Journal of King Saud University – Science (2013) **25**, 267–270

King Saud University
Journal of King Saud University – Science
www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Habitat association of Little Grebe (*Tachybaptus ruficollis*) at Kallar Kahar Lake, Pakistan

Sadia Bilal, Muhammad Rais *, Maqsood Anwar, Iftikhar Hussain, Madiha Sharif, Bilal Kabeer

Wildlife Management, PMAS-Arid Agriculture University, Rawalpindi, Pakistan

Received 29 December 2012; accepted 12 March 2013
Available online 21 March 2013

KEYWORDS
Little Grebe;
Kallar Kahar Lake;
Habitat preference;
Hydrophytes;
Eutrophication;
Birds of Pakistan

Abstract Understanding of species–habitat relationship is fundamental to effective conservation planning and management. We studied the association of Little Grebe abundance with habitat parameters at Kallar Kahar Lake, District Chakwal, Punjab, Pakistan, from September 2010 to July 2011. Bird population density data, vegetation and physico-chemical parameters were collected along three strips from different areas of the lake based on habitat variability. The association of Little Grebe abundance with physico-chemical parameters of water was determined using simple linear regression. The physico-chemical parameters differed significantly ($P < 0.05$) among the three strips. Water temperature and turbidity were negatively related while pH and depth were positively related with grebe population. We concluded that the species more frequently occurred in shallow water habitats with preponderance of reed vegetation, slightly high alkalinity, low water temperature and low turbidity. The reed vegetation such as *Phragmites* and *Typha* provided shelter and nesting sites while open water had abundant planktons and crustaceans, algae such as *Spirogyra* spp. and submerged vegetation such as *Chara* spp. provided foraging sites. Threats to the species included eutrophication, fluctuation in the water level and littering by visitors which need to be addressed through appropriate management interventions.

1. Introduction

Habitat resources such as food, refuge and water are the basic needs of an animal species required for its survival and successful reproduction in a particular area (Leopold, 1933; Thomas, 1979). Habitat selection is a hierarchical process related with a series of innate and learned behavioral decisions made by an animal about what kind of a habitat it would select at different scales of the environment (Hutto, 1985). The Little Grebe (*Tachybaptus ruficollis*) or Dabchick (Order Podicipediformes; Family Podicipedidae) is one of the smallest grebes with body length of 25–29 cm and having a buoyant rounded body. The

* Corresponding author. Address: Environment Resource Center, Department of Biology, Indiana-Purdue University, Fort Wayne, Indiana, USA. Tel.: +1 92 332 5442050.
E-mail address: sahil@uaar.edu.pk (M. Rais).
Peer review under responsibility of King Saud University.

ELSEVIER Production and hosting by Elsevier

1018-3647 © 2013 Production and hosting by Elsevier B.V. on behalf of King Saud University.
http://dx.doi.org/10.1016/j.jksus.2013.03.001

global conservation status of Little Grebe is of Least Concern (IUCN, 2009). Little grebe is widely distributed all over the world. It occurs in Europe, central and southern Asia and sub-Saharan Africa, Pacific islands and southern Africa except in Kalahari (Hockey et al., 2005). In Pakistan, Little Grebe is widespread in distribution. It is resident to large lakes, but very rarely seen in the flowing rivers and occasionally visits the estuaries and salt water bodies along the seacoast. In Punjab province, the species occurs in Salt Range lakes including Khabbeki, Nammal and Ucchali (Roberts, 1991) and Kallar Kahar Lake (Ali, 2007; Azam et al., 2009). Human activities and environmental changes are prime factors of decline in most of the waterfowl populations. Consequently, essential conservation efforts need to be taken. It is also important to have high quality baseline information on species habitat preferences and breeding biology to construct guidelines for the preservation and improvement of waterfowl habitat (Bruce et al., 1992). The data regarding biology and ecology of Little Grebe are deficient in Pakistan. Present study was, therefore, conducted to study the association of Little Grebe abundance (population density) with habitat parameters at Kallar Kahar Lake, Chakwal, Punjab.

2. Materials and methods

2.1. Study area

Kallar Kahar Lake (32 46 30.31 North of latitude; 72 42 23.80 East of longitude) is an Inland permanent saline/brackish lake. It is located in District Chakwal, Punjab, Pakistan. The lake is situated at an altitude of about 457 m above the sea level, and covers an area of 133.50 hectares (Rais et al., 2011). The lake lies in a tropical region. Weather is hot in summer and dry and cold in winter. Kallar Kahar is fed by numerous freshwater springs at the base of hills in the catchment area. An area of 164 hectares has been enclosed within a constructed bund. The volume of water, however, keeps on changing based on the seasons and amount of rainfall received, and may reduce to even almost 50 hectares during the dry season and swell again after the rains especially in the monsoon (Rais et al., 2011).

2.2. Study design

The study site was surveyed twice a month during morning and evening hours from September, 2010 to July, 2011. For habitat assessment, vegetation analysis and physico-chemical characteristics of water (i.e. water depth, temperature, turbidity and pH) were studied. Two strips (each 600 m long and 100 m wide; area 6 hectares) were laid out along the edge of the lake to record Little Grebe population and to sample habitat features along the shoreline (Lichvar and Campbell, 1997) while one strip (400 m long and 100 m wide; area 4 hectares) was laid out in open water. The number of Little Grebes was noted and vegetation and water samples were collected from 30 quadrates along ten sampling points at an interval of 40 m along each strip. A simple garden rake with long handle and double head was used for submerged aquatic vegetation (Kenow et al., 2007). The rake was dragged in substrate up to 1.5 m depth and the collected samples were stored in polythene bags along with water. Later, slides for each sample were prepared. The number of each plant species and its percentage cover within each quadrate was noted. The following calculations were made: Density (D) = total number of plant species/total area of sampling points; Relative density (RD) = total number of individuals of a species/total number of individuals of all species; Relative Frequency (RF) = Frequency value of a species/total frequency value of all species × 100; Relative cover (RC) = total cover of a species/total cover of all species × 100 and Importance value of each species (IVI) = Relative density + relative frequency + relative dominance (Coroi et al., 2004). The depth of water was determined using a marked steel rod. The water temperature was recorded using a thermometer while pH was recorded with a pH meter (pH range – 1.0–15.0 pH). Water turbidity was measured with the help of Secchi disk. The number of individuals of Little Grebes in each quadrate was noted. The population of Little Grebes was calculated by dividing the number of Little Grebes with the area (Area = Length × Width) of the strip.

The means of physico-chemical parameters of water were compared using single factor ANOVA at $\alpha = 0.05$. The relationship of population of Little Grebe with physico-chemical parameters of water was determined using simple linear regression at $\alpha = 0.05$.

3. Results

We recorded two main habitat types viz. open water and marshy to swampy areas along the edges of Kallar Kahar Lake. The most dominant species of emergent hydrophytes recorded from the lake was *Phragmites karka* (Importance Index Value = IVI = 43.22) followed by *Saccharum spontaneum* (IVI = 13.86) while the most abundant submerged species was *Spirogyra* spp. (Relative Cover = RC = 30.79), *Chara* spp. (RC = 24.88) and *Hydrilla verticillata* (RC = 10.86) (Table 1). The strip I had similar dominant emergent species of hydrophytes while strip II also had *Schoenoplectus lacustris* (IV = 15.34) as important emergent species in addition to *Phragmites karka* (IV = 15.99), and *Saccharum spontaneum* (IV = 13.65) (Table 1). The strip III had only submerged and floating vegetation with *Chara* spp. (RC = 34.69), *Spirogyra* spp. (RC = 19.80) and *Cladophora* spp. (RC = 13.71) (Table 1). The mean water temperature was relatively higher at strip II (Table 2). The pH of the lake was slightly basic (above 8). The turbidity was the highest along strip II while strip III had the maximum depth (0.69 m) (Table 2). The studied physico-chemical parameters differed significantly ($F = 3.35$, $df = 27$, $P < 0.05$) among three strips. We recorded 203 individuals (N) of Little Grebes with a population density (PD) of 12.68 individuals per hectare from the lake during the study period (Table 2). The maximum number of grebes was 129, with a population density of 21.5 recorded from strip I followed by strip III ($N = 60$; PD = 15) and strip II ($N = 14$; PD = 2.33). The population density of grebe differed significantly ($P < 0.05$) among the strips. The maximum number of Little Grebe ($N = 28$) was recorded in June, 2011 while the minimum number ($N = 11$) was recorded in January, 2011 (Table 2). Temperature ($\beta = -1.343$, $t = -3.654$, $P = 0.001$) and turbidity ($\beta = -0.058$, $t = -1.888$, $P = 0.001$) were negatively related while pH ($\beta = 10.537$, $t = 3.601$, $P = 0.001$) and depth ($\beta = 0.159$, $t = 2.845$, $P = 0.008$) were positively related with the population density of Little Grebe. The temperature ranged from 21.2 to 25.6 °C at the lake during the present study. The maximum number of nests (06) was noted along strip I which