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DETERMINING SEX OF EASTERN SCREECH-OWLS USING DISCRIMINANT FUNCTION ANALYSIS

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Abstract.—Seven morphometric characteristics and weight of males and females of a captive colony of Eastern Screech-Owls (*Otus asio*) were compared. Females were significantly larger than males in weight, total length, and length of tail, wing and bill. A discriminant function analysis based on weight, wing and tail length correctly identified the sex of 88% of the 77 birds.

Identificación del sexo en el Tecolote Nororiental (*Otus asio*)

Extracto.—Se compararon siete características morfométricas, y el peso de tecolotes (*Otus asio*) machos y hembras de una colonia cautiva. Las hembras fueron significativamente más grandes que los machos en peso, largo total, y largo de la cola, alas y pico. Un análisis de función discriminante basado en peso, alas y largo de la cola, identificó correctamente el sexo en un 88% del total de 77 aves.

[Traducción de Eudoxio Paredes-Ruiz]

Earhart and Johnson (1970), Snyder and Wiley (1976), Mueller (1986) and McGillivray (1987) described sexual dimorphism in owls and noted that this is less pronounced in screech-owls and some other small owls than in many of the larger owls and diurnal birds of prey. Owen (1963a, 1963b) and Marshall (1967) reported screech-owl size variations in association with differences in plumage coloration and geographical location. The lack of conspicuous sexual dimorphism makes it difficult to accurately sex Eastern Screech-Owls (*Otus asio*). We examined sexual dimorphism in a captive colony of Eastern Screech-Owls and used discriminant function analysis (DFA) to determine the most effective combination of characters to distinguish the sex of individuals.

Materials and Methods

We measured seven morphological characteristics and weight of 77 live Eastern Screech-Owls that formed the captive breeding colony at Patuxent Wildlife Research Center. Details of this colony are provided in Wiemeyer (1987). Most of the screech-owls in this colony are from parent stock originally obtained from Ohio; a few were from Maryland.

The sex of each individual was determined by laparoscopy. Measurements of tarsus, ulna, tail and toe follow Baldwin et al. (1931). Total length was measured as the distance from the feathers of the top of the head to the tip of the central tail feather; this measure was taken by placing the owl's head against an angle iron fixed to a ruler. Wing length was measured as the length of the flattened wing from the tip of the longest primary to the anterior surface of the distal end of the radius. Bill length was taken with a caliper from the tip to the base at the frontonasal hinge. Owls were weighed to the nearest 1 g with calibrated Pesola scales. All birds were measured and weighed between 27 February and 3 March 1986. All had hatched in captivity in 1984.

Stepwise discriminant function analysis was used to identify the combination of characteristics that provided the highest discrimination between sexes. Data were standardized following SPSSx procedures prior to entry. All statistical analyses followed SPSSx routines (Norusis 1985). Default criteria were used throughout and Mahalonobis was the selected method for stepwise discriminant function analysis. The critical level for all tests was $\alpha = 0.05$.

Results and Discussion

Significant differences between sexes occurred in weight, total length, length of wing and tail, and bill size (Table 1). Weight showed the most obvious difference between sexes. Average weight was 18.2% greater in females than in males, which is generally consistent with weight differences reported by Earhart and Johnson (1970), VanCamp and Henny (1975) and Wiemeyer (1987). Female total length averaged 4.0% greater, and tail length 6.0% greater than males. Ulna, right middle toe and tarsus lengths showed the least variation between females and males.

Table 1. Morphometric comparisons of adult Eastern Screech-Owls based on measurements of 77 owls at the Patuxent Wildlife Research Center, Laurel, Maryland. Length is given in cm, weight in g, and all other measurements in mm. Ranges given in parentheses.

CHARACTER	MALES $\bar{x} \pm$ SD ($N = 38$)	FEMALES $\bar{x} \pm$ SD ($N = 39$)	t	P
Weight	171.0 ± 12.8 (145–208)	202.1 ± 21.9 (163–263)	−7.65	<0.001
Length	20.0 ± 0.8 (18–21)	20.8 ± 0.8 (19–23)	−4.31	<0.001
Wing	162.9 ± 4.0 (157–171)	169.9 ± 3.9 (163–177)	−7.77	<0.001
Ulna	61.8 ± 3.5 (58–71)[a]	62.5 ± 3.2 (57–68)[b]	−0.69	0.497
Bill	22.9 ± 1.1 (21–26)	23.6 ± 0.9 (21–26)	−3.04	0.003
Tail	80.4 ± 3.1 (73–88)	85.2 ± 4.4 (78–98)	−5.58	<0.001
Tarsus	28.4 ± 2.6 (23–33)	27.6 ± 2.2 (24–34)	1.49	0.141
Middle toe	24.0 ± 1.7 (22–29)[c]	24.4 ± 1.7 (21–28)[b]	−0.79	0.438

[a] $N = 20$.
[b] $N = 22$.
[c] $N = 15$.

The largest individual was a female with wing length of 171 mm, tail length of 83.5 mm, and weight of 263 g. The smallest was a male with a wing length of 160 mm, tail length of 81 mm and weight of 145 g.

Weights of captive owls averaged slightly higher than weights of captured wild owls or specimens obtained as fresh fall, winter and early spring road kills obtained in Connecticut between 1974 and 1990 (D.G. Smith, unpubl.); 39 wild females averaged 195.8 g (SD = 21.0), 52 males averaged 165.1 g (SD = 8.4). Although the weights of the wild and captive females did not differ ($t = -1.30$, $P = 0.199$), the weights of the wild males were significantly smaller than those of the captive males ($t = -2.64$, $P = 0.010$). The somewhat larger weights of the captive owls may reflect a comparatively sedentary activity and consistently available food. Wing, bill and toe lengths (claw included) of captive owls also were larger than wild owls. Differences in wing length may reflect reduced feather wear of captive owls while longer toes and bills may be associated with consumption of soft food, primarily ground meat and day-old chicks (Wiemeyer 1987) or lack of wear.

The Classification Function (DF). The sex of 88.3% of the captive owls at Patuxent could be determined from a combination of weight (WT), wing (WG) and tail (T) lengths:

$$DF = 0.1128(WG) + 0.0884(T) + 0.0337(WT) - 32.384$$

If DF < 0.0 the individual is classified as a male. Thirty-four of 38 (89.5%) males and 34 of 39 (87.2%) females were correctly identified using this equation. Three of the four misclassified males were larger, heavier birds with longer wings and tails. Conversely, the five misclassified females had shorter wings.

Although weight may provide the best single discriminator between male and female Eastern Screech-Owls (Mueller 1986, this study), caution is needed when using weight as a criterion in wild or captive owls. Studies of radiotransmitter-equipped individuals revealed wide seasonal and sometimes daily weight changes (Smith and Gilbert 1984). Henny and VanCamp (1979) and Wiemeyer (1987) also reported seasonal changes in average weights of Eastern Screech-Owls.

Because of variations in weight, discrimination functions based on other criteria were also determined. A function with tail length (T), total length (TL) and wing length (WG) correctly identified the sex of 80.5% of the owls:

$$DF = 0.0766(T) + 0.3900(TL) + 0.1818(WG) - 44.55$$

If DF < 0.0, classify the individual as male. This function correctly identified 84.6% of females and 76.3% of the males. Again, wing length was an important factor in the misclassification of both males and females.

Total length may be difficult to measure, especially by inexperienced workers; thus a discrimination function based on wing and tail lengths was determined:

$$DF = 0.16531(T) + 0.37896(WG) - 76.74288$$

If DF < 0.0, classify the individual as male. This function correctly identified 77.9% overall; 78.9% of the males and 76.9% of the females.

For the Eastern Screech-Owl, overlap between males and females was too great to permit identification of sex by any single characteristic. If weight is excluded from the equation, combinations of 2 or 3 of the most significantly different characteristics provided correct classification rates of only 78–81%.

Because of the geographic size variations (Owen 1963a, James 1970), and probable differences between captive and wild owls, the discriminant functions we present may not be applicable to other data sets for Eastern Screech-Owls. Nevertheless, our approach should be a useful model for constructing new discriminant functions for other wild Eastern Screech-Owl populations.

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