EFFECT OF THE COLONY EDGE ON THE CLUTCH SIZE AND FLEDGING SUCCESS IN THE LITTLE EGRET

ABSTRACT: The term ‘edge effect’ can be defined as an abrupt and local change in the abundance, diversity, composition etc. at the edge of any distinct, spatial patches (structure(s). It usually refers to forest/field, meadow/shrub and other ecotone environments. This effect in relation to breeding densities and success in birds has been the focus of considerable debate (Manolis et al. 2002). The edge of bird colony is expected to affect similarly on avian population (Krebs 1974). Although such studies can be very useful for management and conservation strategies, they are scarce in the Mediterranean.

KEY WORDS: breeding success, edge effect, nest location, Little Egret

The Little Egret Egretta garzetta often breeds in mixed colonies and selects nesting sites in relation to the type and height of vegetation, land use and nesting period (McCrimmon 1978, Beaver et al. 1980, Hafner 1980). Although population density has no effect on breeding success in this species (Kim et al. 2006), we suspect that distribution of nests within a colony may affect both nest height, clutch size and breeding success, as well-located nests may give easy access to nesting material, defense against predators, provision of food, and reduction of inter- and intra-specific competition. This is well documented phenomenon among birds living in colonies (e.g. Coulson 1968, Krebs 1974, Kopij 1997), although it is still not well explicit. In this paper, we have investigated the effect of the edge of colony on the nest height, clutch size and breeding success in the Little Egret nesting in a mixed heronry. We expected that the mean clutch size will not be affected by the distance of nests from edge, while breeding success will increase as that distance increases.

Studies were carried in the Poyrazlar Lake located in the north-west Turkey, 6 km away from the Sakarya city center (40°50′N, 30°28′E) (Fig. 1). The lake lies on the route of the two important migration ways of birds. The surface area of the lake is 0.6 km² and the maximum depth 3 m. The lake was formed in the old Sakarya river bed, but has a limnetic character. The emerged water vegetation was composed of the following species: the sea club-rush Scirpus maritimus L. (45%), common spike-rush Eleocharis palustris (L.) (30%) and reed Phragmites australis (Cav.) (25%). Its height reached up to 128 cm, while the water depth decreased to 20 cm during the breeding period. Surroundings of the lake are comprised of forest with black pine Pinus
**nigra**, Scotish pine *Pinus sylvestris*, common oak *Quercus robur* and hornbeam *Carpinus betulus*. The ichthyofauna of the Poyrazlar Lake is dominated by the pike *Esox lucius*, wels catfish *Silurus glanis* and carp *Cyprinus carpio* (Saraoğlu 1990). Mean annual temperature of lake water is 17°C, the highest in July 23.2°C, the lowest in January 6.0°C. The average annual rainfall is 840.6 mm (Yardimci 2000).

A heronry comprising nests of the Little Egrets (250–300 nests), Night Heron *Nycticorax nycticorax* L. (210 pairs), Cattle Egret *Bubulcus ibis* L. (25 pairs), Squacco Heron *Ardeola ralloides* Scopoli (20 pairs) and Pygmy Cormorant *Phalacrocorax pygmaeus* Pallass (5 pairs) was established on the north part of this lake in the willow (*Salix* spp.) shrub vegetation covering an area of 4000 m² (100 × 40 m). Studies were carried out in the half of the area occupied by the heronry (*i.e.* 40 × 50 m²). The study area was divided into five equal plots (the surface of each plot was 40 m²) along a gradient (distance from the edge of the willow vegetation): a: 0–10 m, b: 10–20 m, c: 20–30 m, d: 30–40 m, e: 40–50 m). Area boundaries were marked with fishing line. Twenty nests were randomly selected from each of these plots. Distance of each nest to the edge and its height above water level was measured. In order to determine clutch size and breeding success, the content of each nest was checked on a weekly basis. Fledgling success is defined as the proportion of the number of chicks fledged to the number of eggs laid, expressed in percentages. Fledgling is assumed as a chick 19–20 day, able to leave the nest. A stick with a mirror attached at the tip was used to survey inaccessible nests.

Data (not transformed) were analyzed in the SPSS program (Version 14). The t-test was used to compare the effect of nest height,
Edge effect in the colony of Little Egret

clutch size and breeding success in each study plot. Distance–response relationships were determined from the correlation (Pearson) and regression coefficients R² for nest height, average clutch size per nest and breeding success (Kazantzidis et al. 1996).

Nest height varied from 51 to 293 cm. The longer was distance from the heronry edge the lower was the average nest height (r = –0.93). Clutch size varied from 2 to 5 eggs. Although the average clutch size was different in each plot, these differences are not statistically significant (Table 1). Also the nest height is not related to the clutch size (r = –0.05). The fledgling success in the Little Egret increased (r = 0.67) with the increase of the distance of nests from the heronry edge. However, if plots are compared, only the differences between the most outer and all other plots are statistically significant (Table 1).

Although the Lake Poylazlar is abundant of food (i.e. mainly fish, frogs, supplemented by reptiles, crustaceans and aquatic insects) for all bird species nesting in the heronry (Uzun and Uzun 2008), the availability of nesting sites is a limiting factor. As a result, a harsh competition was observed for suitable nesting sites both within Little Egrets and between them and other bird species nesting in the heronry. Similar situation was recorded in a South African heronry dominated by the Cattle Egret (Kopij 1996). This competition is slightly mitigated by the fact that particular species have somewhat different timing of breeding (Uzun and Tabur 2006). Because availability of food is not a limiting factor in the Lake Poyrazlar, the mean clutch size in the Little Egret is not dependant on nest height, neither on the distance from the edge.

At Lake Poylazlar, Little Egrets locate their nests most probably as a response to human pressure and Magpie Pica pica predation. Plots close to the edge are at the highest risk of predation and destruction. Hence, in these plots nests are constructed at higher positions. Willow green vegetation provides both a camouflage against Magpies and a shelter against rain and wind. In the inner plots, Little Egrets tend to build nests at the lower height. Despite this, they have higher reproductive success. Also Kazantzidis et al. (1997) and Kopij (1997) shown that distribution of nests within a heronry has no effect on clutch size but it has an effect on breeding performance in egrets.

A colony serves often as an information centre. Birds breeding in the colony centre may have, therefore, more possibilities to follow neighbours for foraging places, being able to collect more food for chicks. The survival of these chicks should be therefore higher than those from colony edges. But more importantly, in the colony centre chicks can be better protected against predators than on its edge. Since the mean clutch size is the same at the colony centre and edge, the genetic quality of females appear to be similar at colony edge and at its centre. Because the predation risk in the colony centre is lower than in the edge birds breeding in the centre may locate their nests lower than those breeding at edges. By nesting lower chicks can also be better protected against strong wind.

In conclusion, in a mixed heronry, the edge of the colony has an effect on the average nest height and fledgling success in the Little Egret, but no effect on the mean clutch size. The average nest height decreases, while the fledgling success increases with the distance from the heronry edge.

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<table>
<thead>
<tr>
<th>Distance from edge (m)</th>
<th>Mean nest height (cm) ± SE</th>
<th>Mean clutch size ± SE</th>
<th>Fledging success (%) ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–10</td>
<td>199.0 ± 9.48</td>
<td>2.80±0.16</td>
<td>64.3 ± 6.40</td>
</tr>
<tr>
<td>10–20</td>
<td>171.6 ± 11.54</td>
<td>3.05±0.21</td>
<td>90.0 ± 3.87</td>
</tr>
<tr>
<td>20–30</td>
<td>172.0 ± 15.96</td>
<td>2.75±0.19</td>
<td>89.1 ± 4.20</td>
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<tr>
<td>30–40</td>
<td>164.1 ± 16.26</td>
<td>3.00±0.19</td>
<td>85.0 ± 4.16</td>
</tr>
<tr>
<td>40–50</td>
<td>132.6 ± 12.97</td>
<td>3.15±0.22</td>
<td>90.3 ± 3.76</td>
</tr>
</tbody>
</table>
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