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New Findings on the Breeding Habits of the Great Cormorant (*Phalacrocorax carbo* L.) in Bosnia and Herzegovina

Original scientific paper
UDK 598.235.4(497.6)

The Great Cormorant (*Phalacrocorax carbo* L.) has been recorded in Bosnia and Herzegovina as a rare breeding species. The first two colonies, recorded between 1976 and 1983 at Bardača and Hutovo blato, no longer exist, as a result of disturbance and disruption of their habitats. The presence of mixed breeding colonies of the Great Cormorant (*Phalacrocorax carbo*) and the Grey Heron (*Ardea cinerea*) in the Modrac area was confirmed in August 2010 at Prokosovići on the north side of Lake Modrac. The Great Cormorant nested at this site in a mixed colony with the Grey Heron (*Ardea cinerea* L.). The colony was visited on three occasions in 2010 and 2011, when a count was taken of the birds and nests. In 2011, 108 Great Cormorant nests and 88 Grey Heron nests were recorded. This Great Cormorant colony is the largest and only confirmed breeding population of this species in Bosnia and Herzegovina at present.

Key words: Great Cormorant, Grey Heron, breeding, Modrac, Bosnia and Herzegovina

Introduction

The Great Cormorant (*Phalacrocorax carbo* L.) is a very widespread species, ranging from Europe to Asia, Australia, New Zealand and East and South Africa, and is also present here and there in the Nearctic, in western Greenland, south-eastern Canada and New England (Loïc et al., 1997).

According to BirdLife International's data for the decade from 1990 to 2000, the European breeding population of the Great Cormorant numbered between 310,000 and 370,000 pairs, while over 420,000 individuals winter in Europe (BirdLife International, 2004). The worldwide population of the species is estimated at between 1,400,000 and 2,900,000 individuals (Delany & Scott, 2006). It is generally believed that the worldwide population of the Great Cormorant has been on the increase in the past 30 to 40 years (BirdLife International, 2004, Delany & Scott, 2006).

The Great Cormorant is known, from reference works and material in the collections of the National Museum of Bosnia and Herzegovina and the Museum of Republika Srpska, to have been recorded in Bosnia and Herzegovina from the late 19th to the mid 1970s only in the migration and winter periods (Gašić, 1999; Obratil, 1967, 1978, 1984; Reiser, 1939). The data relate to recordings in sites along the Rivers Bosna and Drina and in the sub-Mediterranean area of the Hutovo blato wetlands.

The first recording of the Great Cormorant nesting in Bosnia and Herzegovina was in 1976, at the Dugo polje fish-farm at Bardača, where nine nests and 62 individuals were recorded. Evidence was found of the nests being destroyed to prevent the birds from breeding; five of the nine nests recorded earlier that year were destroyed. In August 1977, 48 individuals were recorded at the same site, but not evidence of nesting was recorded (Obratil, 1978). The next instance of the Great Cormorant nesting in Bosnia and Herzegovina (Obratil, 1984) was in 1983, at Hutovo blato, where two nests and seven individuals were observed on willow trees (*Salix* sp.).

On the basis of this information, the Great Cormorant has been designated as a rare species in Bosnia and Herzegovina on the proposal for the Red List (Obratil and Matvejev, 1989).

Studies conducted in the first ten years of the 21st century have not found evidence of the species breeding, leading to the Great Cormorant being designated as potentially extinct as a breeding species in the most recent inventories of the ornithofauna of Bosnia and Herzegovina (Kotrošan and Papes 2007; Kotrošan, 2008-2009). Published data for this period reveal that the Great Cormorant has been recorded during the breeding season at Lake Buško-Livno polje (Stumberger and Sackl, 2008-2009) and Hutovo blato (Stumberger et al., 2008-2009), but with nothing to confirm that they are successfully breeding. At Lake Buško, four pairs of Great Cormorant were recorded from 2009 to 2011 as nesting, or at least as building nests (Kotrošan et al., 2011; Milanović & Kotrošan, 2012), but there is no evidence that they actually bred. In addition, from published data relating to the period from 2000 to 2010, the Great Cormorant has frequently been recorded during the winter count at several sites along the Rivers Una, Bosna, Željeznica, Fojnica, Sava, Neretva, Buna and Trebišnica, and at Hutovo and Buško blato, as well as at Lakes Bilećko, Trebinjsko and Pliva (Dervović, 2005, 2006, 2007; Kotrošan and Dervović, 2010; Stumberger and Sackl, 2008-2009; Stumberger et al., 2008-2009).

Accounts of mixed breeding colonies of cormorants and herons at Prokosovići in 2003 are to be found in a digital record from the daily press (Anon., 2009), but these accounts have not so far been corroborated. The aim of this study was to confirm the presence of a mixed colony of the Great Cormorant and Grey Heron at Prokosovići and to identify the size of the breeding population of the Great Cormorant at the site.

Methods

The study covers data collected during research conducted as part of the projects entitled "Protection of Birds and Bird Habitats of Importance for the Federation of BiH" and "Study of the Biodiversity and Ecotourism Potential of Šerićka Bara and Lake Modrac." This included three site visits over four days (5 August 2010, 3 to 4 September 2010 and 1 June 2011) covering the area from Prokosovići to the north to Šerićka Bara on the east side of Lake Modrac (Fig. 1, 2, 3). The research team consisted of two zoologists (an ornithologist and an entomologist) from the National Museum of Bosnia and Herzegovina and two members of the Naše ptice ornithological society. Information from local residents was used to locate the colony. The limitations imposed by the number of observers and financial resources meant that the research at Modrac was not conducted systematically; as a result, there are no data from April and May, the start of the breeding season and chick hatching.

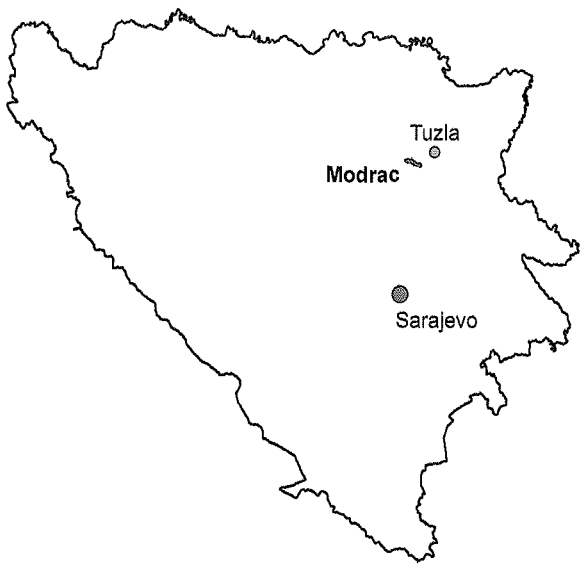

Fig. 1. – *Location of the area studied*

The first site visit, on 5 August 2010, included observations from 9.30 to 15.00. It was a sunny day with good visibility, making it possible to record the birds accurately. The observations were conducted from the shore, about 200 to 250 m from the colony, through binoculars (magnification 8×50) and telescope (magnification 20-60×80). The colony was also photographed and videoed for the archives. The second site visit consisted of two days of observation, on 3 and 4 September 2010, when the birds in the colony (on nests) and beyond it were counted. Their movements to and from the colony were also observed to determine the direction from which they came and went. The observations were conducted in the early morning and

early evenings. The third site visit was on 1 June 2011, when the Cormorant and Grey Heron nests in the colony were counted, beginning at 18.48, from a distance of 200 metres. The nests counted were those where birds were seen (adult individuals, adults with juveniles, or juveniles only), as movements made it impossible to be sure whether a given nest was in use or not.

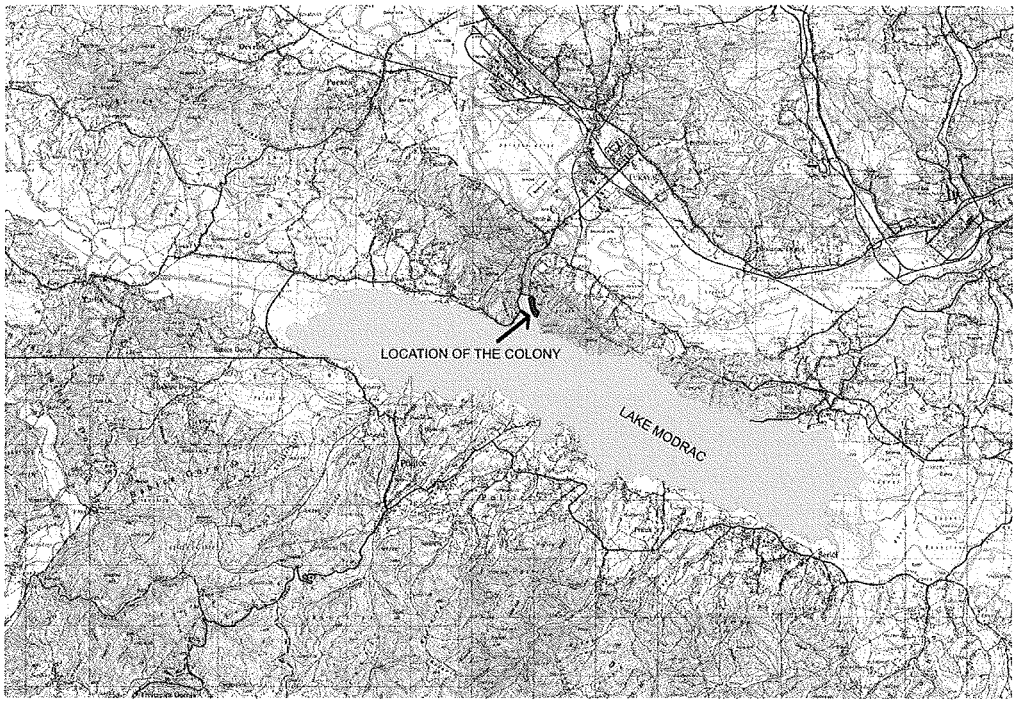

Fig. 2. *Location of the Great Cormorant colony on Lake Modrac*

Fig. 3. *View of the Great Cormorant and Grey Heron colony on Lake Modrac*

Results

A mixed Great Cormorant (*Phalacrocorax carbo* L.) and Grey Heron (*Ardea cinerea* L.) colony was observed near the dam in the northern part of Lake Modrac, at Prokosovići (UTM CQ03,N 44°30'30.63", E 18°30'29.53"). The colony was at the edge of mixed woodland, at the lakeside. The Cormorant nests were observed on a number of bare trees with oak (*Quercus* sp.) and pine (*Pinus* sp.) growing nearby.

On the first visit, on 3 August 2010, a total of 145 Great Cormorant individuals and 30 Grey Heron individuals were counted. In addition, a few individuals in flight along the entire lake were seen. The number of individuals in the colony should not therefore be taken as conclusive. Some of the individuals were also concealed in the trees and difficult to see when counting; these are not included in the above numbers. The Great Cormorant was breeding, as evidenced by the presence of adult and juvenile individuals near or on a nest. Though they were not counted separately, on account of the birds' constant coming and going, it was clear that there were more juvenile than adult individuals of Great Cormorant. The density of the vegetation and the observers' distance from the colony made it hard to count all the nests and identify precisely which species belonged to which nests. It was also impossible to determine whether all the nests observed were in use or not. A total of 80 nests were counted during this visit.

The second visit to the colony took place in September 2010. In the afternoon of the first day (3 September), 114 Great Cormorants and 22 Grey Herons were counted (Fig. 4). On day two (4 September), the morning was spent tracking the movements of the cormorants from the colony to the other side of the lake, towards Šerićka Bara, when a total of 232 Great Cormorants were counted; the herons were not counted. The direction of the cormorants' and herons' comings and goings

Fig. 4. *Great Cormorants on nests*

Table 1. *Estimated size of the Great Cormorant and Grey Heron populations on Lake Modrac*

Species	Estimated total number of nests	Estimated total number of individuals	Percentage of individuals in the colony
Great Cormorant (*Phalacrocorax carbo* L.)	120-150	300-400	66,6
Grey Heron (*Ardea cinerea* L.)	90-120	150-200	33,6

from the colony was also observed. Most of the cormorants were observed flying from the colony to Šerićka Bara and back, suggesting that the latter was their feeding ground. The herons were observed flying in the same direction as the cormorants, along Lake Modrac to Šerićka Bara, but also away from the colony along the banks of the River Spreča.

The third visit to the colony took place on 1 June 2011, when the number of occupied nests was counted. On this occasion 108 Great Cormorant nests and 88 Grey Heron nests were counted.

In the absence of systematic studies to determine the exact number of Great Cormorant individuals in the colony, the current estimate is that they constitute 2/3 of the mixed colony (Table 1). On the evidence of the birds' movements, they appear to feed mainly on the lake itself and at the separate end section known as Šerićka Bara. The Grey Heron feeds on the lake margins and at several sites along the banks of the River Spreča.

Discussion and conclusions

The Great Cormorant (*Phalacrocorax carbo* L.) has been recorded in Bosnia and Herzegovina as a rare breeding species. Past records indicate that until the 21st century the species bred in very small numbers at just two sites. Our own studies and reference sources relating to the period from 2000 to 2012 reveal that the Great Cormorant is still a rare breeding species in Bosnia and Herzegovina. In addition to the breeding site at Modrac, four pairs of Great Cormorant are known to have a nest at Lake Buško from 2009 to 2011 (Kotrošan et al., 2011; Milanović and Kotrošan, 2012), but it is not known whether they bred successfully, either whether they hatched any chicks, and if so how many. Another attempt at breeding, known to be unsuccessful, was recorded at Hutovo blato in 2008 (Borut Stumberger, pers. comm.). The problem is that all this information derives from general ornithological studies over a wider region, leading to incomplete data on the breeding of cormorants in Bosnia and Herzegovina.

It should also be noted that another species of cormorant, the Pygmy Cormorant (*Phalacrocorax pygmaeus* Pall.), nests in only one place in Bosnia and Herzegovina: it has been recorded as breeding only at Hutovo blato. According to published details (Stumberger et al., 2008-2009) and our own research conducted from 2008 to 2010, the population size of this species ranges from 150 to 855 pairs. There is danger that this species will cease to breed here, as a result of habitat degradation and disturbance of the colony. Strict measures are therefore required to protect the habitat where the Pygmy Cormorant colony breeds at Hutovo blato.

According to the data published in the Red Book of endangered bird species of Croatia (Radović et al., 2003), there are two breeding colonies of the Great Cormorant in Croatia, the total population size of which is estimated at about 3,000 pairs, from which the breeding population of this species is designated as Vulnerable. There were also another three colonies in Croatia, at the Jelas and Kočanica fish farms and in Lonjsko polje, which have been destroyed because the damage they caused to the fish farms or the destruction of their habitats and disturbing the birds (Radović et al., 2003; Šetina, 1996). It is suggested that the birds from the Jasinje fish farm (Mirko Šetina, pers. comm.) moved over into Bosnia somewhere near Bardača. Our studies conducted from 2000 to 2010 have not found Great Cormorants breeding at or around Bardača, though they have been observed feeding at the fish farm at Bardača.

According to Puzović and associates (1999), there were four breeding colonies of the Great Cormorant in Serbia in 1998. Preliminary data on the counting of breeding colonies conducted in Serbia in 2012 reveal that there are 15 breeding colonies in that country (Marko Šćiban, pers. comm.). Great Cormorant colonies have been recorded along the Rivers Danube and Tisa in Vojvodina and on Lake Vlasina in south-eastern Serbia (Tucakov, 2006). The size of the breeding population of the Great Cormorant in Serbia is estimated at 1,100 to 1,400 pairs (Puzović et al., 2009). The Great Cormorant is on the list of protected species in Serbia (Pravilnik o proglašenju i zaštiti strogo zaštićenih i zaštićenih divljih vrsta biljaka, životinja i gljiva, 2010).

In Montenegro, the species breeds in the Bojana delta and on Lake Skadar (Vizi, 2003). Initial estimates, relating to 2002, indicated that about 2,000 pairs of Great Cormorant breed in Montenegro (Saveljić, 2006), but more recent information (Darko Saveljić, pers. comm.) suggest that the numbers range from about 1,300 to 1,500 pairs. On the basis of these findings, the Great Cormorant is on the list of protected species in Montenegro (Rješenje o stavljanju pod zaštitu pojedinih biljnih i životinjskih vrsta, 2006).

In general terms, on the basis of known data on the breeding of the Great Cormorant in Bosnia and Herzegovina and its neighbouring countries, the breeding population of the Great Cormorant in Bosnia and Herzegovina could be described as very sensitive. Since there is only one true breeding colony in Bosnia and Herzegovina, any disturbance or disruption of the habitat could result in their ceasing to breed, as has already happened with the colonies at Bardača and Hutovo blato. A particular danger comes from fishermen, who see the species as harmful to fish stocks and therefore kill the birds and destroy their nests. This belief of theirs derives from the fact that the Great Cormorant is present in large numbers at waterside habitats in Bosnia and Herzegovina during winter. There is extensive evidence of cormorants being killed in Bosnia and Herzegovina (Kotrošan et al., 2011), but even though the species is subject to statutory protection, no appropriate steps are taken to protect it (Kotrošan et al., 2011).

It is also important to highlight the need for systematic studies to include mapping and counting breeding colonies, particularly in the early stages of nesting and chick hatching (April-May). The number of roosting sites of the Great Cormorant in winter (January) should also be monitored and mapped. The data collected would provide accurate details of the numbers and distribution of the species in Bosnia and Herzegovina. The same studies should also be conducted for the Pygmy Cormorant in Bosnia and Herzegovina. This would later make it possible to develop an appropriate programme for the protection of both species. At present, since there is only one breeding colony, the habitat of the Great Cormorant at Prokosovići on Lake Modrac should be under strict protection.

Acknowledgements

Our thanks go to Amir Tursinović and Hašim Halilagić for information and assistance provided during the field studies. We are also grateful to the Federal Ministry of the Environment and Tourism, which financed the projects under the auspices of which data on the Great Cormorant colony on Lake Modrac were collected.

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Novi podaci o gniježđenju velikog kormorana (*Phalacrocorax carbo* L.) u Bosni i Hercegovini

Veliki kormoran (*Phalacrocorax carbo* L.) je u Bosni i Hercegovini zabilježen kao rijetka i malobrojna gnjezdarica. Prve dvije kolonije, zabilježene između 1976. i 1983. godine, na Bardači i Hutovom blatu, su usljed uznemiravanja i narušavanja staništa nestale. Gniježđenje velikog kormorana na području Modraca je konstatovano tokom istraživanja u avgustu 2010. godine. Gniježđenje je zabilježeno u mjestu Prokosovići na sjevernoj strani jezera Modrac. Veliki kormoran je na spomenutoj lokaciji gnijezdio u mješovitoj koloniji sa sivom čapljom (*Ardea cinerea* L.). Ukupno je prebrojano 145 jedinki velikog kormorana i 30 jedinki sive čaplje. Pored toga prebrojano je 80 gnijezda. Procjenjuje se da u koloniji gnijezdi 40 do 60 parova velikog kormorana i 10 do 20 parova sive čaplje. Navedena kolonija velikog kormorana je jedina gnijezdeća populacija ove vrste u Bosni i Hercegovini u ovom trenutku.

Ključne riječi: veliki kormoran, siva čaplja, gniježđenje, Modrac, Bosna i Hercegovina