

## MORPHOMETRICS AND SEXUAL DIMORPHISM OF SOME NEOTROPICAL PASSERINES

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**Morfometría y dimorfismo sexual en paserinos Neotropicales.**

**Key words:** Morphometrics, passerines, dimorphisms, Argentina.

### INTRODUCTION

Interpretation of ecological and behavioral data is often improved when the sexes of study animals are known. For many avian species, sex can be determined without the need for internal examination, either by observing plumage or sex-specific structural characteristics (such as colored soft-tissue), measuring morphological characteristics, or observing sex-specific behaviors (Jodice *et al.* 2000).

Many birds are monomorphic and cannot therefore be sexed on the basis of variations in external features such as plumage or bill coloration (Montalti *et al.* 2001). Morphological measurements are frequently used for sexing individuals in the field (Peiró 1991). Sexual dimorphism in size is almost universal in birds, and numerous theoretical hypothesis have been developed to explain its ecological and evolutionary significance (Orians 1969).

Little is known on morphometrics of most Neotropical birds. Even less is known

about sexual variation in body measurements. Information about morphometric data of Passeriformes from the Neotropical region is scarce and is limited to few localities (Navas 1970, Zapata & Martínez 1972, Oniki 1986, Mason 1987, Navas & Bó 1991, Oniki & Willis 1991, 1993, 1999; Camperi 1992, Bergkamp 1993, Fiorini 2002).

Morphometry can give taxonomic as well as biological information. Morphological measures should be incorporated in the forthcoming Neotropical studies in order to get a better understanding of the taxonomical, ecological, physiological and evolutionary problems. With this purpose, here we present morphometric data on some species of Buenos Aires Province, Argentina.

### MATERIAL AND METHODS

Adult birds, both males and females of 11 Passeriformes species, were collected near La Plata (34°55'S–57°57'W) and Guaminí

(37°00'S–62°24'W), Buenos Aires province, Argentina, during the years 1997–2000.

Measurements were taken in the laboratory immediately after death and before skin preparation, using a vernier caliper (0.1 mm) and a metal ruler (1 mm). For measurements, criteria taken from Baldwin *et al.* (1931) were used. The following external measurements were taken from the right side on each bird, taking into consideration the possible bilateral asymmetry suggested by McNeil & Martínez (1967) and McNeil *et al.* (1971): length of exposed culmen (culmen), length of bill from gape, length of tarsus (tibiotarsus), length of middle toe and claw, length of middle toe, length of middle claw, length of closed wing (wing chord), length of open wing, extent of wing with feathers, length of tail (tail), total length with feathers (total length).

Nomenclature and common names of birds follow Ridgely & Tudor (1989, 1994). A total of 304 individuals belonging to seven families were taken for this study. Statistical differences between sexes were tested using *t*-tests.

## RESULTS AND DISCUSSION

All morphometric data are listed in Appendix 1. Sexual dimorphism in colour is prominent in Masked Gnatcatchers (*Poliophtila dumicola*), Hooded Siskins (*Carduelis magellanica*), Yellow-winged Blackbirds (*Agelaius thibius*) and Shiny Cowbirds (*Molothrus bonariensis*). On the other hand, Rufous Horneros (*Furnarius rufus*), Freckle-breasted Thornbirds (*Phacellodomus striaticollis*), Great Kiskadees (*Pitangus sulphuratus*), Tropical Kingbirds (*Tyrannus melancholicus*), House Wrens (*Troglodytes aedon*), Rufous-collared Sparrows (*Zonotrichia capensis*) and Brown-yellow Marshbirds (*Pseudoleistes virescens*) are not sexually dichromatic. There were no significant differences in morphometric measurements between male and female Tropical Kingbirds. On the contrary, in Shiny

Cowbirds, sexual dimorphism was found in all body parts, except the tarsus. In the measurements of other species, where there was a significant difference, males were larger than females although the magnitude of differences between sexes varied among species. On the other hand, in some species, some parts of the body were larger in females than males (e.g., Rufous Hornero and Great Kiskadee culmens). But none of these differences were significant.

In general, the length of wing with feathers, the length of wing chord, and the length of middle toe with claw were the most discriminating parameters. Rising & Somers (1989) described wing measurements as “the best measure of overall body size” in non-migratory birds.

According to Anderson (1982), sexual size dimorphism in many animals increases with body size. In agreement with this, our results show that the larger studied genera (*Furnarius*, *Phacellodomus*, *Pitangus*, *Agelaius*, *Molothrus*, *Pseudoleistes*) presented higher differences between sexes than the smaller ones (*Troglodytes*, *Poliophtila*, *Zonotrichia*, *Carduelis*).

In birds, sexual dimorphism in size and structure of the different parts of the body is often reflected by ecological polymorphism and sexual differences in niche utilization. Sexual divergence is believed to have adaptive value in alleviating intersexual competition for food (Selander 1966). Species with a limited resource base may be more frequently sexually dimorphic, and the frequency of dimorphism may change with habitat structure (Willson *et al.* 1975).

Accurate sex identification of birds is important in studies of sex-specific differences in breeding behavior, ecology, and energetics. The information presented here contributes to our knowledge of the morphometric characteristic of several Neotropical passerines. We suggested that the morphometric information about birds is essential for

understanding taxonomical, ecological, physiological and evolutionary problems.

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## APPENDIX 1. Morphometrics of males and females individuals.

Species	Morphometrical characters	Males			Females		
		Mean $\pm$ SD	Range	N	Mean $\pm$ SD	Range	N
Rufous Hornero ( <i>Furnarius rufus</i> )	Culmen	20.3 $\pm$ 2.4	16.0–23.0	17	21.5 $\pm$ 3.4	17.0–29.0	16
	Bill from gape	27.8 $\pm$ 2.4	24.0–31.0	17	27.7 $\pm$ 1.9	23.0–30.0	16
	Tarsus	31.8 $\pm$ 2.9	25.1–35.0	16	32.2 $\pm$ 2.7	26.0–35.0	14
	Middle toe with claw	*26.8 $\pm$ 1.3	25.0–28.0	15	*25.1 $\pm$ 1.2	23.0–27.0	16
	Middle toe	19.8 $\pm$ 1.5	17.0–22.0	15	19.7 $\pm$ 1.0	18.0–21.0	16
	Claw	7.3 $\pm$ 0.8	8.0–12.0	17	7.7 $\pm$ 0.5	6.9–8.0	13
	Wing chord	96.5 $\pm$ 10.1	115.0–127.0	17	96.5 $\pm$ 3.3	88.0–102.0	14
	Open wing	141.6 $\pm$ 9.8	156.0–182.0	14	136.0 $\pm$ 8.0	118.0–147.0	14
	Wing with feathers	328.5 $\pm$ 21.2	361.0–421.0	14	317.6 $\pm$ 11.1	304.0–338.0	11
	Tail	73.1 $\pm$ 7.0	86.0–97.0	17	71.5 $\pm$ 3.9	62.0–75.0	14
	Total length	*215.6 $\pm$ 10.1	235.0–268.0	17	*209.5 $\pm$ 6.2	196.0–220.0	16
	Freckle-Breasted Thornbird ( <i>Phacelodorus striatocollis</i> )	Culmen	16.03 $\pm$ 0.95	15.1–17.0	12	15.03 $\pm$ 0.06	15.0–15.1
Bill from gape		**23.00 $\pm$ 1.41	22.0–24.0	12	**20.53 $\pm$ 0.50	20.0–21.0	15
Tarsus		**21.57 $\pm$ 0.51	21.0–22.0	13	**19.70 $\pm$ 1.25	19.8–21.0	15
Middle toe with claw		21.43 $\pm$ 0.51	21.0–22.0	13	21.33 $\pm$ 0.47	21.0–22.0	14
Middle toe		16.03 $\pm$ 0.29	16.0–16.5	13	16.40 $\pm$ 0.71	15.6–17.0	14
Claw		6.07 $\pm$ 0.12	6.0–6.2	13	5.83 $\pm$ 0.35	5.3–6.0	14
Wing chord		64.00 $\pm$ 0.00	64.0–64.0	13	63.33 $\pm$ 2.89	60.0–65.0	15
Open wing		86.67 $\pm$ 7.09	79.0–93.0	10	86.33 $\pm$ 4.16	83.0–91.0	11
Wing with feathers		212.00 $\pm$ 1.73	210.0–213.0	10	205.67 $\pm$ 5.51	200.0–211.0	11
Tail		86.00 $\pm$ 4.58	81.0–90.0	10	81.50 $\pm$ 5.00	75.0–87.0	11
Total length		193.33 $\pm$ 4.73	188.0–197.0	13	186.25 $\pm$ 5.50	179.0–191.0	11
Great Kiskadee ( <i>Pitangus sulphuratus</i> )		Culmen	27.94 $\pm$ 4.79	12.0–33.0	17	28.71 $\pm$ 1.68	26.0–31.0
	Bill from gape	38.07 $\pm$ 2.92	31.0–41.0	17	39.00 $\pm$ 1.92	36.0–41.0	14
	Tarsus	28.12 $\pm$ 2.37	23.0–31.0	17	28.71 $\pm$ 2.74	24.0–33.0	14
	Middle toe with claw	**29.08 $\pm$ 1.73	26.0–32.0	14	**27.86 $\pm$ 1.52	26.0–30.0	14
	Middle toe	**20.07 $\pm$ 1.14	17.0–21.0	14	**19.29 $\pm$ 1.33	17.0–22.0	14

APPENDIX 1. Continuation.

Species	Morphometrical characters	Males			Females		
		Mean ± SD	Range	N	Mean ± SD	Range	N
	Claw	10.29 ± 1.14	8.0–12.0	14	10.50 ± 0.65	10.0–12.0	14
	Wing chord	119.82 ± 7.65	95.0–127.0	17	121.57 ± 3.23	115.0–130.0	14
	Open wing	169.33 ± 8.34	156.0–182.0	12	164.00 ± 7.56	152.0–177.0	10
	Wing with feathers	390.00 ± 20.61	365.0–421.0	11	379.6 ± 24.51	342.0–415.0	10
	Tail	91.50 ± 10.80	53.0–98.0	16	92.36 ± 3.63	87.0–97.0	14
	Total length	248.41 ± 20.56	175.0–268.0	17	248.15 ± 12.27	233.0–270.0	13
Tropical Kingbird ( <i>Tyrannus melancholicus</i> )	Culmen	22.60 ± 1.52	21.0–25.0	15	23.00 ± 2.83	21.0–25.0	12
	Bill from gape	27.80 ± 0.84	27.0–29.0	15	28.50 ± 0.71	28.0–29.0	12
	Tarsus	18.40 ± 0.89	17.0–19.0	11	18.50 ± 0.71	18.0–19.0	12
	Middle toe with claw	20.50 ± 0.58	20.0–21.0	11	21.00 ± 0.00	21.0–21.0	9
	Middle toe	12.00 ± 3.94	13.0–15.0	11	14.50 ± 0.71	14.0–15.0	9
	Claw	8.00 ± 0.00	8.0–8.0	11	7.00 ± 0.00	7.0–7.0	9
	Wing chord	114.40 ± 4.39	110.0–120.0	15	110.50 ± 0.71	100.0–111.0	12
	Open wing	164.25 ± 4.03	161.0–170.0	11	161.00 ± 0.00	161.0–161.0	9
	Wing with feathers	371.50 ± 13.82	351.0–381.0	11	371.00 ± 0.00	371.0–371.0	9
	Tail	97.20 ± 5.22	89.0–103.0	11	93.00 ± 2.83	91.0–95.0	9
	Total length	233.60 ± 6.80	225.0–241.0	11	240.00 ± 10.61	230.0–245.0	9
House Wren ( <i>Troglodytes aedon</i> )	Culmen	13.40 ± 0.55	12.2–14.0	17	12.00 ± 0.52	11.5–12.0	12
	Bill from gape	17.50 ± 0.58	17.0–18.0	14	16.50 ± 0.71	16.0–17.0	12
	Tarsus	15.50 ± 2.51	13.0–19.6	17	17.67 ± 1.53	16.0–19.0	13
	Middle toe with claw	16.33 ± 1.53	15.0–18.0	14	15.33 ± 1.53	14.0–17.0	13
	Middle toe	11.75 ± 0.50	11.0–12.3	15	11.67 ± 1.15	11.0–13.0	13
	Claw	4.75 ± 0.50	4.0–5.0	15	4.67 ± 0.58	4.0–5.0	13
	Wing chord	51.86 ± 2.34	49.0–55.0	17	50.00 ± 1.00	49.0–51.0	13
	Open wing	**69.50 ± 5.80	64.0–75.0	14	**61.33 ± 3.06	58.0–64.0	13
	Wing with feathers	168.00 ± 3.00	165.0–171.0	13	166.50 ± 9.19	160.0–173.0	12
	Tail	44.29 ± 2.21	42.0–48.0	17	45.33 ± 1.53	44.0–47.0	13

SHORT COMMUNICATIONS

Species	Morphometrical characters	Males			Females		
		Mean $\pm$ SD	Range	N	Mean $\pm$ SD	Range	N
	Total length	124.29 $\pm$ 7.18	110.0–130.0	17	116.00 $\pm$ 8.89	106.0–123.0	13
Masked Gnatcatcher ( <i>Poliophtila dumicola</i> )	Culmen	9.83 $\pm$ 0.98	9.0–11.0	9	9.00 $\pm$ 0.00	9.0–9.0	8
	Bill from gape	**14.67 $\pm$ 1.03	13.0–16.0	9	**12.50 $\pm$ 0.71	12.0–13.0	8
	Tarsus	**19.33 $\pm$ 0.52	19.0–20.0	9	**18.00 $\pm$ 1.00	17.0–19.0	8
	Middle toe with claw	12.17 $\pm$ 1.17	11.0–14.0	9	12.33 $\pm$ 0.58	12.0–13.0	8
	Middle toe	9.67 $\pm$ 1.37	8.0–12.0	9	9.33 $\pm$ 0.58	9.0–10.0	8
	Claw	4.17 $\pm$ 0.41	4.0–5.0	9	4.00 $\pm$ 0.00	4.0–4.0	8
	Wing chord	**53.83 $\pm$ 2.86	50.0–58.0	9	**50.33 $\pm$ 1.53	49.0–52.0	8
	Open wing	**72.40 $\pm$ 3.51	67.0–76.0	9	**65.33 $\pm$ 2.52	63.0–68.0	7
	Wing with feathers	169.25 $\pm$ 5.50	162.0–174.0	9	160.50 $\pm$ 4.95	157.0–164.0	7
	Tail	61.00 $\pm$ 4.10	58.0–69.0	9	57.33 $\pm$ 3.79	53.0–60.0	6
	Total length	130.83 $\pm$ 6.62	124.0–139.0	9	123.33 $\pm$ 4.51	119.0–128.0	6
Rufous-collared Sparrow ( <i>Zonotrichia capensis</i> )	Culmen	11.89 $\pm$ 0.88	11.0–13.0	20	11.60 $\pm$ 0.55	11.0–12.0	15
	Bill from gape	13.23 $\pm$ 0.93	12.0–15.0	15	13.40 $\pm$ 0.55	13.0–14.0	15
	Tarsus	20.33 $\pm$ 1.91	17.0–23.0	22	21.20 $\pm$ 1.30	20.0–23.0	15
	Middle toe with claw	19.86 $\pm$ 0.86	18.0–21.0	15	20.00 $\pm$ 0.71	19.0–21.0	15
	Middle toe	14.88 $\pm$ 0.62	14.0–16.0	17	15.20 $\pm$ 0.45	15.0–16.0	15
	Claw	6.06 $\pm$ 0.44	5.2–7.0	17	6.00 $\pm$ 0.00	6.0–6.0	15
	Wing chord	67.77 $\pm$ 3.10	65.0–72.0	22	66.00 $\pm$ 2.45	64.0–70.0	15
	Open wing	92.67 $\pm$ 6.37	81.0–102.0	15	90.60 $\pm$ 5.77	85.0–97.0	11
	Wing with feathers	**224.53 $\pm$ 5.64	216.0–234.0	15	**216.40 $\pm$ 8.85	208.0–229.0	11
	Tail	**61.27 $\pm$ 2.86	56.0–68.0	22	**58.20 $\pm$ 1.64	57.0–61.0	11
	Total length	147.20 $\pm$ 8.13	135.0–159.0	20	144.00 $\pm$ 4.83	140.0–151.0	11
Hooded Siskin ( <i>Carduelis magellanica</i> )	Culmen	10.11 $\pm$ 0.33	10.0–11.0	10	0.00 $\pm$ 0.00	11.0–11.0	8
	Bill from gape	11.22 $\pm$ 0.44	11.0–12.0	10	11.00 $\pm$ 0.00	14.0–15.0	8
	Tarsus	14.33 $\pm$ 1.87	14.0–17.0	10	15.00 $\pm$ 0.63	14.0–15.0	8

APPENDIX 1. Continuation.

Species	Morphometrical characters	Males			Females		
		Mean ± SD	Range	N	Mean ± SD	Range	N
	Middle toe with claw	14.67 ± 1.94	10.0–17.0	10	15.50 ± 0.84	15.0–16.0	8
	Middle toe	10.89 ± 0.33	10.0–13.0	10	11.50 ± 0.84	11.0–12.0	8
	Claw	5.78 ± 0.67	5.0–7.0	10	5.83 ± 0.75	5.0–7.0	8
	Wing chord	70.00 ± 5.00	60.0–75.0	10	68.33 ± 2.58	65.0–70.0	8
	Open wing	92.56 ± 4.33	85.0–100.0	10	90.83 ± 5.85	85.0–100.0	8
	Wing with feathers	**221.44 ± 6.33	210.0–230.0	10	**216.00 ± 6.52	210.0–220.0	8
	Tail	44.67 ± 1.94	32.0–47.0	10	41.00 ± 6.06	43.0–45.0	5
	Total length	121.56 ± 4.10	105.0–129.0	10	116.25 ± 8.54	115.0–125.0	5
Yellow-winged Blackbird ( <i>Agelaius thilins</i> )	Culmen	21.26 ± 1.24	19.0–23.0	20	18.50 ± 1.72	16.0–21.0	10
	Bill from gape	22.85 ± 1.09	21.0–25.0	20	20.50 ± 1.51	19.0–24.0	10
	Tarsus	24.74 ± 0.99	23.0–27.0	19	22.80 ± 0.79	22.0–24.0	10
	Middle toe with claw	**23.95 ± 1.61	22.0–27.0	20	**22.50 ± 1.72	21.0–27.0	10
	Middle toe	**18.30 ± 1.26	17.0–21.0	20	**17.20 ± 0.92	16.0–19.0	10
	Claw	7.30 ± 0.57	6.0–8.0	20	7.00 ± 0.67	6.0–8.0	10
	Wing chord	*82.95 ± 4.37	71.0–89.0	20	*77.90 ± 3.81	73.0–85.0	10
	Open wing	**110.65 ± 10.30	82.0–125.0	20	**101.90 ± 6.87	94.0–117.0	10
	Wing with feathers	*264.00 ± 12.63	240.0–290.0	20	*249.67 ± 13.01	232.0–270.0	9
	Tail	**66.35 ± 4.79	64.0–72.0	20	**62.11 ± 3.98	55.0–64.0	10
	Total length	**178.89 ± 10.26	165.0–202.0	18	**165.33 ± 9.70	153.0–180.0	9
Shiny Cowbird ( <i>Molothrus bonariensis</i> )	Culmen	*18.40 ± 0.89	18.0–20.0	15	*17.00 ± 0.00	17.0–17.0	11
	Bill from gape	*19.60 ± 1.14	18.0–21.0	15	*17.80 ± 0.45	17.0–18.0	11
	Tarsus	28.20 ± 1.79	26.0–31.0	15	26.40 ± 2.61	22.0–28.0	11
	Middle toe with claw	**28.20 ± 1.64	26.0–30.0	15	**25.33 ± 2.31	24.0–28.0	11
	Middle toe	*20.80 ± 0.84	20.0–22.0	15	*18.40 ± 1.14	17.0–20.0	11
	Claw	*8.40 ± 0.55	8.0–9.0	15	*8.20 ± 0.45	8.0–9.0	11
	Wing chord	*105.60 ± 3.51	102.0–110.0	15	*99.20 ± 3.19	95.0–103.0	11
	Open wing	**151.00 ± 6.86	146.0–163.0	12	**137.67 ± 5.69	133.0–144.0	10

Species	Morphometrical characters	Males			Females		
		Mean $\pm$ SD	Range	N	Mean $\pm$ SD	Range	N
	Wing with feathers	**346.80 $\pm$ 9.55	339.0–363.0	12	**317.00 $\pm$ 8.14	312.0–327.0	10
	Tail	*76.80 $\pm$ 4.09	74.0–84.0	12	*70.00 $\pm$ 2.83	66.0–74.0	10
	Total length	**207.50 $\pm$ 10.89	190.0–219.0	11	**195.60 $\pm$ 6.43	188.0–205.0	10
Brown-and-Yellow Marshbird ( <i>Pseudoleistes virescens</i> )	Culmen	*31.00 $\pm$ 1.10	29.0–32.0	16	*29.32 $\pm$ 0.64	28.6–32.1	11
	Bill from gape	32.67 $\pm$ 1.51	30.0–34.0	16	31.83 $\pm$ 0.98	31.0–35.5	11
	Tarsus	**31.50 $\pm$ 1.38	30.0–33.0	16	**30.25 $\pm$ 0.42	30.0–32.7	9
	Middle toe with claw	31.00 $\pm$ 1.41	29.0–32.0	15	31.50 $\pm$ 0.55	31.0–32.3	9
	Middle toe	23.33 $\pm$ 0.82	22.0–24.0	16	23.50 $\pm$ 0.84	22.7–25.0	8
	Claw	9.33 $\pm$ 1.03	8.0–11.0	16	9.43 $\pm$ 0.64	8.6–10.0	9
	Wing chord	**119.83 $\pm$ 3.76	115.0–126.0	16	**116.44 $\pm$ 3.13	113.0–122.0	11
	Open wing	162.40 $\pm$ 6.35	153.0–170.0	11	161.44 $\pm$ 4.56	153.0–167.0	9
	Wing with feathers	**379.60 $\pm$ 6.35	367.0–392.0	11	**371.88 $\pm$ 4.73	365.0–379.0	10
	Tail	91.00 $\pm$ 4.55	87.0–97.0	9	89.67 $\pm$ 3.61	85.0–97.0	9
	Total length	246.75 $\pm$ 15.84	233.0–265.0	9	245.56 $\pm$ 12.98	223.0–259.0	9

\*  $P < 0.01$ \*\*  $P < 0.05$