color. Birds were referred to light, medium, and dark breast color groups (Table 1). Males showed a significant increase in tail length from light to dark color groups. A similar trend in females approached significance. These data suggest that tail length and richness of breast color increase with age in Barn Swallows.

Mean tail length of swallows at Merkle W.M.A. were compared with those of birds at West Virginia breeding colonies reported by Samuel (1971, 1972). Assuming the sex ratio of his sample was similar to mine, Samuel's mean was smaller than that found in my study. However, means that he obtained from specimens in the Carnegie Museum were virtually identical to those I obtained from living birds. I thought it odd that he did not get similar means from live birds and study skins. To check my field data further I measured specimens in the collections of the National Museum of Natural History (Smithsonian Institution, Washington, D.C., formerly U.S. National Museum) and the Carnegie Museum, Pittsburgh, Pennsylvania.

Results and Discussion

My field measurements compared favorably with those of specimens collected at about the same latitude in North America (Table 2). More importantly, I found a considerable variation in mean tail length for Barn Swallows breeding toward the northern and southern limits of their range. This clinal variation, although based upon limited data, appears large enough to question the use of the sexing couplet contained in the *Bird Banding Manual* (hereafter the *Manual)* key, at least in some parts of North America where breeding birds are banded. Use of this key may also be questioned when migrating birds are banded S of Lat. 42°N. Here, relatively long-tailed northern females without brood patches may be easily mistaken for males.

Table 1. Tail measurements (mm) of male Barn Swallows banded at Merkle W.M.A., 1981, according to breast color grouping.

Breast color	N	Range	Mean	S.D.	S.E.	%>91 mm
Light	14	76-90	81.4*	4.04	1.08	0.0
Medium	38	75-97	83.9	5.28	0.86	11.0
Dark	21	78-101	87.5*	5.83	1.27	18.0

*Difference significant, P = 0.05

Table 2. Tail lengths (mm) of Barn Swallows showing clinal variation. Data from specimens in collections at National Museum of Natural History and Carnegie Museum, Burleigh (1942), and from live birds at Croom, MD.

	Females				Males			
Region	N	$\bar{X}$	S.D.	S.E.	N	$\bar{X}$	S.D.	S.E.
Canada-Alaska[1]	18	78.389	5.552	1.347	18	88.333	6.272	1.521
42°N to Canada[1]	24	77.208	5.335	1.112	41	88.000	6.011	.939
37°N to 42°N[2]	39	74.410	4.394	.704	54	86.278	6.454	.878
Croom, MD	63	73.220	4.630	.583	73	85.500	5.370	.630
37°N to Mexico[2]	11	73.182	4.327	1.368	38	82.868	6.239	1.012
Mexico	2	73.000	—	—	9	79.220	1.885	.667
Summary								
42°N Northward[1]	42	77.714[3]	5.460	.842	59	88.102[4]	6.152	.801
42°N Southward[2]	50	74.140	4.411	.624	92	84.870	6.581	.686
42°N Southward[2] (June-July only)	24	75.292[3]	4.852	1.012	28	84.250[4]	6.722	1.294
H.r. insularis[5]								
N.M.N.H. sample	5	70.000	—	—	12	83.580	4.555	1.373
Burleigh (1942)	6	76.000	—	—	12	87.200	—	—
Combined samples	11	73.270	—	—	24	85.390	—	—

[1,2] Summary data drawn from regional samples above.

[3,4] Differences significant, P=0.05.

[5] Proposed Gulf Coast race; see text.

In the case of Barn Swallows, the *Manual* key permits the use of tail measurements to determine sex when neither brood patch nor cloacal protuberance is present. Such would be the case in all spring migrants and almost all late-summer migrants. When the adults are trapped at nesting colonies they are sexed easily by noting the presence of brood patch (female) or cloacal protuberance (male). Females may develop a brood patch a week or more before laying begins, and the

ventral apterium will remain featherless until the post-nuptial molt, which normally occurs south of the United States. The cloacal protuberance becomes noticeable as sexual activity heightens prior to the onset of laying, but regresses about the time nesting activity ceases or shortly thereafter.

It is assumed that tail length sexing criteria in the *Manual* key results in at least 95 percent sexing accuracy. The key directs that birds having tails 74 mm or shorter be sexed female, while those 83 mm or longer be sexed male. Birds with tails falling within the overlap area (75-82 mm) are to be considered "sex unknown." In Maryland, about two-thirds of all birds could be sexed using the key. When I compared results obtained by applying the key against data derived from brood patches and cloacal protuberances, I found the key's accuracy to be highly satisfactory.

Table 3 shows the rate of error produced by the *Manual* key when it was applied to birds of known sex in the museum collections. The percentage of sexing error appears to become excessive N of Lat. 42°N, in the case of females. Figure 1 shows the distribution of tail lengths for specimens collected N and S of Lat. 42°N and for breeding birds at Merkle W.M.A. These data suggest the present key overlap area is adequate to achieve 95 percent accuracy S of 42°N, but that a different overlap area is indicated for more northerly breeding birds.

I must emphasize the tentativeness of these findings. First, I am assuming that all specimens in the collections are properly sexed. Second, the sample sizes are small and probably do not represent a true cross section of Barn Swallows from each latitudinal area, either geographically or by age class. Examination of the data for Fig. 1 reveals that tail measurements are not uniformly distributed about the means, and would not result in a normal or Gaussian distribution curve. This could be the result solely of small sample size. If, on the other hand, age is a factor in determining tail length in this species, a normal distribution would not be expected unless the data were weighted to account for age-dependent variation. Many of the museum specimens appear to have darkened with age, and I was not able to refer them properly to breast color groups in order to weight these data.

To illustrate the problem with small samples, see Table 2 for data regarding *H. r. insularis*, a proposed subspecies not yet accepted by the A.O.U. Committee on Classification and Nomenclature (A.O.U. 1957). Means are given for 5 females and 12 males in the N.M.N.H. collection, donated by T.D. Burleigh who nominated the race. The next line of the Table shows means for 6 females and 12 males as given by Burleigh (1942) when proposing the new subspecies. Because the samples are small they are quite different, and the means for the samples combined do not fit the pattern of clinal variation suggested by all other samples, but closely approximate means for Maryland birds. Table 2 also shows means for all specimens collected S of Lat. 42°N and, from within this sample, for birds collected during June and July, when northern migrants probably were not present. Males collected during this period had tails slightly shorter than the sample that included migrants, but the reverse was found for females. This anomaly was probably caused by small sample size.

Much larger samples are needed from many points, both north and south, as well as east and west, to study better the phenomenon of clinal variation in Barn Swallow tail length. Banders can help greatly in this study.

Table 3. Analysis of museum specimens sexed according to instruction in Bird Banding Manual key for Barn Swallows, using tail length.

Females

Region by latitude	Sample size	Key sexes correctly (No.) (%)	Overlap[1] area (No.) (%)	Key sexes opposite (No.) (%)
S of 37°N	11	7 (64)	4 (36)	0
37° to 42°	39	19 (49)	19 (49)	1 (03)
42° to Canada	24	7 (29)	14 (58)	3 (13)
Canada-Alaska	18	4 (22)	10 (56)	4 (22)
Totals	92	37 (40)	47 (51)	8 (09)
Merkle W.M.A., MD (Live birds, 1981) Latitude 38.4°N	63	44 (70)	17 (27)	2 (03)

Males

Region by latitude	Sample size	Key sexes correctly (No.) (%)	Overlap[1] area (No.) (%)	Key sexes opposite (No.) (%)
S of 37°N	38	16 (42)	20 (53)	2 (05)
37° to 42°	54	36 (67)	18 (33)	0
42° to Canada	41	31 (76)	10 (24)	0
Canada-Alaska	18	13 (72)	5 (28)	0
Totals	151	96 (64)	53 (36)	2 (01)
Merkle W.M.A., MD	74	43 (58)	31 (42)	0

[1] 75-82 mm, females shorter, males longer.

Special Significance in Southeast

The occurrence of Barn Swallows as breeding birds in the deep southeastern United States is a fairly recent event. A small population noted by Burleigh (1942) has been limited to a few Gulf Coastal Islands, mainly in Alabama and Louisiana. Sample sizes from this population and from birds breeding in Mexico are too small to permit adequate comparison to the rest of the population breeding S of Lat. 37°N.

Barn Swallows were considered uncommon as breeding birds in Tennessee (Gainer 1922), North Carolina (Pearson, et al 1942) and South Carolina (Sprunt and Chamberlain 1949) until well after 1900. A southward

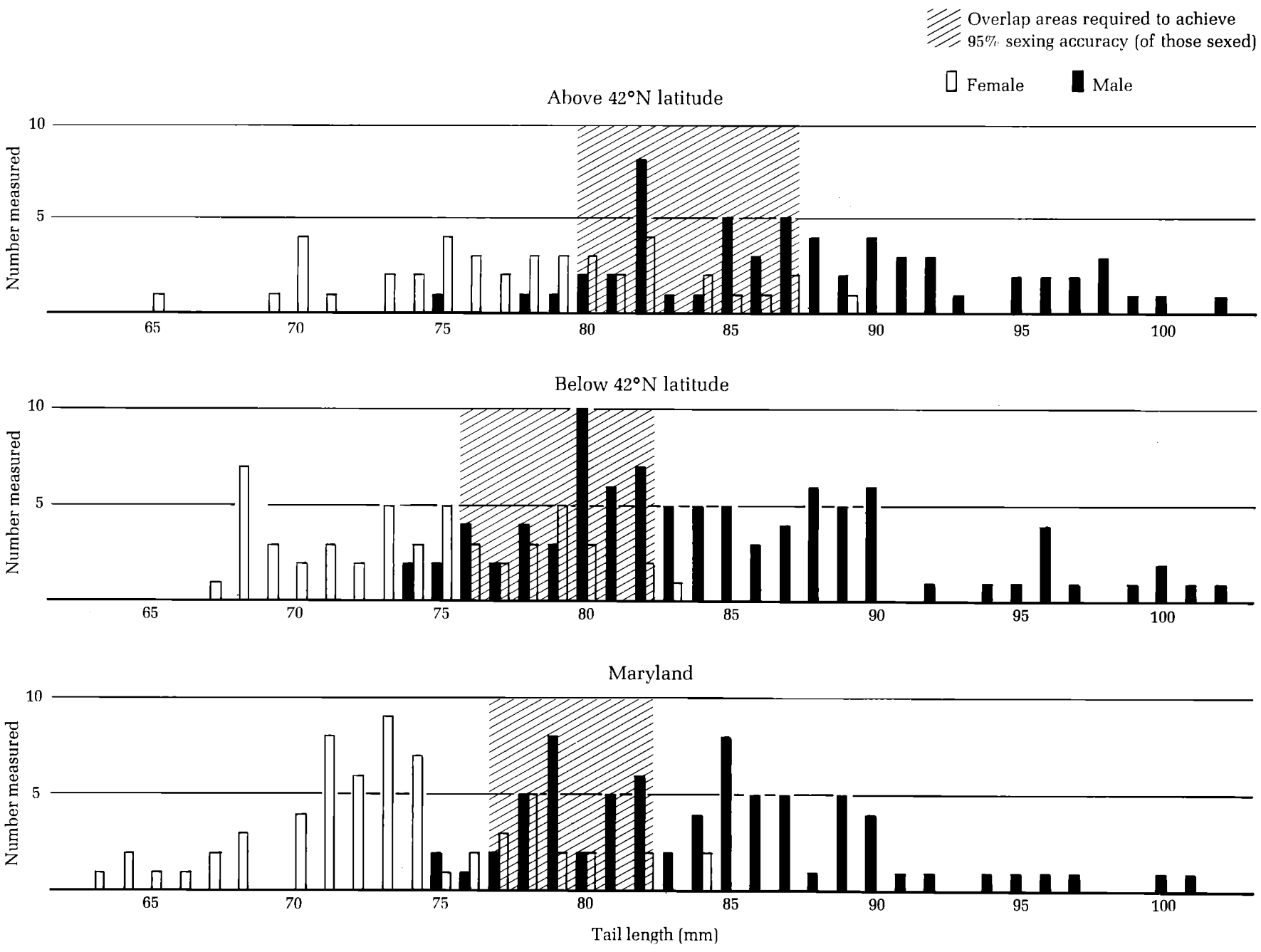

Figure 1. Distribution of Barn Swallow tail lengths by latitudinal area based upon museum specimens and upon live birds breeding in Maryland.

expansion of the species' range has been noted since the 1960's in Georgia (Denton 1969), Florida (Stevenson 1978), Alabama (Jackson and Weeks 1976, Ortego 1977), Mississippi (Jackson and Burchfield 1975) and Louisiana (Goertz and Mowbray 1970). Using data collected by the U.S. Fish and Wildlife Service' Breeding Bird Survey, Bystrak (1979) mapped the range expansion occurring between 1966-1973. According to the most recent Breeding Bird Surveys (D. Bystrak, pers. comm.), this southward range expansion is continuing at a somewhat slower pace than previously reported, but has nearly reached the Gulf Coast in some areas. It would be worthwhile to collect data from this southern population so that, perhaps many years from now, it may be determined whether or not tail length or other measurable features have undergone changes corresponding to the clinal variation noted here.

Differences in Wing Chord

Slight differences in wing chords were found between birds collected N of Lat. 42°N (longer) and those collected south of this line. Similarly, birds collected W of Longitude 95°W had slightly longer wings than their eastern counterparts. Although males measured about 1 mm longer than females, there was an almost complete overlap in wing measurements between the sexes. Differences in wing chords based on sex, latitude and longitude were not statistically significant. I conclude that wing chord in Barn Swallows is not a useful indicator of sex.

Cooperation Requested

If you have Barn Swallow records which include tail length and data regarding presence or absence of brood patch or cloacal protuberance, I would appreciate hearing from you. Even a few records are valuable since they can be combined with those from other banders from the same state, province or latitudinal area. Banders who are interested in collecting data but who may be unfamiliar with trapping methods or sexing procedures, are invited to write to me. I will be happy to provide instructions and reporting forms that are too lengthy to include here.

Summary

Tail lengths of Barn Swallows, *Hirundo rustica*, in museum collections were compared with measurements from birds breeding in Maryland. A clinal variation was found that may be statistically significant. Birds breeding N of Lat. 42°N averaged larger than those nesting elsewhere. These differences may require that the *Bird Banding Manual*, Vol. II, age-sex key for Barn Swallows be modified to reduce sexing error. Additional data are needed to assess the extent of the problem. Banders are requested to contribute data from their records and/or collect data from breeding birds in 1982.

Acknowledgments

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12601 Buckingham Drive, Bowie, MD. 20715