Clutch-Size and Egg Dimensions of the Black Swan *Cygnus atratus* at Lake Ellesmere, Canterbury, New Zealand

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The Black Swan, *Cygnus atratus,* a native of Australia, was introduced into New Zealand, during the mid 19th century. Large numbers are found nesting on the western side of Kaitorete spit at Lake Ellesmere. Delacour (1954) states that there is no fixed breeding season in Australia. At Lake Ellesmere nesting lasts from approximately mid August to January. In the 1963 and 1964 season about 5000 pairs nested.

This paper describes the variation in clutch-size and length, diameter and volume of eggs observed during September of the 1963 breeding season at Lake Ellesmere.

To determine clutch-size, 225 clutches were surveyed towards the end of the laying period when all but a few nests were complete. The number of eggs per clutch varied between 1 and 13, normally distributed with mean of 5.9, and mode of 6.0. This mean agrees with the following Australian records; Gould (1865) 5-8 eggs per clutch, Lucas and Le Souef (1911) 4-6, North (1913), 5-6, Serventy and Whittell (1948) 4-8, and Delacour (1954) 4-8. Oliver (1955) observed clutches at Lake Ellesmere and gives clutch-size as 4-7.

Egg dimensions were obtained by measuring maximum length and diameter to the nearest 0.1 mm with a vernier gauge. 25 clutches were measured and marked as laid, so that the present study distinguishes between eggs laid first, second, third, etc., in the clutch. The first three eggs were laid approximately $1\frac{1}{4}$ days apart, but after the third egg one was laid every day.

Egg volumes were calculated using the expression $V = 0.512 \times \text{length} \times \text{diameter}^2$. (Stonehouse 1966).

The following tabulation indicates the differences between first, second, and third eggs, etc., in the clutch.

This table shows considerable variation in length and diameter. When mean, range, standard error and standard deviation of these two variables are plotted to give a Hubbs-Perlmutter diagram, the first eggs as a whole appear somewhat smaller than all other eggs. Analysis of variance and interpretation tests confirmed that first eggs were significantly shorter than third, fourth, fifth, sixth and ninth eggs ($p = 0.003$), and "t" tests showed first eggs to be significantly narrower than second to sixth eggs ($p = 0.05$). The smaller samples of seventh to ninth eggs did not allow tests for significance and it is possible that first eggs would be significantly

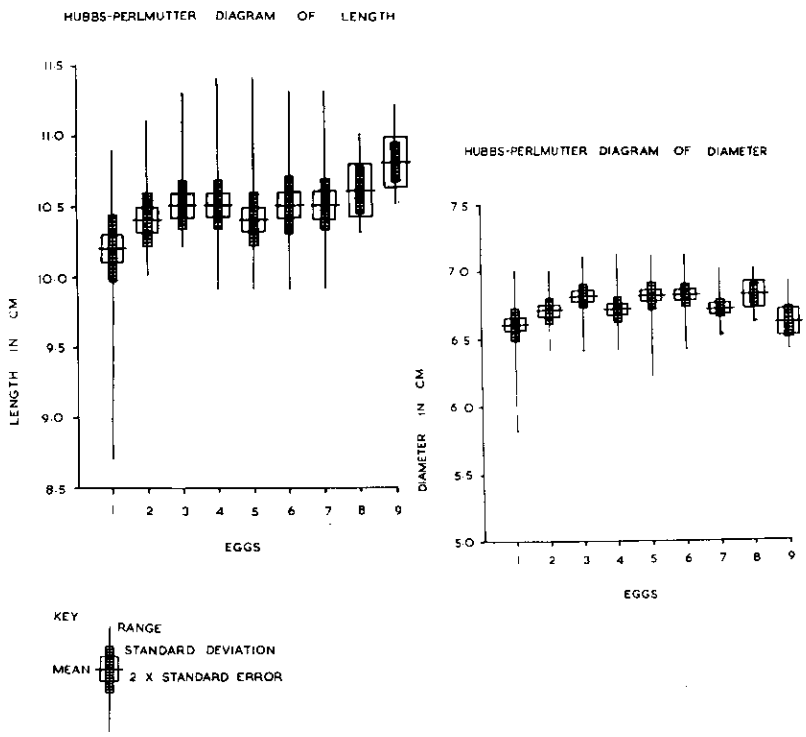
Table of Means, Standard deviations, and Range of the measurements of Length, Diameter, Volume and l/d ratio of First, Second, Third, etc., Eggs.

	No.		Length (cm.)	Diameter (cm.)	Volume (cc.)	l/d
First eggs	21	Mean	10·2	6·6	227·4	1·54
		Range	8·7–10·9	5·8–7·0	150·2–264·1	1·5–1·7
		S.D.	0·48	0·24	23·4	0·15
Second eggs	20	Mean	10·4	6·7	239·1	1·54
		Range	10·0–11·1	6·4–7·0	196·3–272·6	1·5–1·7
		S.D.	0·37	0·19	19·5	0·15
Third eggs	23	Mean	10·5	6·8	245·6	1·56
		Range	10·2–11·3	6·4–7·1	212·1–276·9	1·5–1·6
		S.D.	0·34	0·17	18·3	0·15
Fourth eggs	24	Mean	10·5	6·7	243·3	1·56
		Range	9·9–11·4	6·4–7·1	207·1–282·4	1·5–1·7
		S.D.	0·33	0·18	17·0	0·15
Fifth eggs	24	Mean	10·4	6·8	243·5	1·55
		Range	9·9–11·4	6·2–7·1	197·7–290·1	1·5–1·6
		S.D.	0·38	0·20	21·0	0·15
Sixth eggs	19	Mean	10·5	6·8	246·7	1·55
		Range	9·9–11·3	6·4–7·1	214·0–275·3	1·5–1·6
		S.D.	0·42	0·16	18·7	0·15
Seventh eggs	10	Mean	10·5	6·7	238·8	1·57
		Range	10·0–11·0	6·5–7·0	218·9–259·9	1·5–1·6
		S.D.	0·33	0·12	13·6	0·15
Eighth eggs	3	Mean	10·6	6·8	247·5	1·57
		Range	10·3–11·0	6·6–7·0	231·7–274·6	1·5–1·6
		S.D.	0·31	0·16	6·1	0·47
Ninth eggs	3	Mean	10·8	6·6	242·7	1·63
		Range	10·5–11·2	6·4–6·9	210·9–267·8	1·6–1·7
		S.D.	0·28	0·21	7·6	0·49

smaller than all others if all samples were larger. A glance at the ranges shows that the smallest egg in length, diameter and volume is one laid first in a clutch, and although volume of first eggs did not show up statistically as being significantly different from volumes of other eggs, it seems likely that they are smaller in this respect also.

Lengths and volumes of all eggs are normally distributed. Diameter and l/d ratios depart from normality in a symmetrical manner, probably due to the small size of the samples.

Gould (1865) gives egg dimensions of 110.3 × 67.4 mm for Australian Black Swans, Lucas and Le Souef (1911) give 102.4 × 64.2 also for Australian birds, and North (1913) gives a series of 14 measurements, the means of which are 101.4 × 61.3 mm. Serventy and Whittell (1948) give dimensions 102.0 × 67.0 mm and range 98.0-106.0 × 66.0-69.0, and Delacour (1954) 115.0 × 65.0 mm. Oliver (1955) list eggs from the Chatham Islands with dimensions 108.0 × 70.0 mm, and from Lake Ellesmere, Canterbury, with dimensions 111.0 × 68.0 mm. In the present study the average egg size for the whole sample was 104.1 × 67.2 mm, with range 87.2-114.0 × 58.0-71.2 mm.



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