Discriminant Functions for Sexing Woodhens

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We recommend using culmen and tarsal lengths to indicate sex in Woodhens. For dried museum skins a function 1.8 tarsus + culmen = 135,, using measurements in mm, separates females (below) from males (above) the value. However, for live Woodhens, 1.7 tarsus + culmen = 141 is the function.

Roy Bell collected Woodhens, *Tricholimnas sylvestris* on Lord Howe Island, N.S.W. during a stay between 1913 and 1915 and his manuscript diary records details about his collecting activities (Bell unpublished ms). Most of the Woodhens Bell collected are held today by the American Museum of Natural History in New York. Recently we were fortunate to have had the whole of this collection of Woodhens on loan in Sydney for study.

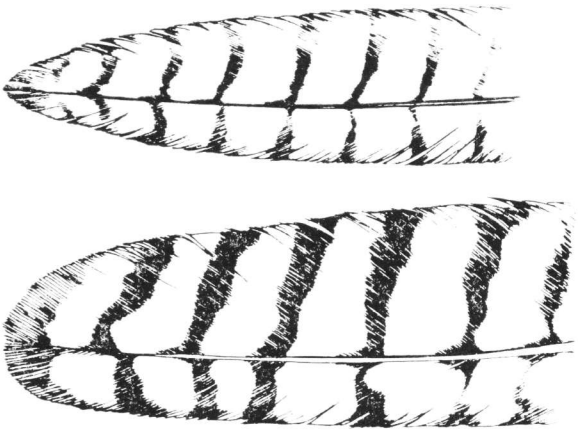
Bell probably collected 85 woodhens of which we have traced 63. Careful comparison of specimens with diary entries allowed us to set aside 52 examples that we considered to be reliably sexed and more than a year old when collected. All first year birds were identified by the pointed condition of their primary feathers (Fig. 1).

These 52 specimens were measured using the procedures of Disney (1974a). All extreme values were checked twice. The full data are shown in the Appendix.

Adult male Woodhens are significantly larger than adult females in the length of the exposed culmen, tarsus, mid-toe and wing chord, but not in tail length (Fullagar, Disney and de Naurois, in prep.). We have calculated a discriminant function to sex Woodhens following the procedures outlined by Dunnet and Anderson (1961) for the Fulmar, *Fulmarus glacialis*, and Anderson (1975) for the Moorhen, *Gallinula chloropus*.

With measurements in mm the calculated function was 1.8 tarsus length + exposed culmen length = 135; females less, males more. From our sample of Woodhens there were 49 culmen v tarsus plots available for analysis. Only 5 birds were wrongly classified. One male had a very short tarsus and four females exceptionally large culmen lengths (see Appendix). Several other simple functions were examined, but were rejected either because some measurements were more difficult to obtain accurately or (mostly) because they were less effective in separating males from females.

We conclude that a discriminant function using culmen and tarsal lengths will sex museum



• Figure 1. *An outer primary feather from two Woodhens. (a) Adult male, Aust. Mus. 0.2712; square ended. (b) Juvenile female, Aust. Mus. 0.16364; pointed.*

skins of fully grown Woodhens and give better than 90% correct identification. It is possible to refine the use of the function to provide a confidence estimate for any particular specimen (see Dunnet and Anderson, 1961; Craig *et al.* 1980) and other refinements of the method (for example, see Shugart 1977) may prove useful in field studies; but they lack, perhaps, the virtue of simplicity.

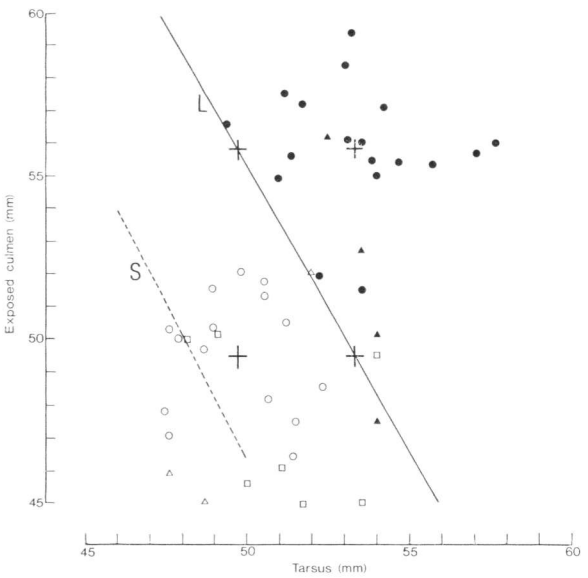
A small population of Woodhens still exists on Lord Howe Island, which we have been studying since 1969 (Disney 1974b,c; Disney and Fullagar, in press; Disney and Smithers 1972; Fullagar and Disney 1975; Fullagar, Disney and de Naurois, in prep.). Colour banding of individual Woodhens has been used since February 1971 and this has provided some useful information on the live bird. Observations on the behaviour of individuals have been used to establish sex. Therefore, measurements obtained from these colour banded Woodhens give us another set of data from which to calculate a discriminant function.

The culmen and tarsal feasurements obtained from live Woodhens that we feel were sexed reliably and were fully-grown when measured, have been plotted and a discriminant function calculated (Fig. 2). The function was obtained by the simple procedure of determining the mean culmen against tarsus value for the males and females. These mean points were extended parallel with the vertical and horizontal axes to their intercepts with each other. A line was then drawn between these intercepts and a regression equation calculated for it.

For live Woodhens the discriminant function had the value 1.7 tarsus + culmen = 141. Of course any line can be drawn that fits the plot data and a function obtained from its slope.

The function obtained from museum skins does not fit the data from live birds (see Fig. 2). This is explained by a difference between live birds and dried skins caused by a shrinkage of 3-4 mm in the skins.

Care should be taken to avoid using the function on birds that are not fully grown. These can be distinguished in the field by observing eye colour. Adults have red eyes, but juveniles and immatures have pale brown eyes darkening to orange in sub-adults.



• Figure 2. *The relation between tarsus length and exposed culmen length in 47 live Woodhens measured in the field on Lord Howe Island and two discriminant functions to separate sexes. Discriminant function (L) for live birds was calculated from 33 individuals (solid circles = males; open circles = females). The mean values obtained from these birds and the intercepts used to draw the line are shown. Also shown is the discriminant function (S) obtained from museum skins (See Appendix). Additional plots have been included, which were obtained from live, but immature birds solid triangles = males; open triangles = females and open squares = unknown sex. In all cases sex was determined by subsequent observation (see text).*

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APPENDIX

Measurements taken from 52 Woodhens collected by R. Bell for G. M. Mathews on Lord Howe Island during 1913 to 1914 now held by the American Museum of Natural History, New York. All measurements by P.J.F. but extremes checked by H.J. de S.D.

Measurements (mm)							
AMNH Number	Bell's Collection Number	Sex	Culmen	Tarsus	Mid-toe	Wing chord	Tail
545310	18	♂	49.4	48.9	51.3	134	53
545337	36	♀	—	48.2	52.2	141	69
545346	37	♂	54.1	52.2	52.3	139	63
545339	38	♀	44.9	46.2	48.2	135	62
545358	43	♂	52.3	51.2	49.7	135	55
545353	44	♀	44.0	46.5	48.6	138	60
545360	45	♂	51.0	49.1	50.5	142	63
545327	61	♀	54.0	48.0	47.8	136	61*
545344	62	♂	54.0	49.0	52.0	136	53
545349	63	♂	50.5	51.1	50.7	144	59
545338	64	♀	49.0	47.1	48.0	138	65
545335	65	♀	49.4	47.4	52.1	130	58
545343	66	♀	47.7	45.8	45.8	126	61
545359	66	♂	50.2	48.3	50.4	137	62
545367	67	♂	—	50.9	50.7	144	69
545368	68	♀	46.2	45.4	48.6	135	60
545362	69	♂	55.8	50.3	52.7	143	63
545357	70	♀	47.5	45.7	49.7	128	62
545350	71	♂	52.6	50.7	53.0	135	61
545334	72	♀	—	47.0	46.7	142	56
545330	73	♀	48.5	46.2	47.3	133	59
545332	74	♀	50.9	47.9	48.6	133	60*
545329	76	♀	46.6	45.0	45.6	137	61
545298	99	♀	49.8	48.1	50.5	138	59
545324	101	♀	45.0	45.5	47.6	—	58
545215	104	♀	42.5	44.0	47.3	139	63
545326	105	♀	46.5	44.6	47.2	137	65
545354	105	♂	54.6	50.3	51.8	137	62
545328	106	♀	47.7	49.0	51.1	131	60
545302	107	♂	52.8	48.0	50.5	—	—
545323	110	♀	45.8	46.2	50.0	137	64
545307	111	♂	51.6	47.6	48.9	138	60
545314	112	♀	43.9	44.7	46.2	133	60
545303	113	♂	51.5	48.5	51.0	140	63
545309	115	♂	50.3	45.6	47.2	136	61*
545352	134	♂	50.3	49.4	52.7	135	58
545351	135	♂	51.2	53.3	54.1	—	—
545333	159	♀	47.7	45.6	46.5	134	55
545348	160	♂	60.3	50.7	54.5	145	64
545336	161	♀	53.5	47.2	49.0	134	59*
545305	161	♂	50.0	49.8	49.7	135	56
545345	162	♂	55.7	47.2	51.6	135	59
545331	163	♀	51.5	47.3	45.8	131	57*
545296	180	♂	50.8	47.7	51.0	138	62
545313	183	♀	45.7	45.2	46.6	132	62
545300	184	♂	51.2	47.5	51.0	145	71
545308	185	♂	51.7	48.0	51.0	136	61
545325	186	♀	42.3	45.4	48.1	132	60
545321	188	♀	45.9	44.7	45.3	142	61
545322	189	♀	46.4	48.3	50.1	130	58
545304	190	♂	53.3	49.6	52.3	142	59
545306	192	♂	54.0	49.4	42.3	144	60

* See text for comments on these 5 birds.