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UTILITY OF WING LENGTH, TAIL LENGTH AND TAIL BARRING IN DETERMINING THE SEX OF BARRED OWLS COLLECTED IN MICHIGAN AND MINNESOTA[1]

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Barred Owls (*Strix varia*) exhibit sexual size dimorphism with respect to wing and tail length (Ridgeway 1914, Earhart and Johnson 1970, Karalus and Eckert 1974, Mueller 1986); however, there is no method to sex this species using either of these measurements (Anonymous 1980). Furthermore, published measurements were based on small samples containing individuals collected from widely separated geographic locations. Thus, apparent sexual differences may be partially due to geographic variation. Differences in the number of complete tail bars has also been suggested as a possible method for sexing Barred Owls (Barrows et al. 1982). Here I examine the utility of wing and tail length and the number of complete tail bars in determining the sex of Barred Owls collected in Michigan and Minnesota.

METHODS

I determined the length of the flattened wing, tail length, and the number of complete tail bars (Barrows et al. 1982) for male and female Barred Owls collected in Michigan and Minnesota and housed in the University of Michigan Museum of Zoology collection. Birds in juvenal plumage were excluded. Most specimen tags did not indicate if gonads were located, so the recorded sex was assumed to be correct. Plumages of male and female specimens were compared to detect any subtle differences. Age determination using the tips of the rectrices (Forsman 1981) detected few subadults; consequently, adults and subadults were combined for all analyses. This should not affect the results; no significant differences were detected between adults and subadults in the related Northern Spotted Owl (*Strix occidentalis*) for any of the variables examined in this paper (Blakesley et al. 1990).

Differences between specimens from each state and between the sexes were examined with 2-Way Analyses of Variance (ANOVA) or Wilcoxon 2-sample tests (SAS Institute 1985). Then I performed a discriminant analysis using wing and tail length. The number of complete tail bars was not included in the discriminant analysis because these data were not normally distributed, thus violating the assumption of a multivariate normal distribution (SAS Institute 1985). All statistics were done using Statistical Analysis System (SAS Institute 1985).

RESULTS

No plumage differences were detected between male and female specimens. Owls collected in Minnesota had a significantly greater number of complete tail bars than did owls collected in Michigan (S = 680.5, P = 0.0087, Wilcoxon 2-sample test; Table 1) so data from each state were analyzed separately. The number of complete tail bars was not significantly different between males and females from either state (S = 384.5, P = 0.26 for Michigan; S = 58.0, P = 0.18 for Minnesota; Wilcoxon 2-sample test).

There were no significant differences between the two states for wing and tail lengths (Table 2) so data from both states were combined. There were significant differences between the sexes for wing and tail lengths (Table 2). Nine (33%) of 27 males had wing lengths <325 mm, the lowest female value, and 13 (38%) of 34 females had wing lengths >340 mm, the highest male value. Eight (30%) males had tail lengths <204 mm, the lowest female value, and four (12%) females had tail lengths >220 mm, the highest male value. Eleven (41%) males had wing or tail lengths < the lowest female measurement and 14 (41%) females had wing or tail lengths > the highest male measurement. Thus, only 41% of the 61 birds measured could be sexed on the basis of wing or tail length.

Lengths of the flattened wing loaded more heavily (0.9575) on the discriminant function summarizing sexual differences than did tail length (0.7491). The discriminant analysis correctly classified 27 (79%) of

TABLE 1. Frequency distribution of the number of complete tail bars of male and female Barred Owls collected in Michigan and Minnesota.

Number of complete tail bars	Male		Female	
	MI	MN	MI	MN
2	1			
3	5	2	2	2
4	8	2	17	3
5	4	2	3	3
6	1	2	3	1
7				
N	19	8	25	9
Mean number	3.9	4.5	4.3	5.3

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TABLE 2. Flattened wing and tail lengths (mm) of Barred Owls collected in Michigan and Minnesota.

Variable	Sex	Range	Mean ± SD	N	Source of variation[a] State	Sex	State × sex
Wing	M	303–340	327.8 ± 8.06	27	0.31 ns	21.54****	0.08 ns
	F	325–357	338.3 ± 8.03	34			
Tail	M	182–220	205.5 ± 9.08	27	0.09 ns	12.57***	0.47 ns
	F	204-225	212.4 ± 5.58	34			

[a] F statistics and probability levels from 2-Way ANOVAS.
ns = $P > 0.05$, *** = $P \leq 0.001$, **** = $P \leq 0.0001$.

34 females and 18 (67%) of 27 males. Thus, 45 (74%) of the 61 owls were correctly assigned to the proper sex with the discriminant analysis, significantly more than would be expected by chance (Wilks' lambda = 0.67, $F = 14.34$, df = 2, 58, $P = 0.0001$).

DISCUSSION

This study showed that the number of complete tail bars (Barrows et al. 1982) is not useful for sexing Barred Owls. Barrows et al. (1982) found the number of complete tail bars useful in sexing the related Northern Spotted Owl. However, Blakesley et al. (1990) found that the number of complete tail bars varied between juveniles and adults and changed between and within molts and was therefore unreliable for sexing Northern Spotted Owls. There was a significant difference between Michigan and Minnesota owls in the number of complete tail bars, suggesting that there may be geographic variation in this trait, as there is in the Northern Spotted Owl (Barrows et al. 1982).

A higher proportion of Barred Owls could be sexed by wing length than by tail length, contrary to the findings of Blakesley et al. (1990) in the related Northern Spotted Owl. The discriminant analysis using wing and tail length increased the proportion of birds that could be sexed to 74% from 41% but still failed to achieve the 95% level obtained by Hayward and Hayward (1991) in Boreal Owls, *Aegolius funereus*. Blakesley et al. (1990) found that weight was the most reliable indicator of sex in Northern Spotted Owls. Weight was not recorded for most of the specimens used in this study and even if it had been it would probably have been biased since many museum specimens are prepared from birds found dead as a result of starvation, road kills, or other accidental casualties. These individuals are likely to be in poor physical condition, with weights further reduced through trauma and desiccation (McGillivray 1987, Kerlinger and Lein 1988).

The measurements from this study cannot be applied directly to live owls due to shrinkage (Mueller 1990). However, wing and tail lengths could be useful for sexing live Barred Owls. Researchers who capture live Barred Owls, which can be sexed by vocalizations (Elody and Sloan 1984) and behavior, should record weight and wing and tail length so that a discriminant model can be developed that may permit sexing using these measures.

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