

**Full Length Research Paper****Breeding Ecology of Purple Moorhen (*Porphyrio porphyrio*) at Hokersar Wetland Kashmir**

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**Abstract**

The breeding ecology of purple moorhen *Porphyrio porphyrio* was worked out in Hokersar wetland (34° 06' N, 74° 05' E) a Ramsar site, one of the major wetlands of the valley protected and managed by the Department of Wildlife Protection, Government of Jammu and Kashmir. Breeding was initiated by the pair formation. Nesting sites were chosen in thick emergent vegetation, dominated by *Typha* and *Phragmites*. Nests were constructed by both sexes on an average in 6 days (range 4-10) but females played the dominant role and dimensions varied in different vegetation. Clutch size varied from 2-5 eggs and mean egg measurement were 52.91±1.82mmX35.76±1.71mm. The volume and shape index of eggs was found to be 33.86±4.28cm<sup>3</sup> and 66.74±1.49 respectively. Incubation was mainly performed by females during an average period of 23.2±1.28 days. Hatchlings were nidifugous and hatching period varied from 1-2 days. Overall egg weight loss of 15.6% was recorded during incubation. The average weight of freshly hatched chicks was 23.02±1.8g. Hatching, fledging, nesting and overall breeding success as recorded traditionally were 68.7%, 55%, 66.24% and 42.19% respectively. But on the basis of exposure hatching and nesting success were 0.53 and 0.57 respectively.

**Key words:** breeding, incubation, hatching, hatching period, nesting success, population

**Introduction**

The purple swamp hen (*Porphyrio porphyrio*) is a medium sized water bird (Ali, 1979) which lives in marshes, lagoons, and reservoirs with appropriate vegetation cover and water depth. A beautiful but clumsy purplish-blue bird with long red legs and toes and bald red forehead, is found in tropics and subtropics with several subspecies and a distribution extending from Europe and Africa to New Zealand (Urban *et al.*, 1986; Merchant and Higgins, 1990). Undisturbed areas with tall, thick vegetation cover and shallow calm water are generally sites preferred by swamp hens (Cramp and Simmons, 1980; Sanchez-Lafuente *et al.*, 1998). Purple swamp hens have been intensively studied by several investigators and detailed facets of their breeding biology have been explored in Spain, New Zealand and Italy (Craig (1980; Sanchez-Lafuente 1993; Grussu, 1999). It is widely distributed in India but there have been no studies on its breeding behaviour. The objectives of current study were to assess its nesting season, peak breeding activity and various breeding parameters in the Hokersar wetland Kashmir.

**Material and Methods****Study Area**

The study was carried out at Hokersar wetland (34°06' N; 74°05' E) a Ramsar site (Fig.1). It lies 10 km. west of Srinagar on Srinagar Baramullah highway. The wetland provides excellent wintering resorts, cover and safe roosting and feeding grounds to a large number of migratory waterfowl as well as breeding and nesting grounds for diverse migratory and resident birds in summer. This wetland is mainly fed by Doodhganga watershed in Pir Panjal range of Himalayas. It has the dominant vegetation of *Typha angustata*, *Phragmites communis*, *Sparganium ramosum*, *Butomus umbellatus* and *Saccharum spontaneum*.

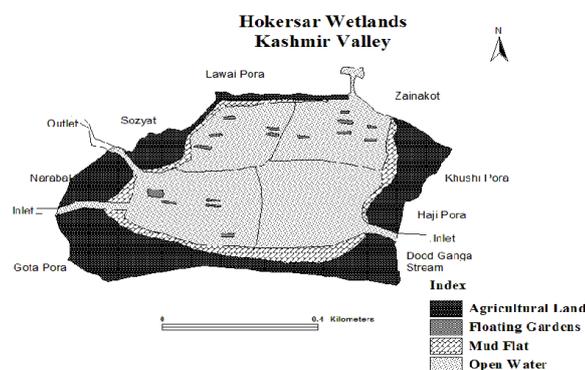


Figure1. Hokersar Wetland

### Field procedures

Nests were searched systematically throughout the wetland. On finding a nest, various dimensions viz diameter, depth and height above vegetation were measured with the help of measuring tape. Egg mass and egg morphometry were taken using electronic balance and digital calliper respectively. Freshly laid eggs were marked with indelible marker pen in the order of their laying to calculate egg weight loss, incubation period and hatching period. Slender willow stakes flagged with strips of red cloth were used to mark nest locations so that nests could be relocated (Klett *et.al*, 1998). To monitor outcome, the nests were visited thrice in a week. A nest was defined as successful if there was at least hatching of one chick in the nest, the presence of piping holes on the egg made by the chick, or by observing the behaviour of incubating bird like distraction displays viz inability to fly and thrashing of wings on water. Unsuccessful nests were characterised as if the eggs were cold, absence of adults in vicinity of the nest, displacement of eggs from the nest.

To find whether there is any variation in the egg dimensions of early and late clutches, they were divided into three groups (only 3 egg clutches). The clutches laid from 24<sup>th</sup> April to 29 June were considered as early clutches, the clutches laid from 30 June to 4<sup>th</sup> July were considered as intermediate clutches and the clutches laid from 5<sup>th</sup> July to 11 August were considered as late clutches. Incubation period was defined as the period since the laying of last egg of clutch until the hatching of first egg (Gill 1994). To calculate the average egg weight losses, eggs were weighed regularly with the help of digital balance till they hatched. Freshly hatched chicks were weighed to the nearest gram and their beaks and tarsi were measured with the help of vernier callipers. The incubation and hatching behaviour was studied with the help of Super Zenith binoculars (50x70) from a hide at least 10m away from the nest. Egg volume was calculated as  $V=0.051 \times L \times B^2$  and Shape index as  $W/L \times 100$  (Hoyt, 1978). Hatching, fledging and breeding success were defined as the probability that eggs laid would hatch, the probability that hatchlings would fledge and the probability that eggs laid would survive from laying to fledging. These calculations were done as per Mayfield (1975).

### Statistical analyses

Measurements of early, intermediate and late clutches were compared with one way ANOVA followed by post-hoc Tukey's test. Correlation between reed height and number of nests predated was determined also correlation between clutch size and nest diameter and between egg volume and clutch size was found. Probabilities were two tailed, and significance level was set as 0.05. All statistical analysis were performed using SPSS and MS Excel

### Nest site, building and structure

Nest sites were chosen in the areas which had thick growth of emergent vegetation dominated by *Typha angustata*, *Saccharum spontaneum*, *Sparganium ramosum*, *Butomus umbellatus* and *Phragmites communis*. Some nests (n=21) were built using entirely the emergent vegetation of *Phragmites communis*, while few nests that were found in sparse vegetation these nests were made mostly of dried vegetation. Reed height in nesting sites varied from 89.1 to 121cm and density from 56-71/m<sup>2</sup>. But in sites with sparse vegetation reed height varied from 21-30cm and density 25-32/m<sup>2</sup>. The first signs of nest building were noticed in the middle of April. Both the parents built the nest but most of the architectural work of arranging and giving the nest characteristic shape was done by female. In the nest formation, densely growing emergent macrophytes were used. The dominant being *Typha angustata*, *Phragmites communis*, *Saccharum spontaneum*, *Sparganium ramosum* besides these grasses, *Juncus* and leaves of *Trapa spp.* were also used in nest building. The nest diameter ranged from 15.7-25.1cm in thick emergent vegetation and 16.1-19.9cm in sparse vegetation.

### Egg morphometry, Clutch size and Incubation

Eggs were elliptical, dark white in colour with scattered brown markings and measured on an average 52.91±1.82mm X 35.76±1.71mm (Table1). The volume and egg shape index of eggs was found to be 33.86±4.28cm<sup>3</sup> and 66.74 ±1.49 respectively. The mean clutch size of purple moorhen was found to be 4. A positive correlation was found between the clutch size and the nest diameter (fig.2).

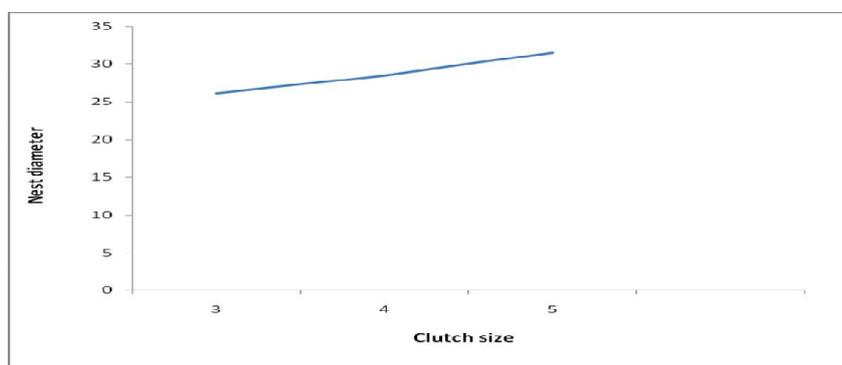


Figure 2: Positive correlation between clutch size and nest diameter

Table 1: Egg Parameters

Egg parameter	Minimum value	Maximum value	Mean value	Number measured
<b>Weight (un-incubated)</b>	28.2gms.	31.6gms.	29.65±1.17gms.	30
<b>Weight (incubated)</b>	24.8gms.	25.2gms.	25±0.15gms.	30
<b>Length</b>	50.02mm	55.78mm	52.91±1.82mm	90
<b>Breadth</b>	32.02mm	37.98mm	35.76±1.71mm	90

The average volume of eggs within a clutch had a marginally significantly negative correlation with the size of the clutch (fig.3). The eggs of early and intermediate clutches were significantly longer ( $F_{2, 87}=44.64, P<0.05$ ) and broader ( $F_{2, 87}=55.57, P<0.05$ ) as compared to final clutches (Table2). But there was no significant difference between early and intermediate clutches ( $P=0.80$ ). Incubation period varied from 22-26 days with an average of  $23.2\pm 1.28$  days. During incubation the eggs lose on an average 15.7% of weight (Fig.4). Both the parents incubate the eggs but females which are larger attended the nests and eggs, the most. From the observations on nests it was found that females spent 80% of the day time in incubating and shading the eggs and males only when females left for feeding..

### Hatching and Hatching success

The hatching was asynchronous and the eggs hatched in the nests in the order in which they were laid. The hatchlings were nidifugous and weighed on an average 21.21g. Soon after emergence they followed their parents for food. The hatching success during the study was 68.7% (traditional method) and 53% (Mayfield) (Table3). The major causes for hatching failure were flooding, predation, abandonment of nest by female and eggs lost due to faulty incubation.

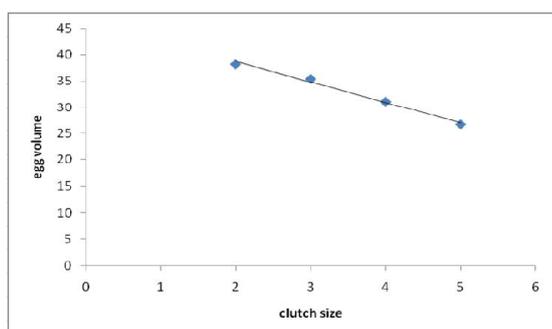


Figure3. Negative correlation between Egg.

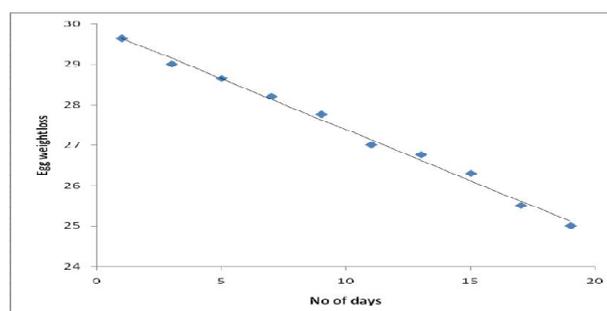


Figure4. Egg weight loss volume and Clutch size

Table 2: Egg dimensions of early, intermediate and late clutches

Parameters	Length (mm)	Breadth (mm)	Vol. (cm <sup>3</sup> )	Shape index (SI)	No. measured
<b>Early clutches</b>	53.84±0.87 $\alpha$	34.88±0.99 $\alpha$	28.12±1.59 $\alpha$	76.86±3.03A	(n=30)
<b>Intermediate clutches</b>	51.73±0.99 $\alpha$	34.67±1.00 $\alpha$	27.51 ±1.96 $\alpha$	76.19±3.16A	(n=30)
<b>Late clutches</b>	50.76 ±1.07b	31.77±0.95b	21.53±1.14b	74.94 ±3.12B	(n =30)
<b>P =</b>	0.000	0.000	0.000	0.000	
<b>F =</b>	38.11	66.64	31.60	58.73	

### Nesting Success

The total number of nests found during the breeding season was 157. In June 48.40% of nests were recorded and in August only 7%. Out of 157 nests 53 nests failed to survive and were mostly lost to predation and flooding thus giving an overall nesting success of 66.24% when calculated by the traditional method. But when calculated by Mayfield's method of exposure it was 57% (Table3).

The fledging success during the study period was 55% and the overall breeding success was 42.19%.

### Development and behaviour of hatchlings

Freshly hatched chicks were more or less fully developed with eyes open. They were covered with black natal down though the skin underneath was visible. The beak was white with well developed with red markings having an average length of  $9 \pm 0.57$  mm and the legs were slender black with average tarsal length of  $11.51 \pm 0.47$  mm. The average weight of hatchling was  $26.62 \pm 0.83$  gms.

**Table3.** Mayfield survival probability for different stages of Purple moorhen

Parameters	Exposure days	No. of eggs/ nestlings/ nests	No. of eggs/nestlings/ nests failed	Daily survival	Success rate
Hatching	8122	628	217	0.97	0.53
Nesting	5432	157	53	0.98	0.57
Fledging	2147	411	146	0.93	0.55

### Parental care

Parental care continued as the hatchlings came out of the egg. They were brooded for 5-8 days. Freshly hatched chicks were fed after 3-4 hours by the attending parents. Older chicks after learning capturing and feeding technique helped parents to feed the young chicks by collecting food material and presenting them to parents which they fed to the young ones. Major chick predators the common crow and night heron were vigorously attacked and compelled to fly away by tending parents.

### Discussion

The duration of breeding season in purple moorhen lasted for nearly five months, with a single breeding season extending from April to August. Bates and Lowther (1952) and Ali (1979) also reported a single breeding season for moorhens but from May to August. Shah (1984) also reported a single breeding season for moorhen extending from April to August. These findings are in accordance with the findings of that of Shah (1984). The early initiation of breeding can be attributed to the favourable climatic conditions as during April there were low rains and mercury level was high in comparison to the preceding month March. The nesting site varied greatly but it was mostly characterised by thick growth of *Typha angustata*, *Phragmites communis*, *Butomus umbellatus* and *Sparganium ramosum*, and it provided adequate cover and protection to the eggs and nestlings from predators. Similar observations regarding nesting site were recorded by Shah (1984) in case of moorhen. A number of workers have also found cattail and rushes as preferred nesting sites of moorhen (Bates and Lowther, 1952; Hylander, 1959; Whisteler, 1963; Relton, 1972 and Ali, 1979). Both sexes took part in building of a nest but male mostly collected nesting material and female did the architectural work. These findings were in accordance with Bates and Lowther (1952). Various workers have reported the different clutch size in purple moorhen. Manez (1997) 3-5 eggs / nest, Schenk (1993) 4-6 eggs and Moali and Isenmann (2000) 3-6 eggs. The clutch size during the present study varied from 2-5 eggs with a mean of 4, which is lower than that of *Porphyrio porphyrio melanotus* which has 5.6 (range 2-10) as reported by Craig (1980) in New Zealand. The clutch size of swamp hens thus varies geographically usually decreasing with latitude. This supports Lack's (1968) hypothesis derived from earlier observations on different avian species.

During the present investigation egg measurements were  $52.91 \pm 1.82$  mm  $\times$   $35.76 \pm 1.71$  mm. Doss *et al.* (2009) have also reported more or less similar egg measurements of purple moorhen ( $52.5 \pm 2.8$  mm  $\times$   $34.8 \pm 1.1$  mm). Both parents incubated the eggs but females performed the most and the incubation period varied from 22-26 days with a mean incubation period of  $23.2 \pm 1.28$  days. Different workers have reported about the incubation periods Manez (1997) 23-25 days, Schenk (1993) 24-27 days, Moali and Isenmann (2000) 22-26 days. The variation in incubation period may be related to the varied climatic and ecological conditions that determine food availability, day length and daily temperature of a place that have lot of effect on incubation. But our findings seem to be in accordance with those of Moali and Isenmann (2000).

During the present study there appeared a gradual loss of 15.6% in egg weight during incubation. Shah (1984) reported a gradual loss of about 10.5% in the weight of eggs of moorhen during incubation. Fazili (2002) has also reported that eggs lose weight from 15.6 to 18.4% in different bird species. The eggs hatched in the order in which they were laid indicating the fact that hatching was asynchronous. Lack (1968) also observed asynchronous hatching in moorhen and according to him this phenomenon is an adaptation to a variable food supply. Factors that contributed low hatching success were flooding, predation, faulty incubation, and abandonment. Common crow (*Corvus splendens*), Pariah kite (*Milvus migrans*) and Night heron (*Nycticorax*

*nycticorax*) were main egg predators. Shah (1984) also found, common crow and pariah kite to be main predators of moorhen in Hokersar wetland.

The Purple moorhen did not exhibit any special parental care though it fed and protected the young ones till they were able to feed themselves and even thereafter. However, it was noticed that the grown up chicks help their parents to feed the younger ones. Wood (1974) had also observed juveniles to collect food and present it to their parents, which in turn fed it to the chicks.

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