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Breeding of Dalmatian Pelican *Pelecanus crispus* on Skadar Lake

Gnezdenje kodrastega pelikana *Pelecanus crispus* na Skadarskem jezeru

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Historical data on Dalmatian Pelican *Pelecanus crispus* breeding at Skadar Lake, the largest lake in the Balkans, are presented. Breeding was first confirmed in 1894 but there is then a gap in the literature relating to nesting of this species at the Lake from 1896 to 1965. Intensive research started in 1972 and still continues. The size of the breeding population reached a maximum in 1977 with 52 pairs. The Dalmatian Pelicans at Skadar Lake nest on the floating peat islands with the exception of two years when they nested on the rocky island. Most of the data gathered relate to the Pančeva oka ornithological reserve. Although their population is estimated as stable in the Mediterranean area, the population at Skadar Lake is still highly endangered, although with a small tendency to growth. The most significant impact on the success of this species' nesting at the Lake results from flooding of nests and human disturbance.

Key words: Dalmatian Pelican, *Pelecanus crispus*, breeding, Skadar lake, Montenegro, population dynamics
Ključne besede: kodrasti pelikan, *Pelecanus crispus*, gnezdenje, Skadarsko jezero, Črna gora, populacijska dinamika

1. Introduction

Dalmatian Pelican *Pelecanus crispus* is a globally threatened species. It was formerly listed as vulnerable and recently reassessed as conservation dependent, mostly due to an increase of population based on active preservation, particularly at its largest colony of 500 pairs on Mikri Prespa Lake in Greece (Crivelli *et al.* 2000, BirdLife International 2001). The species' breeding population is local and confined to SE Europe, the Middle East and Central Asia. The world population is estimated to have stabilized at between 15,000 and 20,000 individuals (BirdLife International 2002). The latest estimates of breeding population range from 4,031 to 5,196 pairs (Crivelli *et al.* 2000, Wetlands International 2002). Only about 15% of the global population breeds in the Mediterranean region: 15 – 20 pairs in Montenegro, 50 pairs in Albania, 500 pairs in Greece, and 120 pairs in Turkey (Hoffman *et al.* 1996). The Mediterranean population is considered to be stable (Perennou *et al.* 2000). In Montenegro, Dalmatian Pelican was recorded for the first time in 1891 by Brusina (1891), who recorded the species on Skadar Lake. There are no records from Skadar Lake for the period between 1896 and 1965. The first serious investigations were conducted in 1972, with annual censuses up to the 1990's. Since then, breeding of Dalmatian Pelicans has not been confirmed on Skadar Lake (*unpubl. data*).

In this study, records of breeding Dalmatian Pelicans on Skadar Lake in Montenegro are presented, from the first breeding record by Führer (1894) to the most recent records in 2003. Data on breeding of Dalmatian Pelican on Skadar Lake are summarized for the first time.

2. Study area and methods

2.1 Study area

Skadar Lake is situated in the very south-eastern part of Montenegro (19°30' N, 42°30' E). It is the largest lake on the Balkan Peninsula with a water surface of between 354 and 505.8 km^2, according to the season and water level. It is 44 km long and 15 km wide. Its main water source is the Morača river, which provides more than 60% of the lake's water. Besides the Morača there are many other smaller rivers and sublacustric springs flowing into the lake. Occasionally it is provided with water from the river Drim that flows into the river Bojana, by which the lake is connected to the Adriatic Sea (Burić & Radulović 1983).

Skadar Lake is situated in a crypto-depression with an average depth between 5 and 6 m. Its maximum depth is found in the sublacustric spring Raduš that is more than 90 m in depth. Water temperature can reach 30°C in summer (Burić & Radulović 1983). Two thirds of the lake area is situated in Montenegro and one third in Albania. The Montenegrin part was declared as a national park in 1983 and got IBA status in 1989 (Grimmett & Jones 1989). Since 1995 this part of the lake is also a Ramsar site. The Albanian part of the lake remains without any legal protection. 281 species of birds have been recorded on Skadar lake (Dhora & Saveljić 2001). With about 2,000 breeding pairs of Pygmy Cormorants *Phalacrocorax pygmeus* Skadar Lake hosts the second largest European colony of this globally threatened species (Vasić *et al.* 1992, own data). It is known as the westernmost breeding site of the Dalmatian Pelican in the world and is one of the most important wetlands for wintering water-birds in the Mediterranean basin, where more than 250,000 water-birds are counted annually (Vasić & Vizi 2000).

2.2 Methods

In spring 2002 we counted nesting Dalmatian Pelicans in Pančeva oka from a small aeroplane flying over the colony at a height of 300 m. In spring 2003 we visited the same colony twice (May and June) with a boat and approached the inaccessible pelican nests by foot and by swimming. Young pelicans were counted. Records for the previous years were summarized from published sources.

3. Results

3.1. Historical data

The presence of Dalmatian Pelicans at Skadar Lake was first recorded by Brusina (1891). In 1894 in Hum bay (from 1968 the ornithological reserve Pančeva oka) 29 pairs were recorded building nests (Führer 1894). As Führer (1894) explains, he took eggs from 15 nests, leaving the eggs from the remaining 14 nests untouched. The latter nests were later destroyed by flooding (Führer 1894). In 1896 Reiser & Führer (1896) again recorded a colony of 20 pairs (Table 1). From then until 1972 detailed research on the birds of Skadar Lake is lacking and records on the presence of pelicans are also lacking. Only in 1965 were 42 pelicans recorded in the mating season at the former breeding place (Ivanović 1970). The colony was then disturbed by hunters.

Intensive research on Dalmatian Pelican started in 1972 (Vizi 1975; Table 1). In May 1972 the colony was visited for the first time and 20 nests with 16 to 18 young birds were recorded. In subsequent years severe disturbance of the colony by predators and flooding was recorded (Vizi 1975). The original colony location, Pančeva oka, was displaced in 1975, because of human disturbance, to another place, Crni žar, an area consisting of floating peat islands and floating vegetation, situated about 1.5 km to the south (Vizi 1979). Until 1977, when a maximum of 52 pairs was reached, the number of nesting pelicans had been increasing. In 1978 the colony was once more destroyed by high water levels (Vizi 1979). During the 80's pelicans were mainly nesting on both Crni žar and on Pančeva oka.

3.2. Recent status

In the 1990's, the number of successfully fledged pelicans was low, although disturbances were not recorded. In 1990, 21 pairs were recorded on Crni žar, but all the eggs and a young bird were later destroyed by hail.

During 1991 and 1992 the colony was located on the stone island of Grmožur. Continuous disturbance by tourists resulted in complete abandonment of the colony in subsequent years (Vizi 1995a). Between 1993 and 2001 nesting of Dalmatian Pelicans has not been recorded on Skadar Lake.

The first recent record of nesting pelicans on Skadar Lake was confirmed on 11 Jul 2002 when five

Table 1: Number of breeding pairs of Dalmatian Pelicans *Pelecanus crispus* on Skadar Lake from 1894 to 2003 with number of successfully fledged young, breeding success, type of disturbance (F – flood, H – hunting, E – egg collecting, P – predation, G – hail, T – tourism), and nesting location (* years when all the eggs and/or young were completely destroyed but there were pairs present, ? exact number not known, – missing data).

Tabela 1: Število gnezdečih parov kodrastega pelikana *Pelecanus crispus* na Skadarskem jezeru med letoma 1894 in 2003 s številom uspešno speljanih mladičev, uspešnostjo gnezdenja in tipi motenj (F – poplave, H – lov, E – jemanje jajc, P – plenilstvo, G – toča, T – turizem) in lokacijo gnezdišč (* leta, ko so bila v celoti uničena jajca in/ali mladiči, a so pari ostali v območju, ? ni natančnega števila parov, – ni podatkov).

Year / leto	No. of breeding pairs / št. gnezdečih parov	No. of young / št. mladičev	Breeding success/ gnezditveni uspeh (young/pair)	Type of disturbance/ tip motenj	Nesting location/ lokacija gnezdišč	Source / vir
1894	29	–	–	E, F	Pančeva oka	Führer (1894)
1896	20	–	–		Pančeva oka	Reiser & Führer (1896)
1965	21	–	–	H	Pančeva oka	Ivanović (1970)
1967	30	–	–		–	Terasse & Toillard (1967)
1972	20	16 – 18	0.8 – 0.9		Pančeva oka	Vizi (1975)
1973	24	18	0.7		Pančeva oka	Vizi (1975)
1974*	16	0	0.0	P	Pančeva oka	Vizi (1975)
1975	29	11	0.4		Crni žar	Vizi (1979)
1977	52	46	0.9		Crni žar	Vizi (1979)
1978*	–	0	0.0	F	Crni žar	Vizi (1979)
1979	–	3	?		–	Vizi (1979)
1983	11	6	0.5		Crni žar, Pančeva oka	O. Vizi
1984	11	5	0.4		Crni žar, Pančeva oka	O. Vizi
1986	8	9	1.1		Crni žar	O. Vizi
1987	14	19	1.4		Crni žar	O. Vizi
1989	29	7	0.2		Crni žar	O. Vizi
1990*	21	0	0.0	G	Crni žar	O. Vizi
1991	7	2	0.3	T	Grmožur	Vizi (1991 & 1995b)
1992	15	11	0.7	T	Grmožur	Vizi (1995b)
2002	5	2	0.4		Pančeva oka	Vizi (2003)
2003	7	10	1.4		Pančeva oka	this work / to delo
Average (SD)	19.0 (±11.7)	9.8 (±11.2)				

pairs, followed by two fledged young, were seen at the colony in Pančeva oka. At the same place, during two visits in 2003, seven pairs with 10 fledged young were recorded only 20 m away from the nesting rafts, which were set there according to Perennou *et al.* (2001) (Table 2).

3.3. Nesting ecology

Dalmatian Pelicans have bred on three ecologically different sites on Skadar Lake. The first and most frequently occupied nesting locality is Pančeva oka. Pančeva oka (meaning "Pelican's springs" in local language) is a vast complex of dead and live flooding vegetation that has formed up to 11 m deep layers of

peat-moss. It consists of floating peat islands accessible only with difficulty, freshwater pools, and thick *Salix* vegetation. Among other vegetation found there is *Salix alba*, *S. fragilis, Typha angustifolia,* and *T. latifolia*. The pelican colony is situated on a floating island of peat on the southern edge of the Pančeva oka complex and is surrounded by large colonies of Cormorants *Phalacrocorax carbo*, Pygmy Cormorants *Ph. pygmeus*, Little Egrets *Egretta garzetta* and Squacco Herons *Ardeola ralloides*. The Pelican colony is situated in the basin, not far from the open water.

The second breeding site was in Crni žar. The area covers a few km^2 and lies to the south of Pančeva oka. It is a complex of mostly live floating vegetation formed mainly by *Nuphar luteum, Nymphea alba, Phragmites australis* and *Trapa natans*. Numerous small islands are formed by dead vegetation and peat. The larger islands were also formed from *Salix alba* and *S. fragilis*. The pelican colony was situated on an island of dead vegetation, surrounded by a colony of Common *Sterna hirundo* and Whiskered Terns *Chlidonias hybridus* and a few other water-bird species.

The third locality where pelicans were found breeding in 1991 and 1992 is Grmožur island. This rocky island is found close to the north-west shore of the lake, near Virpazar. The island is a few hundred square metres in area. Vegetation, present mainly on the highest points of the island, consisted of a few *Ficus carica, Punica granatum* and *Vitex agnus-castis* plants. Pelicans' nests were situated close to the water, only a few metres from the shore.

4. Discussion

Historical data and recent observations of Dalmatian Pelicans at Skadar Lake show large changes in population numbers. The average breeding population per year is 19 pairs, making it one of the smallest colonies in the Western Palearctic. Regardless of its small size, the species' population has survived more than 100 years in the area. The absence of nesting was recorded only between 1993 and 2001, most probably due to the increased boat traffic and other intensive human disturbance. With diminution of human activities, the pelican nesting population started to breed again, but still in a very low numbers.

Nests of pelicans on Skadar Lake were typically situated on floating islands of dead vegetation (mostly peat islets). Only in 1991 and 1992 was the rocky island used as a breeding site. The shallow freshwater lake, rich in fish, reed beds and floating water plants provides good foraging and nesting possibilities.

Table 2: Comparison of breeding habitat, food prevalence and types of threat to Dalmatian Pelican *Pelecanus crispus* during the breeding period between different breeding localities throughout the area of distribution of the species

Tabela 2: Primerjava gnezditvenega habitata, prevladujoče hrane in tipov ogrožanja kodrastega pelikana *Pelecanus crispus* v gnezditvenem obdobju med različnimi gnezditvenimi lokacijami v območju razširjenosti vrste

Locality/ lokaliteta	Habitat / habitat	Food / hrana	Threats / tipi ogrožanja	Source / vir
Skadar (Montenegro)	Peat and reed rafts, solid rocky island	*Scardinius erythrophtalmus, Rutilus rubilio, Anguilla anguilla, Carassius auratus gibellio*	Flood, hail, human disturbance, predators (*Corvus corone cornix*)	Vizi (1981)
Mikri Prespa (Greece)	Reedbeds, reed islets, artificial islands	*Alburnus alburnus, Rutilus rubilio*	Flood, degradation and erosion of reed islets, human disturbance, predators (*Vulpes vulpes*)	Crivelli (1987), Catsadorakis *et al.* (1996), Catsadorakis & Crivelli (2001)
Amvrakikos (Greece)	?	*Anguilla anguilla*	?	Crivelli (1987)
Karavasta (Albania)	Reedbeds, reed islets, artificial islands	*Anguilla anguilla, Mugil* spp., *Gobius bucchichi, Belone belone*	Hunting, collecting chicks, destruction of nests, human disturbance, flood	Peja *et al.* (1996), Bino (2000)

(continuation of table 2 / nadaljevanje tabele 2)

Locality/ lokaliteta	Habitat / habitat	Food / hrana	Threats / tipi ogrožanja	Source / vir
Tengiz-Kurgal'džin Lakes (Kazakhstan)	Steppe covered sandy/silty islands	*Cyprinus carpio, Carassius carassius, C. auratus, Rutilus* sp., *Perca fluviatilis, Esox lucius, Tinca tinca, Gasterosteus* spp.	?	Andrusenko (1994)
Sarakamyš (Turkmenistan)	Flat muddy/sandy islands with or without sparse vegetation, temporary islands	*Cyprinus carpio, Styzostedion lucioperca, Silurus glanis, Abramis brama, Pelecus cultratus, Aspius aspius, Barbus barbus*	Flood, predators (*Canis lupus, Sus scrofa*)	Poslavski & Chernov (1994)
Ili Delta (Kazakhstan)	Sandy islands, rocky island, rafts of reed	*?*	Predators (*Corvus corone cornix, Larus cachinnans, Silurus glanis*), reed cutting, drying of lakes, fire, poaching, pesticide intoxication, lack of food	Žatkanbaev (1994a & b), B. Rubinič
Caspian Sea, Volga Delta (Russia)	Reed beds, sandy islands	*Cyprinus carpio, Abramis brama, Perca fluviatilis, Rutillus rutilus, Blicca bjoerkna, Neogobius* spp., *Cobitis caspia*	Flood, predators (*Sus scrofa, Vulpes vulpes, Corvus corone cornix, Larus cachinnans*), human disturbance	Krivonosov *et al.* (1994), Romašova (1994)
N Kazakhstan	Poacae, Chaenopodiaceae, reed, Tamarix	*Carassius carassius, C. syratuys*	Lack of food, predators (*Larus cachinnans, L. ichthyaetus, Aquila heliaca, A. chrysaetos, Haliaetus albicilla, Canis lupus*)	Gordienko (1994)
S Tyumen (Russia)	Dead floating vegetation, reed beds	*Carassius carassius*	Shooting of breeding birds	Azarov (1994)
Saltaim-Tengiz Lakes (Russia)	Dead floating vegetation, silty sand-bar	?	Predators (*Larus* spp.)	Blinov *et al.* (1994)
Alakol' Lake (Kazakhstan)	Reed rafts, rocky island	?	Shooting, human disturbance, drying, fires	Annekov (1994), N.N.Berezovikov (*pers comm.*)
Manych, Manych Gudilo lakes, Kalmykija (Russia)	Temporary islands, floating reed	*Cyprinus carpio, Stizostedion* spp., *Pungitius pungitius*	Human disturbance, flood	Kazakov *et al.* (1994), Linkov (1994)

Table 3: Breeding success (fledglings per pair) of Dalmatian Pelicans *Pelecanus crispus* on different breeding localities

Tabela 3: Gnezditveni uspeh (število speljanih mladičev na par) kodrastega pelikana *Pelecanus crispus* na različnih gnezditvenih lokalitetah

Locality / lokaliteta	Years of research/ leta raziskav	Breeding success/ gnezditveni uspeh	Source / vir
Skadar (Montenegro)	1972 – 2003	0.0 – 1.4	this work / to delo
Mikri Prespa (Greece)	?	1.0 – 1.2	Crivelli (1987)
Amvrakikos (Greece)	?	0.6 – 0.9	Crivelli (1987)
Karavasta (Albania)	1992 – 1993	0.5 – 0.8	Peja *et al.* (1996)
Camalti Tuzlasi (Turkey)	1982 – 1993	0.0 – 0.8	Peja *et al.* (1996)
Tengiz-Kurgal'džin (Kazakhstan)	1974 – 1990	0.2 – 1.4	Andrusenko (1994)
Volga Delta (Russia)	1974 – 1990	0.0 – 1.1	Krivonosov *et al.* (1994)
N Kazakhstan	1983 – 1989	0.8 – 1.1	Gordienko (1994)
Bolšoe Beloe Lake (Russia)	1982 – 1987	0.7 – 1.6	Azarov (1994)
Tundrovo Lake (Russia)	1986 – 1987	1.2 – 1.8	Azarov (1994)
Omelina Lake (Russia)	1990	1.2	Azarov (1994)

Similar nesting requirements have been recorded all over the species' range (Table 2). Additional feeding sites used by pelicans are in the Bojana Delta, Ulcinj saltpans and Šasko Lake.

The recorded breeding success of 0.0 – 1.4 successfully fledged young per pair in the period 1972 – 2003 is similar to the range of breeding success in other Dalmatian Pelican colonies (Table 3). However, the Dalmatian Pelican at Skadar Lake is endangered, as only a few pairs have survived, most probably quite old birds. It will take several years with good breeding success to close the age gap in the population.

Dalmatian Pelican's food at Skadar Lake consisted of the commonest fish species of the area, *Scardinius erythrophtalmus, Rutilus rubilio, Anguilla anguilla,* and *Carassius auratus gibellio* (Vizi 1981, own data), similarly to that recorded by other authors in different areas (Table 2).

The types of disturbance at Skadar Lake are similar to those recorded at other breeding places (Table 2). The most common cause of destruction of eggs and young was flooding. Other causes were human disturbance and predation by aerial predators.

Natural disturbance factors have caused lower breeding success, substitutive or late broods, and nest site changes between nesting seasons (Table 3). In the years of most intense human disturbance between 1993 and 2001 no breeding was recorded on the Lake. It may well be, therefore, that the most important factor of disturbance, limiting nesting pair numbers, is the above mentioned human disturbance. During the last few years, the National Park earned money by selling hunting licenses. As the hunting season in Montenegro on waterfowl starts at 15 Aug and ends not before 15 Mar for Garganey *Anas querquedula*, all water birds are extremely shy.

We suppose that a total lack of effective protection is a reason for the low number of breeding Dalmatian Pelicans at Skadar Lake. For example, at the same time as the decrease in the Skadar population, the population at the smaller but ecologically similar Mikri Prespa Lake increased significantly. Effective protection at Skadar Lake would therefore not only provide more stable conditions for the nesting pelicans but very likely also result in an increase of the breeding population, like that on the nearby Mikri Prespa Lake in Greece.

The Albanian proposal to declare Skadar Lake and the Bojana (Albanian Buna) River as a Ramsar site and as a protected area consisting of different categories of protected areas is a great step forward in conservation efforts on Skadar Lake. Only a clear zoning concept on Lake Skadar and a hunting ban at the most important waterfowl sites in Montenegro and Albania could, however, save the extremely small population of the Dalmatian Pelican (see also Schneider-Jacoby 2000 & 2001).

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5. Povzetek

Predstavljena je zgodovina gnezdenja kodrastega pelikana *Pelecanus crispus* na Skadarskem jezeru. Prvič je bilo gnezdenje pelikanov na tem največjem balkanskem jezeru ugotovljeno leta 1894. Za njihovo gnezdenje na jezeru med letoma 1896 in 1965 ni literaturnih podatkov. Intenzivnejše raziskave so se začele leta 1972 in trajajo še danes. Maksimalno velikost je gnezdeča populacija pelikanov dosegla v letu 1977, in sicer 52 parov. Kodrasti pelikani so gnezdili na Skadarskem jezeru na plavajočih otočkih šotnega mahu, z izjemo dveh let, ko so gnezdili na skalnatem otočku. Večina zbranih podatkov se nanaša na ornitološki rezervat Pančeva oka. Kljub temu da je sredozemska populacija kodrastega pelikana stabilna, so skadarski pelikani zelo ogroženi. V zadnjih nekaj letih pa je vendarle zaznati trend počasne rasti gnezdeče populacije. Glavna omejitvena dejavnika gnezditvenega uspeha kodrastih pelikanov na Sakadarskem jezeru sta poplavljanje gnezd in vznemirjanje s strani človeka.

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