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Clutch size and egg characteristics of Cotton Pygmy-Goose in Assam (India)

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ABSTRACT

The reproductive output of the waterfowl depends on the nutrients present in the eggs. The average clutch of each species of waterfowl has been evolved in relation to the average availability of food for the female around the time of laying, modified by the relative size of the egg. It has been also suggested that the species laying eggs that were small, relative to their body size, would be able to lay many eggs, whereas species laying large eggs would lay fewer eggs. The Cotton Pygmy-goose eggs were light creamy white or light ivory white in colour on the day of laying with the mean size of 13.94 ±0.4 SD. The overall clutch size found was 14.2. The mean size of the eggs ranges between 13.50 to 14.76 cm^2 (mean= 13.94 ±0.4 SD). The overall mean length of the egg was found to be 42.8 mm ±0.7 SD (range 42.0 – 44.6 mm, n=21), whereas the mean egg width was 32.4 mm ±0.5 SD (range =31.5 – 33.1 mm, n=21). A strong positive and significant relationship exists between egg length and width (r= 0.8 & p= 0.0001). The mean weight of the eggs was found to be 25.006 ±0.2 SD (range: 24.5 to 25.75 gm). Standard methodology was followed to execute the study. The present paper deals with the study of clutch size and various characteristics of eggs of the species in concern and their relation with the female.

Key words: Anatids, egg mass, female mass, intra-specific, *Nettapus coromandelianus*

INTRODUCTION

Waterfowl lay large eggs relative to their body size (King, 1973; Rahn *et al.,* 1975) and they lay large clutches (Johnsgard, 1978). The average clutch of each species of waterfowl has been evolved in relation to the average availability of food for the female around the time of laying, modified by the relative size of the egg. The species laying eggs that were small, relative to their body size, would be able to lay many eggs, whereas species laying large eggs would lay fewer eggs (Lack 1967). Relation between the female body mass and egg mass with the clutch size in various species of *Nettapus* has been attempted by Frith (1967), Lack (1968) and Mackworth-Praed and Grant (1962) and found an inverse relationship between egg mass and clutch size, whereas the clutch size was positively related to body mass. In anatids, there lies an inverse relationship between egg size and clutch size, which is largely due to their breeding habits, which lay larger eggs but small clutches (Lack, 1970; Weller, 1980). Klomp (1970) and Johnsgard (1978) provided explanations to the variation of the clutch size with environmental changes in an intra-specific condition in waterfowl. Variation in diet quality in captive mallards have significantly affected the clutch size, egg mass, egg composition, laying rate, re-nesting interval and nesting attempts. There is probably considerable flexibility in response to environmental conditions (Eldridge and Krapu, 1988). In general, egg size varies within and between populations, with most variation (50-98%) attributable to differences among different individuals of females (Ojanen *et al.,* 1979; Van Noordwijk *et al*., 1980), but proximate factors like age, egg laying date, and food availability also affect on egg size (Ryder, 1975; Crawford, 1980; Runde and Barrett, 1981; Birkhead and Nettleship, 1982; Gratto *et al*., 1983; Horsfall, 1984; Pierotti and Bellrose, 1986). Variation in egg size also may occur within clutches (Howe, 1976), but this variation usually is much less than variation among females (Ricklefs, 1984; Redmond, 1986).

The Cotton Pygmy-goose (*Nettapus coromandelianus coromandelianus* Gmelin) is a secondary cavity nester and is vulnerable to loss of nesting habitat. The Cotton Pygmy-goose is solely dependent on the wetlands for feeding and tree holes or cavities for the purpose of nesting (Mukherjee, 1974). The pair formation and courtship is started for the species in the month of May, but the egg laying starts from June to August. Ali and Ripley (1983) also reported that, they breed during the monsoon season. The present paper deals with the clutch size and egg characteristics in Sonitpur district of Eastern Assam.

METHODOLOGY

The following methods were followed to detect various characteristics of egg.

(a) *Egg weight and diameter*

Weight of the eggs was measured with a portable Pan balance and spring balance and the egg diameter was measured with a slide calipers (with 0.001 mm accuracy) carefully without disturbing the contents of the eggs. The length and breadth of the eggs were also measured and recorded in a data sheet. Factors affecting variation in the eggs were studied as per Hepp *et al.* (1987).

(b) *Egg mass*

Egg mass was calculated from egg dimensions using the following equation as per Hoyt (1979) (Young, 1972; Mackenzie and Kear, 1976; Riggart, 1977; Rohwer, 1986):

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$$EM = K \times L \times B^2$$

where, EM = egg mass; K = constant (0.555 gm/cm^3); L = length of the egg; B = breadth of the egg.

(c) Relation between egg mass and female mass

The egg mass of more than 50% eggs of a nest was calculated and was compared with the weight of the incubating female and a relative study was made.

RESULTS AND DISCUSSION

The result shows that, egg laying takes place during the early morning hours of the day before 06:00 hours (n = 1), between 07:00 - 08:00 hours (n = 5) and 08:00 – 10:00 hours (n =2). Single egg was laid each day for 10–18 days synchronously. The results of the present study regarding the egg characteristics are described in the following sub-heads:

(a) Colour, size and number of eggs

The eggs were light creamy white or light ivory white in colour on the day of laying but become darker during later periods. The mean size of the egg was found to be 13.94 ±0.4 SD (range: 13.5 to 14.76 cm^2; n = 10). The overall number of eggs ranges between 10 to 18 (average clutch size 14.2, n = 25) excluding one nest (the N_{16}) in which eggs have been counted only up to 7 (seven) and were not recorded on further observations, which might be consumed by some predators.

(b) Egg size vs. clutch size & egg weight

The results of present study shows that, the egg size ranges between 13.50 to 14.76 cm^2 (mean= 13.94 ±0.4 SD; n = 10). The overall mean length of the egg was found to be 42.8 mm ±0.7 SD (range 42.0 – 44.6 mm, n = 21), whereas the mean egg width was 32.4 mm ±0.5 SD (range =31.5 – 33.1 mm, n=21). Analysis shows that a strong positive and significant relationship exists between egg length and width (r = 0.8, Pearson's correlation; p= 0.0001, t-test, 99% CL). The mean weight of the eggs was found to be 25.006 ±0.2 SD (range: 24.5 to 25.75 gm; n = 10; Table-1; Fig. 1). Analysis shows that, there exist a significant relationship between the egg size and egg weight at 99% CL (p = 0.0001, t-test). The clutch size varies from 12 to 18 in 2007 with mean 14.3 ±2.2 SD (n = 200, 14 nests), while the same varies between 10 to 18 eggs with mean clutch size 14.2 ±2.6 SD (n =156, 11 nests) in 2008 (Fig. 2). Analysis shows that there exists a negative, but significant relationship between egg size and clutch size at 99% CL (r = - 0.2, Pearson's correlation; p = 0.0001, t-test).

(c) *Egg mass vs. female mass*

The female mass of the bird varies from 215.5 to 235.5 gm/cm^3 (mean: 223.7 gm/cm^3 ±7.7 SD) and egg mass between 7.275 to 7.875 gm/cm^3 (mean: 7.669 gm/cm^3±0.2 SD). Analysis shows a strong positive and significant relationship between the female mass and egg mass at 99% CL (r =0.4, Pearson's correlation; p =0.0001, t-test; Table-2; Fig. 3).

Table 1. Egg size and weight of a of Cotton Pygmy-goose nest during 2007 (n =10).

No. of Eggs	Egg size (cm^2)	Mean ±SD	Egg weight (gm)	Mean ±SD
E1	14.19		25.150	
E2	13.85		24.960	
E3	14.76		24.500	
E4	14.29	13.94 ±0.4	25.120	25.006 ±0.2
E5	13.58		25.050	
E6	13.87		25.150	
E7	13.71		25.175	
E8	13.50		24.950	
E9	13.57		25.250	
E10	14.12		24.750	

Abbreviation: E- egg

The mean incubation period during the study period was 28.8 days ±1.0 SD (n = 11) and 28.5 days ±0.9 SD (n = 9) with a nesting success of 92.7% and 92.2% respectively in 2007 and 2008. There was a strong positive relationship between clutch size and incubation period during the study period (r = 0.1, Pearson's Correlation; p = 0.001, t-test).

The Cotton Pygmy-goose is very specific in the selection of nesting trees where they lay eggs in protection from the predators. The breeding plumage in Cotton Pygmy-goose results the selection of the cavity bearing nesting trees where they lay eggs with a comparatively larger clutch size. The larger clutch size might be a mechanism to maintain a constant population, as these birds' goslings left the nest just after hatching which increases the chance of duckling mortality. Variation in clutch size is also related with the available food resources. Again, the clutch size and egg size were found to be inversely related. The present findings on clutch size and egg size is consisted with the findings of Lack (1954, 1967, 1968), Klomp (1970), Bengtson (1971), Bellrose (1980) and Hogstedt (1980). The clutch size in Cotton Pygmy-goose approaches the mass of the female, which might be related with the average availability of food for female around the time of egg laying. The study also shows that the larger the clutch size the lighter is the egg weight. This might be due to increased distribution of egg mass with the increase of number of eggs. A similar type of observation was also made by Mackworth-Praed and Grant (1962), Frith (1967) and Rahn *et al.* (1975).

Table 2. Female mass (gm; n = 4) and egg mass (gm/cm^3; n = 12) of Cotton Pygmy-goose recorded from study area in 2007.

Nest	No. of eggs	Female mass (gm)	Egg mass (gm/cm^3)
N_1	E1	215.5	7.275
N_1	E2	215.5	7.637
N_1	E3	215.5	7.615
N_4	E4	223.4	7.875
N_4	E5	223.4	7.659
N_4	E6	223.4	7.762
N_8	E7	235.5	7.625
N_8	E8	235.5	7.754
N_8	E9	235.5	7.759
N_9	E10	220.4	7.754
N_9	E11	220.4	7.459
N_9	E12	220.4	7.850

Abbreviations: N_1- Nest 1, N_4- Nest 4, N_8- Nest 8, N_9- Nest 9, and E- Egg

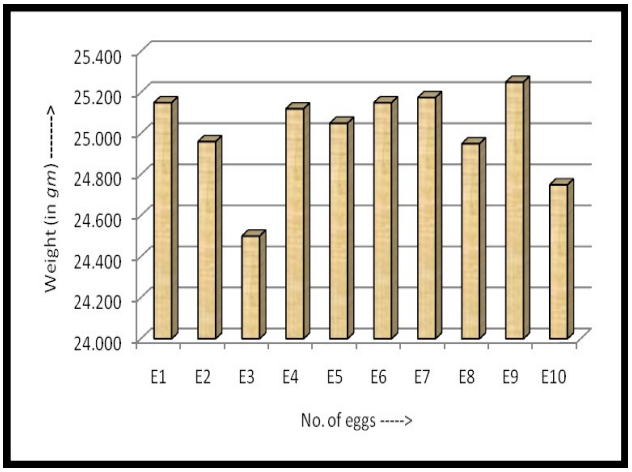

Figure 1. Weight (in *gm*) of Cotton Pygmy-goose eggs selected randomly from N_{11}(n = 10).

Figure 2. The clutch-size of Cotton Pygmy-goose during 2007 - 2008 (n = 26).

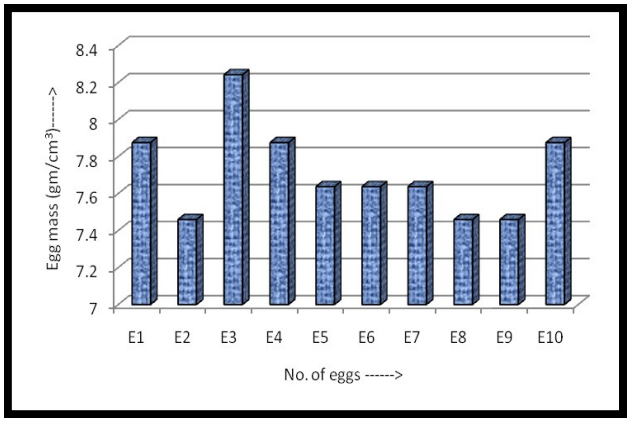

Figure 3. Egg mass (gm/cm^3) of Cotton Pygmy-goose recorded in study area (10 eggs were randomly selected).

Plate 1. Eggs of CPG recovered from a poacher from Kadamani area, 2007. (*in inset*: Shells of hatched eggs)

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