SEX RATIOS IN THE HOUSE SPARROW: SOURCES OF BIAS

By Donald A. Beimborn

The House Sparrow (*Passer domesticus*) is appropriate for an inquiry into sex ratios of birds because it is one of the few common species in which sex can be distinguished in all plumages for most individuals. Previous studies (Piechocki, 1954; Summers-Smith, 1963) have reported that the sex ratio of the House Sparrow differs from unity. "Fisher's principle" states that, as long as the effort involved in producing either of the two sexes is equal, they will be produced in equal numbers (Fisher, 1958). Differential mortality of either sex or polygamy has no effect on this principle. Yet, sampling from bird populations frequently demonstrates bird sex ratios that differ from unity. These ratios may be as low as .45 males to each female (McIlhenny, 1940) or as high as five males to each female (Mayr, 1939). The source of the bias which results in the different sex ratios is not well established. McIlhenny (1940) notes that more female blackbirds (the species to which he refers is unclear) will enter decoy traps when females are used as a decoy than will enter traps if a male decoy is used. He also notes that the hunter will often select for one sex, making sex ratios obtained from hunters' bags subject to bias for that reason. A potential source of bias resulting in sex ratios differing from unity when computed from bird banding data is discussed in this paper.

It is not the intent of this paper to discuss theory related to sex ratios either aberrant or at unity. Treatments of this aspect may be found in papers by Giesel (1972) and Hamilton (1967). Although it would be interesting to compare sex ratios in House Sparrow populations which exist today with those of the populations which existed as the bird was spreading across the continent, data that would make this possible have not been found.

METHOD

Data for 12,494 House Sparrows banded in the United States from 1950 through 1963 were examined. Edward Peartree of Oconomowoc, Wisc. provided data on the age and sex of 1,471 House Sparrows taken from his banding traps and destroyed from 1946 through 1957. Also available were data from a personal study of the species that resulted in captures of about 2,000 individuals. Only bandings from two sites, at which large numbers were captured, were used.

About 95% of the juvenal-plumaged birds can be sexed by means of a duskiness of the throat and a light spot behind the eye in males (Harrison, 1961a; 1961b). The light spot is occasionally unilateral and may be absent. The throat may be dark in some young females. Of 73 juvenal-plumaged birds three could not be sexed by this combination of characters in a North American sample (Johnston, 1967). The postjuvenal molt takes place about five weeks after the young leave the nest (Dwight, 1900). At this time the chestnut-colored feathers become apparent in the wing

coverts and superciliary area of the males. These characters were used to sex juvenal-plumaged birds trapped by me.

RESULTS

Data made available by the Bird Banding Laboratory are presented in Table 1. The data are assumed to be accurate representations of the information originally submitted to the banding office. The overall record shows a high proportion of males. If months of the year when only adults are present are considered, the same is true. The reason for excluding summer months is that there could be confusion in identifying the immature-plumaged males when the similarly-plumaged adult females are present. Even if only those birds banded as adults are considered, the overabundance of males is still significant as indicated by the high chi-square.

TABLE 1.

Number of males in Fish and Wildlife Service banding records, 1950 through 1963.

	Number banded	Number of males	Percentage of males	χ^2
All ages Jan.-Dec.	12,494	6,590	52.74	37.6**
All ages Dec.-April	4,142	2,368	52.17	85.18**
Adult Jan.-Dec.	7,740	4,060	52.45	18.6**
Adults Dec.-April	2,999	1,741	58.05	77.78**

**Significant at $P > .001$

The Bird Banding Laboratory data are divided into months of the year in Figures 1 and 2. Figure 1 demonstrates that a larger number of females were reported in those months when immatures are present.

The month-by-month record in Figure 2 of the birds banded as immatures indicated that more males were banded except during the month of June. Very few birds were banded as immatures during other months. Significantly, more immature males were identified only in September and October. The majority of the records came from the mid-west and eastern states with about one half of the remainder coming from California.

A number of birds were not included in either figure because they were reported to the banding office as sex unknown. When we take the liberty of including these sex-unknown birds in the group of females, as in Table 2, the greater number of identified males in the sample of banded birds is no longer significant.

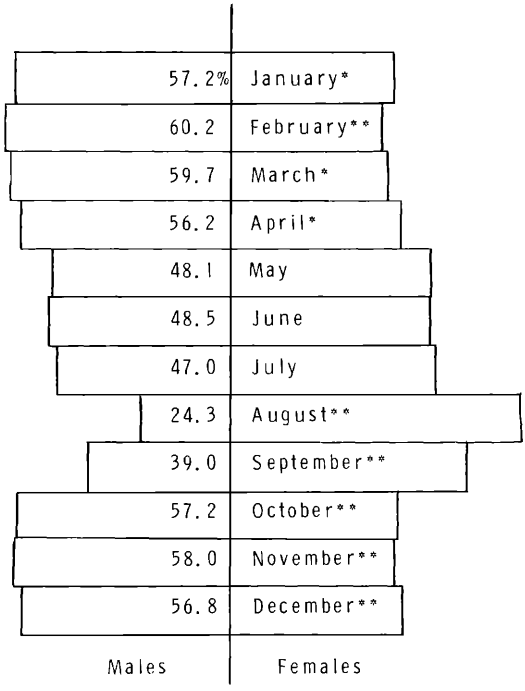

FIGURE 1. Percentage of House Sparrows banded as adult males during months of the year. *Difference significant at $P > .01$; **Difference significant at $P > .001$.

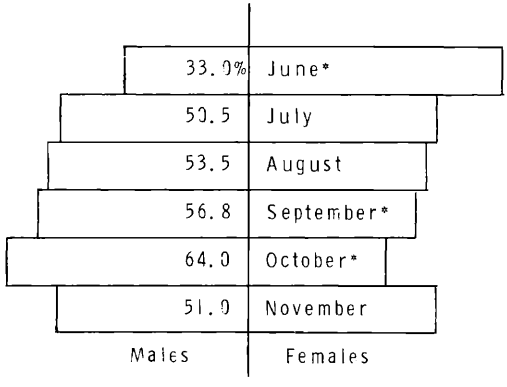

FIGURE 2. Percentage of House Sparrows banded as immature males during months of the year. *Difference significant at $P > .01$.

Trapping effects were also considered as a possible source of the bias. Data collected for which the trapping method is known and in which I am confident of reliability are shown in Table 3. In these data, the sex ratio of the netted birds is nearly at unity whereas

TABLE 2.

Number of males in Fish and Wildlife Service banding records 1950 through 1963.

	Number banded	Number of males	Percentage of males	χ^2
All ages known sex	12,494	6,590	52.74	37.6**
All ages known + unknown sex	12,982	6,590	50.76	3.01

**Significant at $P > .001$

that of the birds captured in baited traps shows significantly more males. This would indicate that there is a difference in susceptibility to capture in traps between the two sexes.

TABLE 3.

Comparison of numbers of males trapped and netted.

Source	Number handled	Number of males	Percentage of males	χ^2
Beimborn traps 1961–66	272	141	51.82	.367
Nichols traps (1934b)	229	119	51.96	.353
Peartree traps 1946–57	1,471	777	52.82	4.68*
All of the above	1,972	1,037	52.58	5.27*
Beimborn nets 1961–66	858	434	50.58	.1165

*$P > .05$

DISCUSSION

Sex ratios of the House Sparrow in Europe are reportedly distributed toward a greater abundance of males (Piechocki, 1954). These data were obtained from a sample of 20,931 birds through winter poisoning campaigns in Germany. Summers-Smith (1963) concludes that the sex ratio of this species is near unity but with slightly more males. He bases his conclusion partly on a study by Nichols (1934a) which reports daily sight records around a feeding

station. Since these counts would inevitably include the same individuals day after day, the large sample size which gives the significant imbalance toward males is invalid. The German study still leaves open the possibility of differential susceptibility of the sexes to the poison used (strychnine-treated grain). In addition, differential winter mortality of the sexes may have preceeded the poisoning.

North American, European, and South American skin specimens indicate a ratio of 1.50 males to each female (Johnston and Selander, 1973). Although many of the European specimens were included in museum collections, most of these birds were collected for the studies. Data from collected birds were not included in this discussion because of the possible bias of the collector and curator toward the more strikingly colored males.

My netted sample does not contradict the hypothesis that the sex ratio is at unity for this species. It is difficult to explain how netting could do otherwise than take samples of either sex in the proportion in which they exist in the population as long as the birds remain in mixed sex flocks. The samples which were taken in baited traps indicate the possibilitity of greater susceptibility to trapping in the males of the population.

In the banding record, the fact that more immatures were identified as males in most months indicates that a large number of immature females were being recorded as sex unknown. This same type of bias is involved in the sample of birds banded as adults in Figure 1. Thus, the banders erred on the conservative side by taking most of the unknowns from the ranks of the females. This has inflated the relative number of males in the sample.

These data all deal with the sex ratio of free-flying birds. The possibility of differential mortality with respect to sex, acting on the primary sex ratio to produce this secondary sex ratio near unity, cannot be excluded.

The House Sparrow is not unique in that its sex can be determined with reasonable accuracy in all plumages. However, the fact that this determination is possible does not seem to be well known. It would be of interest to examine other sets of banding data for which sex can be determined in all plumages and compare that sex ratio information with the data presented here.

CONCLUSION

There is no evidence to conclude that the sex ratio of the House Sparrow populations in North America is anything but unity. Samples show a bander's tendency to include adult females as sex unknowns in their records. Males may be more susceptible to capture by baited traps, again increasing the numbers of males in the trapped sample. Mist nets do not appear to select for either sex.

It is likely that large numbers of birds in the banding records were caught in baited traps. The different susceptibility to trapping in the two sexes has an effect on the overall sex ratios of the birds in the Bird Banding Laboratory files.

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