ABR090290

AVIAN BIOLOGY RESEARCH 3 (1), 2010 31–34

Research note

Contemporary colonisation by waterbirds of a small dam lake in central Argentina

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ABSTRACT

A population of 80 individuals of five waterbird species which arrived at a small dam in Alta Gracia City, Córdoba, Argentina was studied. Observations over 30 years enabled us to confirm that no waterbird populations had settled there previously. The 1.4-ha and 1.5-m deep lake (known as ''Tajamar''), was built by the Jesuits in the middle of 17th century to store water for irrigation. It contains submerged vegetation of *Egeria densa* and *Chara* sp. and areas of open water and also has some species of small fish. The numbers of waterbirds were recorded at varying intervals between 2005 and 2009. The breeding of White-winged Coot (*Fulica leucoptera*) and Pied-billed Grebe (*Podilymbus podiceps*) were documented in the Tajamar, as well as the extinction and re-colonisation of Pied-billed Grebe and an increase in the number of individuals by successive immigrations of the Neotropic Cormorant (*Phalacrocorax olivaceus*). We also constructed the time-line for species arriving and departing.

Keywords: *colonisation, birds,* Fulica leucoptera, Podilymbus podiceps, *reservoir, central Argentina*

INTRODUCTION

Colonisation of isolated habitats, such as wetlands, requires that a species be able to cross unsuitable habitats that separates the isolated habitats from the source area and subsequently establish in the new habitats (Carlquist, 1974; Vuilleumier, 1986; Davis and Dunford, 1987; Grant and Grant, 1995). Difficulties of establishment seem greater than those of immigration, and, consequently, species are present in proportion not only to dispersal ability but also on their ability to establish a population (Carlquist, 1974). Increase of the number of individuals in an isolated habitat can be the result of the successive immigration or recruitment of locally born birds (Grant and Grant, 1995). Therefore, to confirm that an immigrant is established, there should be evidence of breeding.

Most of the widespread and successful coloniser species of birds are associated with freshwater (Mayr, 1965; Paradis *et al.*, 1998). Freshwater birds appear quickly in recently-formed bodies of water, such as docks, dams, overflowing rivers and temporary rainwater accumulations. The area, age and distance from similar habitats are also important conditions for the colonisation of waterbodies (Dudley Williams, 2006).

In the middle of the 17th century, the Jesuits constructed several buildings in what today is the city of Alta Gracia (Córdoba, Argentina), which included a little dam, known locally as the ''Tajamar''. Frequent observations over 30 years have enabled us to confirm that no permanent populations of waterbirds occurred there during that period. Only on a very few occasions did small erratic groups of coots and grebes appear in the Tajamar, leaving a few days later. In January 2005, however, 80 individuals of five waterbird species arrived at the Tajamar and remained there for different periods of time.

The aims of this paper were to describe our observations of the species that colonised the dam, *i.e.* the species bred there, and to document the periods of presence/absence of the different species. Here we document the following events recorded at the Tajamar: breeding of the White-winged Coot (*Fulica leucoptera*) and the Pied-billed Grebe (*Podilymbus podiceps*), extinction and re-colonisation of the Pied-billed Grebe, and increase in the number of individuals of the Neotropic Cormorant (*Phalacrocorax olivaceus*) by successive immigration. We constructed the time-line for species arriving and departing.

doi: 10.3184/175815510X12630517126742

RESULTS AND DISCUSSION

The study was carried out in a freshwater dam lake, 1.4 ha in area and 1.5 m in its deepest part, located in the city of Alta Gracia (31°40′ S–64°26′ W), Córdoba Province, Argentina. The dam was constructed by the Jesuits in 1659 to store water for irrigation of the Alta Gracia Farm. It has abundant submerged vegetation and areas of open water. The waterweed *Egeria densa*, a submerged aquatic plant that invades freshwater systems, is particularly abundant and stonewort (*Chara* sp.), a member of the freshwater group of ''green algae'', is found in smaller amounts and practically disappears during the winter. There are also some species of small fish.

Waterbirds were counted at variable intervals from January 2005 to June 2009 and we searched for nests with greater frequency from September to March, the period that mainly coincides with the breeding season. Nests and fledglings were recorded but because the nests were sighted with binoculars from the edge of the lake it was not possible to see if they contained eggs.

In January 2005, two White-tufted Grebes (*Rollandia rolland*), two Pied-billed Grebes, four Neotropic Cormorants, 70 White-winged Coots, and two Red-gartered Coots (*Fulica armillata*) arrived at the Tajamar. They remained with few variations until February 2007. Then the number of birds decreased considerably, but recovered a few months later. Only the White-tufted Grebe disappeared from the site some months later and a pair of Red-fronted Coots (*Fulica rufifrons*) arrived. Occasionally, individuals of Yellow-billed Teal (*Anas flavirostris*), Yellow-billed Pintail (*Anas georgica*), Cattle Egret (*Bubulcus ibis*) and Brown-hooded Gull (*Croicocephalus maculipennis*) appeared in the dam (Figure 1).

Shortly after the birds arrived, mating displays indicated the beginning of territorial and breeding activities. On 7 February 2005, we located one nest of White-winged Coots and later other nests of this species; in one of them four fledglings were born on 18 April 2005. On 15 December 2005, we found a nest of Pied-billed Grebes in which there were four

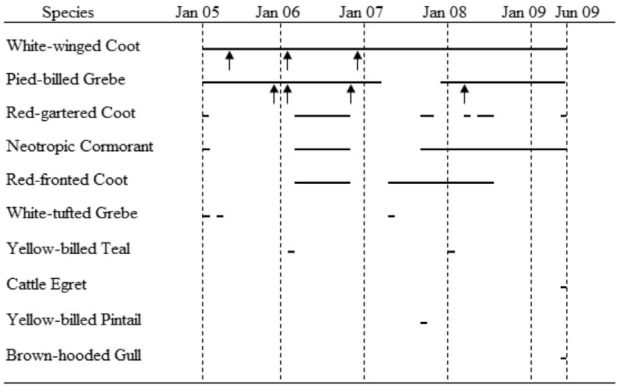

Figure 1 Time-line of presence/absence of the different species on the Tajamar of Alta Gracia (Córdoba, Argentina) from January 2005 to June 2009. The thick line indicates the period when the species were present and the arrows indicate breeding events.

fledglings by 30 December. During the complete study period we found a large number of nests, with a maximum of 12 nests of the White-winged Coot and one of the Pied-billed Grebe on 16 November 2006, but only seven were successful (Table 1) because the others were removed by the people in charge of cleaning the dam lake. A third species, the Red-gartered Coot, made several nesting attempts but without success because these nests were also removed. All nests consisted of a platform built with green waterweed over water and were located towards the centre of the Tajamar.

From March 2007, the number of waterbirds on the Tajamar began to decrease without apparent reason. On 11 March, there were 22 White-winged Coots and the Pied-billed Grebe was extinct; on 1 April, there were 11 White-winged Coots and on 3 May, there were only four, plus one individual White-tufted Grebe and one Red-fronted Coot that arrived on that date. When it seemed evident that the birds that had arrived at the Tajamar in January 2005 were becoming extinct, the number of birds began to increase again. On 8 July 2007, there were 14 White-winged Coots and one individual Red-fronted Coot; on 20 July, there were 24 White-winged Coots and one Red-fronted Coot, and on 8 September

Table 1 Successful nests of White-winged Coot (*Fulica leucoptera*) and Pied-billed Grebe (*Podilymbus podiceps*) on the Tajamar of Alta Gracia (Córdoba, Argentina)

Species	Nest date	Fledging date	No. of fledglings
White-winged Coot	27 March 2005	18 April 2005	Four
White-winged Coot	–	26 February 2006	Two
White-winged Coot	16 November 2006	3 December 2006	Three
Pied-billed Grebe	15 December 2005	30 Dec. 2005	Four
Pied-billed Grebe	–	26 February 2006	Six
Pied-billed Grebe	28 October 2006	16 Nov. 2006	Four
Pied-billed Grebe	–	20 April 2008	Three

greater numbers were back: 76 White-winged Coots, nine Neotropic Cormorants, one Red-fronted Coot, one Red-gartered Coot, one Pied-billed Grebe, and one Yellow-billed Pintail. Since then, the number of waterbirds has remained relatively steady up to the present. In the last census (28 June 2009), there were 70 White-winged Coots, two Red-gartered Coots, 11 Neotropic Cormorants, three Pied-billed Grebes, two Brown-hooded Gulls and 25 Cattle Egrets. The last two species were recorded for the first time at the Tajamar.

Most of the young White-winged Coots and Pied-billed Grebes born in the Tajamar reached adulthood, and this is the first record of colonisation known in the Tajamar in the last 35 years. As there are no previous data available, it is not possible to know if there were other colonisations in the Tajamar in the three and half centuries since its construction.

Waterbirds probably colonised the Tajamar either from La Lagunilla, a natural lagoon of about 10 ha located 11 km to northeast of Alta Gracia City, or from Los Molinos Dam Lake located 17.5 km southwest of Alta Gracia. All the species that appeared in the Tajamar inhabit these two wetlands permanently.

There were no apparent changes in vegetation, water quality, or water depth in the Tajamar before or at the moment of bird arrival in January 2005. Nor were there apparent differences between March and May 2007, when the number of waterbirds decreased markedly, and July–September 2007, when the birds returned to the lake. For this reason, it is difficult to provide an explanation for these events, but they are possibly related to the aquatic vegetation. The role of aquatic macrophytes in stimulating biodiversity and maintaining clear water is currently undisputed (Klaassen and Nolet, 2007). Waterbird species usually respond very strongly to changes in abundance of macrophytes related to changes in water quality (Hanson and Butler, 1994; Hargeby *et al.*, 1994). In Lake Veluwemeer (The Netherlands), for example, an increase of herbivorous birds started when a substantial amount of *Chara* was present. Coot numbers showed a strong, positive relationship with *Chara* biomass and this food source contributed significantly to explaining the number of coots (Noordhuis *et al.*, 2002). The attraction of *Chara* to waterbirds may be due to several properties of the plant, such as its easy digestibility because of the low fibre content (Fox *et al.*, 1994; Noordhuis *et al.*, 2002). The results of our study suggest positive relationships between the White-winged Coots and *Chara* because fledglings are initially fed on this algae, whereas bigger fledglings and adults feed mainly on waterweeds.

Coots do not appear to prefer a particular plant species to build their nests. Any apparent preference is related to plant availability at the moment of nest-building (Gorenzel *et al.*, 1982). In this case, owing to its structure and abundance, *Egeria densa* was the plant mainly used by coots and grebes.

Scheffer *et al.* (2006) pointed out that fishes are rare in small, isolated lakes, probably as a result of a greater likelihood of fish kills combined with their low colonising ability. However, this is not the case of the Tajamar, because people bring fishes from other wetlands and put them there. For this reason, there were a number of piscivorous birds in the Tajamar.

There was one case of extinction/recolonisation on the Tajamar. The Pied-billed Grebe, which bred there on three occasions, became extinct in March 2007. Then, it returned to the dam lake again on 8 December 2007 and bred successfully on 20 April 2008.

The most noticeable example of an increase in the number of individuals by successive immigration was that of the Neotropic Cormorant. In January 2005, six birds arrived at the lake for the first time. Then, the number of individuals varied from zero or a few individuals in some censuses to a maximum of 36 birds on 2 August 2008. Although one border of the lake was covered by large trees (*Platanus* sp.) where the cormorants frequently perched, no attempts at breeding were observed. On 28 December 2008 there were no cormorants on the Tajamar, but on 25 May 2009 there were 20 individuals.

CONCLUSION

Colonisation of the Tajamar by coots and grebes provides an interesting example of the dispersal capacity of these highly opportunistic species. The immigration of other waterbird species without apparent changes in the environment of the lake to encourage this is also of interest. The future of the avifauna of the Tajamar is uncertain because there is human removal of nests and this may be a factor limiting long-term colonisation of the site. We have discussed this problem with the people in charge of cleaning the dam lake and with the Mayor of the city of Alta Gracia but as yet without success.

ACKNOWLEDGMENTS

We thank Joss Heywood and Jorgelina Brasca who edited the manuscript.

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