

**SEXUAL SIZE DIMORPHISM IN THE
SKULL OF THE NORWEGIAN RED FOX
VULPES VULPES L.**

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Sexual dimorphism in 8 skull dimensions of 116 Norwegian Red Foxes *Vulpes vulpes* averaged 4.6% (range 3.9—6.7%), with males significantly larger in all measurements. A relatively large overlap between the sexes was found, and only 73% of the specimens were correctly classified to sex in a discriminant analysis.

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The Red Fox *Vulpes vulpes* L. is widely distributed, but few studies report on variation in size related to sex. Male Red Foxes are 3—8% larger than females in body length, and 13—25% larger in weight (Lund 1959). Cranial variation has been found in Great Britain and North America, but the difference is not always clear or consistent (Chur-cher 1960, Huson & Page 1979). In this study I examine the extent of cranial size dimorphism in Red Foxes from West Norway.

Eight skull and mandible measurements were taken by caliper (0.1 mm) in a total of 116 skulls collected from Hordaland and Sogn og Fjordane counties of West Norway by the Museum of Zoology, University of Bergen. Some skulls were broken, thereby reducing sample size in some measurements. The age distribution was not known. In

Great Britain, 6 skull dimensions of Red Fox males of age class 0—1 year averaged ($\pm$ SD) $95.5 \pm 0.62\%$ of age class 4—5 years, and of females $98.0 \pm 1.42\%$ (calculated from Huson & Page 1980). This small growth beyond the first year of life will probably not have much influence on the results of a possible small bias in the age distribution of the two sexes, and only pups less than about 6 months were excluded from the analysis. In Norway, most foxes are killed during October—March.

The male Red Fox was larger than the female in all 8 dimensions (Table 1), average $4.6 \pm 0.01\%$ (range 3.9—6.7%). However, the sexes overlapped much (Fig. 1). When including all 8 measurements in a discriminant analysis that maximized Mahalanobis' distance between the sexes, only 72.6% of the specimens were correctly classified to sex (Wilk's lambda = 0.67, $\chi^2 = 35.3$, d.f. = 4, $p < 0.001$). Maximum mandible length, postorbital breadth, mandible height, and rostrum breadth were included in the discriminant analysis after the final step, and had diminishing power in the order listed.

Sexual dimorphism in Norwegian Red Fox skulls was small and similar to that of British foxes (about 6%, Huson & Page 1979). A reduced sexual dimorphism is usually associated with monogamy, paternal care, and reduced competition for mates among males (e.g. Bekoff et al. 1981).

Both male and female foxes from Norway had a slightly longer but more narrow skull than foxes from Wales and S.E. England, when zygomatic breadth was calculated as a percentage of condylobasal length ($\sigma\sigma$: Wales = 56.1%, S. E. England = 57.0%, west Norway = 54.3%; ♀♀ : Wales = 55.7%, S. E. England = 56.8%, west Norway = 53.1%). Males from Alaska were similar to British foxes (56.3%, from Pengilly 1981). More foxes

Table 1. Mean (mm), standard deviation, and sample size of 8 skull and mandible dimensions of Red Foxes. The male/female ratio (R) and F-values (ANOVA, $p < 0.001$ in all cases) are also given.

Measurements	Males			Females			R	F
	$\bar{X}$	SD	n	$\bar{X}$	SD	n		
Condylobasal length	144.7	0.54	68	139.3	0.46	47	1.04	30.90
Palatal length	76.6	0.32	69	73.6	0.32	47	1.04	24.19
Zygomatic breadth	78.5	0.47	64	74.6	0.28	43	1.05	23.61
Postorbital breadth	36.8	0.26	63	34.5	0.21	44	1.07	23.52
Molar breadth	44.9	0.21	68	43.1	0.19	47	1.04	23.46
Rostrum breadth	25.6	0.15	68	24.5	0.11	46	1.05	18.94
Maximum mandible l.	110.5	0.43	68	106.3	0.38	45	1.04	27.73
Mandible height	39.7	0.25	68	38.2	0.16	47	1.04	12.98

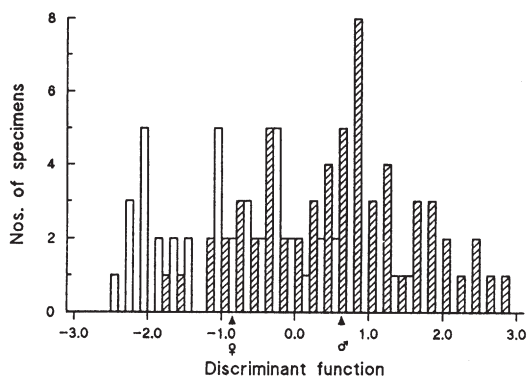


Fig. 1. Histogram of the discriminant function scores of male (hatched) and female Red Foxes. The group centroids are indicated.

were correctly classified to sex in Wales (88%) and S.E. England (80%) than in my analysis, with zygomatic breadth, greatest length, condylobasal length, and palatal length as the most important dimensions (Huson & Page 1979). These were different from the 4 dimensions that best classified the specimens to sex in my analysis. The results from my analysis were not good enough for a classification of unknown specimens to sex.

SAMMENDRAG

Rødrev-hanner fra Vest-Norge (Hordaland og Sogn & Fjordane) var gjennomsnittlig 4.6% (3.9—

6.7%) større enn hunner i 8 kranie-mål. Overlappet var imidlertid relativt stort, og i en diskriminant analyse ble bare 73% av kraniene klassifisert til riktig kjønn.

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