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## INTRODUCTION

Wing chord measurements are used to determine the sex of many species of birds. In owls, females are larger than males (Mueller 1986), although there is considerable overlap in North American species of *Strix, Otus,* and *Aegolius* (Earhart and Johnson 1970). Criteria have been suggested for sexing the Northern Saw-whet Owl *(Aegolius acadicus)* by wing chord (Sheppard and Klimkiewicz 1976, Anon. 1980, Weir et al. 1980, and Buckholtz et al. 1984). These criteria are based upon the data reported by Earhart and Johnson (1970). Mueller (1990) suggested that the published criteria for sexing saw-whets have a limited basis and result in many owls being sexed incorrectly. This paper discusses these criteria, the accuracy of field measurements, the unexpected high percentage of owls identified as females using these criteria in a sample of birds captured during spring in upstate New York, and supports Mueller's contention that the current criteria for sexing saw-whets should not be used.

## METHODS

Northern Saw-whet Owls were captured during the spring (1981-1988) along the south shore of Lake Ontario at the Richard A. Noyes Sanctuary, Nine Mile Point, New York (Slack et al. 1987). Wing chord measurements were taken on both wings of each owl. Birds were assigned to a sex category (M, F, or U) using the mean wing chord and criteria given in the Bird Banding Manual (Anon. 1980).

## RESULTS AND DISCUSSION

A total of 150 Northern Saw-whet Owls was captured. Eleven were classified as males, 46 as females, while 93 could not be sexed (Table 1). No males were identified during three of the years.

### Comparison of Right and Left Wing Chord

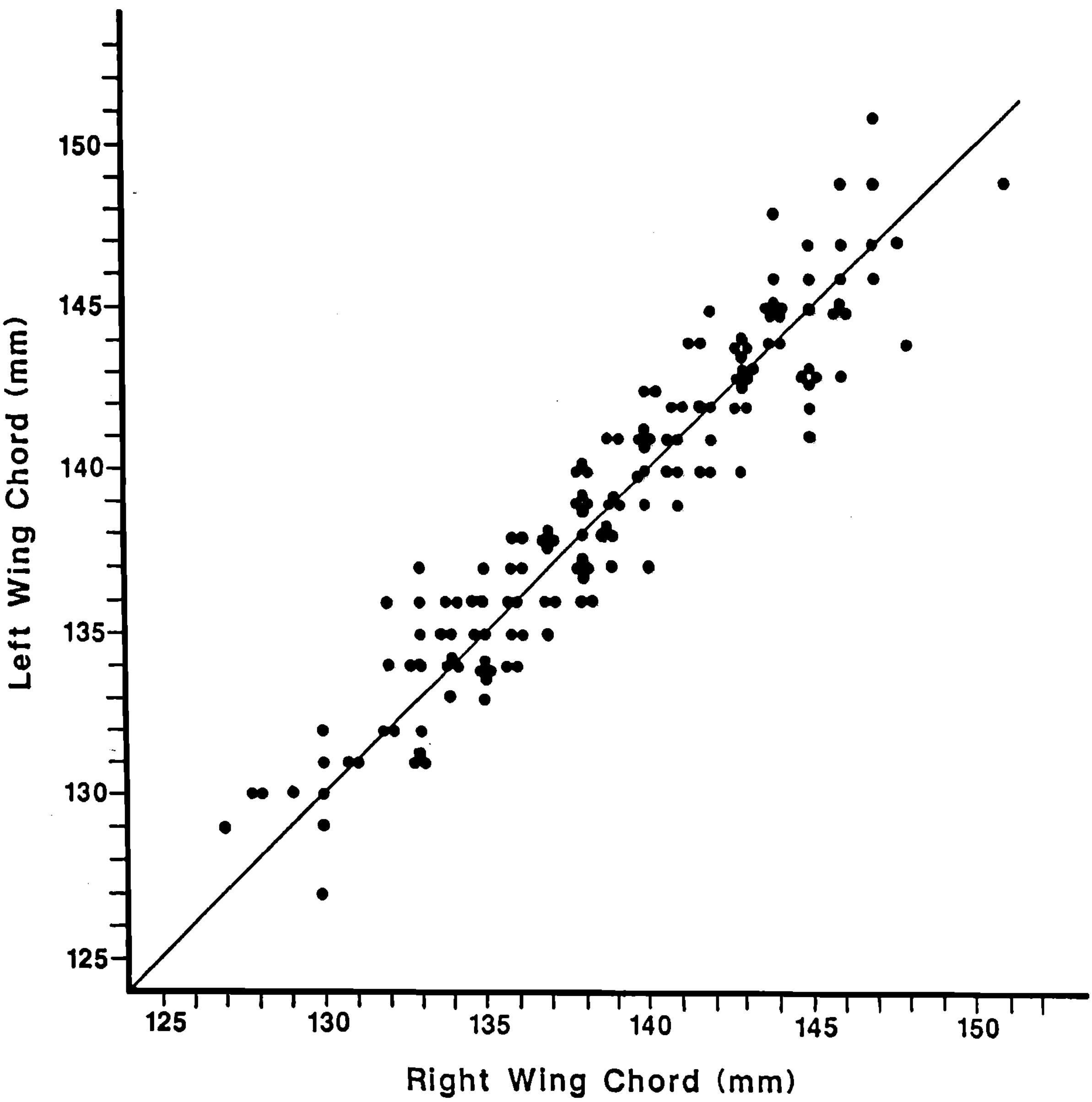
More birds (63) had longer left wings than right wings (54) (Fig. 1). Buckholtz et al. (1984) reported a tendency towards longer right wings in their sample and attributed it to the "right-handedness" of the measurers rather than to real differences. Conversely, this study shows "left-handedness" among the measurers, although none are left-handed. Such differences can not be explained and only serve to illustrate that banders should take particular care when measuring birds and should measure both wings, attempting to avoid any bias. Mueller (1990) noted differences in mean wing chord between the samples of Mueller and Berger (1967) and those of Buckholtz et al. (1984). He suggested that while the difference is likely an artifact of measuring technique, such differences would have considerable effect on sexing criteria.

### Sex Ratio

The ratio of Saw-whets classified as females (46) to males (11) at Nine Mile Point was unexpected. Weir et al. (1980) identified more males than females in Saw-whets banded at Prince Edward Point, Ontario, during fall. This is to be expected, based upon the data of Edwards et al. (1982), who showed the wing chord overlap range would include a higher percentage of females. Mueller (1982), however, questioned the preponderance of males in Weir's sample and suggested that the wing chord criteria used in that study are suspect. In light of these studies, the preponderance of females in the present study seems even more unlikely.

Table 2 compares how the different criteria for sexing influence the results of this study. For each

**Figure 1.** Wing measurements of 150 Northern Saw-whet Owls banded at Nine Mile Point, NY.



bird, the sex is indicated based upon the shortest wing, longest wing, and mean wing chord. Regardless of the criteria or measurement used, the high proportion of females remains. The ratio of females to males ranges from 1.4:1 (shortest wing, criteria of Weir et al. 1980) to 5:1 (longest wing, criteria of Banding Manual 1980). Assuming the measurements are accurate and sexing criteria are reasonably correct, then identifiable females do outnumber identifiable males in this sample regardless of the criteria used in sexing. The only logical explanations for the skewed ratio would be behavioral differences that result in females being more likely to be captured, inaccurate measurements, or invalid sexing criteria.

Although differences in foraging habitat have been demonstrated in some populations of American Kestrels *(Falco sparverius)* (Koplin 1973, Mills 1976, Stinson et al. 1981), no such differences in habitat selection have been reported for saw-whets. Even if such differences do exist, birds captured at Nine Mile Point are migrating and there would be no reason to assume that males and females would take different migration routes. Any possible differences in the timing of migration between the sexes would not explain the skewed ratio since in each year netting began prior to migration and was ceased after migration ended. Therefore, behavioral differences between the sexes do not appear to be an acceptable explanation of a skewed sex ratio in owls captured.

If behavioral differences do not account for the capture of a greater number of females, then measurement techniques or the sexing criteria would be the only likely cause of a skewed sex ratio. In fact, this skewed ratio of females to males is exactly what Mueller (1990) predicted. He noted that using the data of Earhart and Johnson (1970), females would be two to eight times as likely to occur as males.

The wing measurement used in this study was the unflattened wing chord. One obvious error that could skew the sample towards females would be the flattening of the wing while measuring, thus lengthening the wing chord. If this were occurring, the mean wing chord of this sample should be higher than the means of samples where wing chord measurements were taken without flattening the wing. The mean of this sample is $139.0 \pm 4.96$, while the mean of AHY birds was $137.0 \pm 5.07$ at Prince Edward Point (Buckholtz et al. 1984) and $138 \pm 4.6$ at Cedar Grove, Wisconsin (Mueller and Berger 1967). Thus, there is no indication that wings were being flattened significantly during measurement in this study.

Table 3 indicates the sex ratio that would have resulted if mean wing chords were 1, 2, 2.5, 3, or 3.5 mm shorter than were measured; i.e., wings were flattened during measuring. An error of 1.0 mm would still result in a high number of females in the sample. Errors of 2 to 2.5 mm would have to have been made for the sex ratio to be 1:1. An error of 3.0 mm would be necessary for the sex ratio to be near that predicted by Edwards et al. (1982). Since each measurer in this study was aware of the high female to male ratio (and the possible cause) since the second year of the study, it is doubtful that an error of this magnitude occurred repeatedly. Therefore, it does appear that, based upon current sexing criteria, there was an unusually high percentage of identifiable females (or low percentage of identifiable males) in this sample. Since this is not logical, these data support Mueller's contention that the current sexing criteria are not valid.

## ACKNOWLEDGEMENTS

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**Table 1. Sex of Northern Saw-whet Owls captured at Nine Mile Pt., New York**

| YEAR | MALE | FEMALE | UNKNOWN |
|---|---|---|---|
| 1981 | 1 | 1 | 2 |
| 1982 | 0 | 9 | 6 |
| 1983 | 3 | 13 | 17 |
| 1984 | 3 | 7 | 17 |
| 1985 | 0 | 1 | 5 |
| 1986 | 0 | 7 | 11 |
| 1987 | 2 | 5 | 20 |
| 1988 | 2 | 3 | 15 |
| Total | 11 | 46 | 93 |

Based upon criteria from Banding Manual (Anon. 1980).

**Table 2. Male-female ratio of N. Saw-whet Owls as determined by criteria suggested by several authors.**

| Source | Criteria | Wing Measurement: Shortest Ratio M:F | Longest Ratio M:F | Mean Ratio M:F |
|---|---|---|---|---|
| Banding Mn.(Anon.1980) | M < 131 mm<br>F > 143 mm | 16:50 | 11:55 | 11:46 |
| Weir et al. (1980) | M < 134 mm<br>F > 141 mm | 43:60 | 30:76 | 29:67 |
| Buckholtz et al. (1984) | M < 133.1 mm<br>F > 140.8 mm | 27:63 | 19:76 | 14:67 |

**Table 3. Male-female ratios after subtracting assumed errors in mean wing chord.**

| Criteria | Sex Ratios (M:F) when Increment is Subtracted from Mean: -1 mm | -2 mm | -2.5 mm | -3 mm | -3.3 mm |
|---|---|---|---|---|---|
| M < 131 mm<br>F>143 mm | 11:28 | 12:15 | 12:14 | 15:10 | 21:6 |
| M < 134 mm<br>F > 141 mm | 25:39 | 29:37 | 34:32 | 34:28 | 39:21 |
| M < 133.1 mm<br>F > 140.8 mm | 16:44 | 25:37 | 28:32 | 30:28 | 34:21 |