CLUTCH PREDATION IN RELATION TO MEAN VEGETATION HEIGHT AND REED DENSITY AT THE NEST IN LITTLE BITTERN 
(IXOBRYCHUS MINUTUS MINUTUS)

Mustahson Farooq Fazili
Wildlife Research Division, 
Postgraduate Department of Zoology, 
University of Kashmir, Hazratbal Srinagar-190006, Kashmir.

Abstract
The paper attempts to draw a relationship between the clutch predation and mean vegetation height and reed density at nest in case of little bittern. A negative correlation was found between the predation and vegetation height ($r = -0.66$) and predation and reed density ($r = -0.67$). Earlier nests were more susceptible to predation than the later because the early nests were located in relatively shorter and less dense vegetation than the later nests.

Key words: clutch, predation, vegetation, height, density, little bittern.

INTRODUCTION
The cosmopolitan genus *Ixobrychus* is represented by four species in South East Asia: two of these (*I.sinensis* and *I.cinnamomeus*) have both resident and migrant populations; one species (*I.flavicollis*) is a non-breeding migrant species while as little bittern (*Ixobrychus minutus*) is a breeding migrant species (Fazili et al 2010). It prefers to breed in the wetlands, lakes, rivers and ponds (Ali and Ripley, 1968; Lansdown, 1987). The Kashmir population of little bittern is of the race *Ixobrychus minutus minutus* which has its breeding range extending from Europe to about 80° E. Besides Kashmir this bird breeds in suitable localities along the outer Himalayas as far east as Nepal and is winter visitor to Punjab (Baker, 1929).

Bitterns build their nests in tall and dense macrophytic vegetation. There are many studies on this bird in Europe (Groebbels 1935; Steinfatt 1935; Wackernagel 1950; Grosskopf and Graszynski 1958) and a few from Haigam wetland Kashmir India (Holmes 1983; Fazili et.al. 2010). None of the studies has deciphered the relationship between predation and reed density and reed height. The objective of the present paper is therefore to describe the relationship of clutch predation and reed density and vegetation height. Many workers have reported on clutch predation in mallards. Reynold *et al.* (2001) indicated that with an increase in the grass in the landscape duck nesting success also increased. Ball *et al.* (1995) found high duck productivity rates on study blocks where large areas of grass remained intact. Based on this we formed a hypothesis that as the average vegetation density and height around the nest decreases, the clutch predation increases. In the present study an attempt was done to answer this hypothesis.

Study area
The study was conducted from 2007 to 2009 at Wular Lake (34º15' to 34º25' N, 74º32' to 74º42' E), a Ramsar Site in the Baramulla and Bandipore districts of Jammu & Kashmir, India. The lake has a maximum depth of 4.9 m with an area of 111.71 Sq. Km (Latief 2012), that remains covered with dense growth of free floating and emergent vegetation during the major part of the year. The common species are *Trapa bispinosa, Nymphoides peltatum, Nelumbo nucifera, Ceratophyllum demersum, Hydrilla verticillata, Potamogeton indicus, P. lucens, Butomus umbellatus, Carex sp., Phragmites communis, P. elephantoides, Typha angustata, Myriophyllum verticillatum, Sparganium ramosum, Lemna sp. and Saccharum spontaneum*. Besides several springs that are occasionally seen bubbling up to the surface and streams, especially, Erin, Mudhumati, and Ningal Nallah, the lake is mainly and chiefly fed and drained by the river Jehlum.
METHODS
Nest searching was carried out every fourth day during the breeding season (April to August) of 2007, 2008 and 2009, so that nests could be found during the laying period. The nests of birds were generally located in the study sites by wading through reeds in marshy areas and shallow regions (Fazili et al. 2010). Most searches were done close to boat channels. A nest was defined as any depression in which the bird laid one or more eggs (Miller and John 1978). Height and density of vegetation at and around the nest was measured at the time when first detected. Vegetation height was measured at the centre of the nest bowl. Height was also measured at four diagonal points one meter each away from the nest centre and at right angles to each other in order to obtain mean vegetation height (Hill, 1984) around the nest. Density of vegetation at the nest was measured with quadrant method. Slender willow stakes flagged with strips of cloth were used to mark nest locations so that the nests could be relocated (Klett et al. 1988). Predation was determined by searching for egg remains. The main clutch predators were the common crow (Corvus splendens) and black kite (Milvus migrans).

RESULTS
A total of 90 nests were found during three seasons with 23 nests in 2007, 28 in 2008 and 39 in 2009. All these nests were detected during the egg laying stage. Of these 90 nests 15 were found in May, 36 in June, 25 in July and 14 in August. The average height and density of the vegetation surrounding the nests was determined (Table 1). From the table it is clear that the nests in which laying took place in May and June had shorter and less dense vegetation than the nests in which laying started later in July and August. The clutches in the shorter and less dense vegetation were more susceptible to predation than the clutches in tall vegetation as is evident from the table wherein the predation on the earlier nests is profound. The correlation between the number of clutches predated and average vegetation height and reed density at nest site was negative (Fig. 1 and Fig.2) with a Correlation coefficient, r = -0.66 and -0.67 respectively meaning that as the average height and density at nest sight increases, the clutch predation decreases and vice versa.

DISCUSSION
Bittern a regular summer breeding bird, started egg laying in the earliest nests in late May. Peak laying in Kashmir is last week of June to 3rd week of July while as the late breeders lay even in the month of August (Fazili et al. 2010). The early breeders built their nests in relatively shorter and less dense vegetation as in the beginning of the growing season the vegetation has not attained sufficient height and density to fully conceal the nest and thus suffer clutch predation. But the birds laying later in the season nest at a time when the vegetation has attained sufficient density and height to conceal the clutch. These late breeders nest in the taller and dense vegetation where the chances of predation are reduced. Similar results have been reported by many workers. Hill (1984) reported that proportion of mallard nests destroyed by predators increased as the minimum height of vegetation around the nest declined. Lizevy (1981) showed that successful nests were in taller vegetation than nests destroyed by predators. Fayaz et al (2010) has shown negative correlation between clutch predation and vegetation height in mallard at 2010.

In this scenario bittern populations will achieve maximum benefits if management would concentrate their efforts on creating and restoring large blocks of tall and dense macrophytic vegetation.
Table 1: Data regarding the clutch predation and average vegetation height at nest site

<table>
<thead>
<tr>
<th>Month</th>
<th>Year</th>
<th>No. of nests found (n)</th>
<th>$\sum n$</th>
<th>No. of nests Predated ($n_p$)</th>
<th>$\sum n_p$</th>
<th>Average vegetation height at nest site (cm) ± SD</th>
<th>Average vegetation density at nest site ($m^2$) ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>2007</td>
<td>3</td>
<td>15</td>
<td>3</td>
<td>12</td>
<td>54.8 ± 6.1</td>
<td>28 ± 7</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>5</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>7</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>2007</td>
<td>11</td>
<td>36</td>
<td>5</td>
<td>18</td>
<td>129.5 ±18.2</td>
<td>43 ± 9</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>13</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>12</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>2007</td>
<td>7</td>
<td>25</td>
<td>2</td>
<td>5</td>
<td>173.7±15.4</td>
<td>55±3</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>8</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>10</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>2007</td>
<td>6</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>195.1±6.1</td>
<td>57±1</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>4</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>4</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Negative correlation between the average vegetation height at nest site and the number of clutches predated.
Figure 2. Negative correlation between clutch predation and average reed density

REFERENCES