Environmental risk assessment of the Morača dams: ornithofauna of Morača river canyon and Skadar Lake

Darko Saveljić, *Piperska 370 A, 81000 Podgorica; Crna Gora, dasav@t-com.me*

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MAIN OBJECTIVE

The objective of this paper is to explain the potential impact of possible building of hydro-power plants in Platije, on the ornithofauna of this canyon and Skadar Lake through the analysis of the ornithological significance of Skadar Lake and review of the state of ornithology of Morača canyon.

The study gives the overview of the state of:

(Part I)

- Ornithofauna of Morača canyon
- Ornithofauna of the Skadar Lake (diversity, indicator species, endangered species, winter bird census, migration, wintering, important breeding and wintering areas)
- Economic activities related to tourism in NP Skadar Lake
- Legislation, national and international related to protection of birds of Skadar Lake

The study is seeking for the answers to:

(Part II)

- Potential impact of building of hydro-power plants on ornithofauna of Morača River and Skadar Lake

TABLE OF CONTENTS:

LIST OF FIGURES:

LIST OF TABLES:

LIST OF MAPS:

Executive Summary

Thanks to rich bird fauna, attractiveness of landscape and geomorphologic elements, Montenegro has been attracting international ornithologists for more than 170 years.
Unlike the Skadar Lake for which extensive literature exists, for the ornithofauna of Moraca canyon there are no scientific publications. It seems that during the history Moraca canyon was rounded due to larger activities on the nearby Skadar Lake, swamps of Ulcinj, Durmitor and Piva Lake.

Besides a fishing ban (Podgorica, some hundred meters between Vojni/Vezirov most), and two Emerald sites, Morača canyon does not enjoy protection status in Montenegro. However, Morača canyon / Platije was foreseen as a monument of nature by the Draft Spatial Plan of Montenegro from 2006.
After a public debate, there were no remarks to the planned status of protection of this canyon.
The final document of Spatial Plan adopted in the Parliament of Montenegro in 2008, beside resistance of numerous institutions, civil sector, citizens and partially political parties, Platije area was erased from the list of potentially protected areas and was foreseen for building of the following accumulation reservoires: Zlatica, Milunovići, Raslovići and Andrijevo.

In Montenegro, around 380 species have been registered; more than 40% of them does not have satisfactory status. 297 species are protected permanently from 2006.
Many endangered species will be preserved by preserving their habitats. That is also the best way for protecting them. The world's authority for protection of birds and their habitats *BirdLife Inernational* tries to conserve birds' habitats through the implementation of world wide program for protection called Internationally Important Bird Areas – IBA. Montenegro has been part of the program since the beginning of its implementation in 1989.

The activities on extension of the IBA list in Montenegro are continuing; the areas for which data were not available are being researched. The result of this study is the list of species and their number in the canyon (Table1), which represents the basis for declaring "Morača canyon" a new IBA.

This canyon fulfils A1 and B2 IBA standards (see annex 2) due to 29 of 52 identification species registered for IBA Montenegro. Only on the basis of presence of globally endangered Pygmy Cormorant, *Phalacrocorax pygmeus* Platije canyon can be considered as GLOBALLY important area for birds, which expands the national interest for its protection.

From intensive research in 2008, excluding the winter aspect, in total 115 species were registered in Morača Canyon (Tab.1). 84 certain nesting birds and 10 species whose breeding has not been confirmed were registered in the canyon, which represents 42% of the total number of species breeding in Montenegro (Puzović et al, 2004).

Research from 2008 in Morača canyon registered 115 bird species, while in the same year 88 bird species were registered in the NP Lovćen (Saveljić, 2008). According to this, 61% of the total number of species seen in the Morača canyon is being registered in the National Park Lovćen. Contrary to Morača canyon, National Park Lovćen does not fulfill the status of internationally important IBA. In Morača canyon approximately 1,600 plant species are being registered while in NP Lovćen the number is app. 1,500 (S. Vuksanović, pers.com) (see graph.1).

112 species registered in the canyon have a kind of national or international protection status: 32 species are listed in Annex I Annex I Bird Directive, 71 SPEC species of EU, 23 Emerald species, 108 species listed in the Annexes of Bern Convention, 45 from Annexes of Bonn Convention, 14 species of CITES Convention and 7 species of AEWA Convention (Table9).

The construction of any energy source disturbs natural state of environment and, in case its impact is not carefully assessed, short-term and long-term consequences might be drastic. This does not refer only to non-renewable energy sources, that are not *eco friendly* but to each system for electricity production, either solar panels, windmills or hydro-power plants.

Ornithological research realised during the course of one year and the published floristic findings made evident that this study had to focus not only on the potential impact of dams on Skadar Lake but also on the potential impact on such an important biodiversity hotspot like Moraca canyon (as also recommended in the draft Montenegro spatial plan).

It is hard to predict the impact of construction of dams on Moraca River, because at the moment there is no single document that describes their operation, i.e. how the water will be managed. In other words it is not clear from the information released how the water will flow through Moraca river (the main inflow of Skadar Lake), how much water will be retained or released in which period of the year, and the resulting water regime during the pelican breeding season. In short it is unclear to what extent all those activities will influence the lake water level fluctuation. All these are unknowns that have to be solved when planning the dams' management and operation.

The construction of dams in Morača would drastically affect the condition of flora and fauna of the canyon upstream of the dams and have enormous consequences on the environment downstream.

The flooding of the canyon upstream would permanently cause the loss of habitats for resting, reproduction and feeding of birds and would drastically change qualitative and quantitative state of ornithofauna in the canyon. First of all, the species breeding in the cliffs and feeding on river streams or pebble excavation locations would vanish. Then the species breeding on high rocks and hunting in the more open section of canyon, such as

eagles, hawks, owls, numerous songsters breeding in the river bed and in low vegetation or trees above the water, would also vanish.
An example of this type of impact and consequential destruction of plant and animal life is the nearby river canyon beside Piva river and Pivsko lake, where no birds can be found today due to loss of permanently flooded habitats. The whole river course of Piva river was assessed for the identification of Emerald habitats in Montenegro (Emerald data base from 2008), but only the part downstream of the dam, which is today in pristine form, was declared as "emerald European network". The upper flooded part of the canyon did not fulfill the criteria of Montenegrin Emerald team experts.

The question is how the change of micro climate and geomorphology, caused by the flooding of Morača, will influence two already declared Emerald habitats in Montenegro – Mrtvica river canyon and Mala rijeka canyon. The flooding of parts of these habitats due to the inundation of Morača itself is unknown. The loss of habitats and change of vegetation cover, due to change of climate, will impact on the composition of ornithofauna of these two canyons, already acknowledged as valuable by the Council of Europe as Emerald sites.

Based on the facts presented in Part II and summarised in Table 8, it would be intolerable to accept the impacts resulting from the construction of dams on Morača River in the river canyon and the Skadar Lake. Such an activity would in fact be in contradiction with the national legislation and international conventions that forbid the "destruction of protected wild species, disturbance, reduction in number of population of protected wild animal species, destruction or damaging of their habitats or changing of their living conditions", which would result from the construction of dams.

PART I

1. MORAČA CANYON

1.1 Background

Thanks to rich bird fauna, attractiveness of landscape and geomorphologic elements, Montenegro has been attracting international ornithologists for more than 170 years.

The founder of Montenegrin ornithology Ludwig von Führer, who visited Montenegro several times, in 1893/94 visited the Morača canyon but without recording ornithological observations (Firer, 1894). The destination of his journey, as a guest of the Petrovici Palace and Crown-prince Danilo, who was a passionate hunter, was Biogradska gora – crown's hunting ban site.

It seems that during history, Morača canyon paid charge to Skadar Lake, Ulcinj wetlands, Durmitor and Plav Lake since there is no literature providing ornithological data for it. When talking about Morača, ornithologists used to analyse the area passing through nowadays Zeta villages and Morača's mouth into the Skadar Lake.

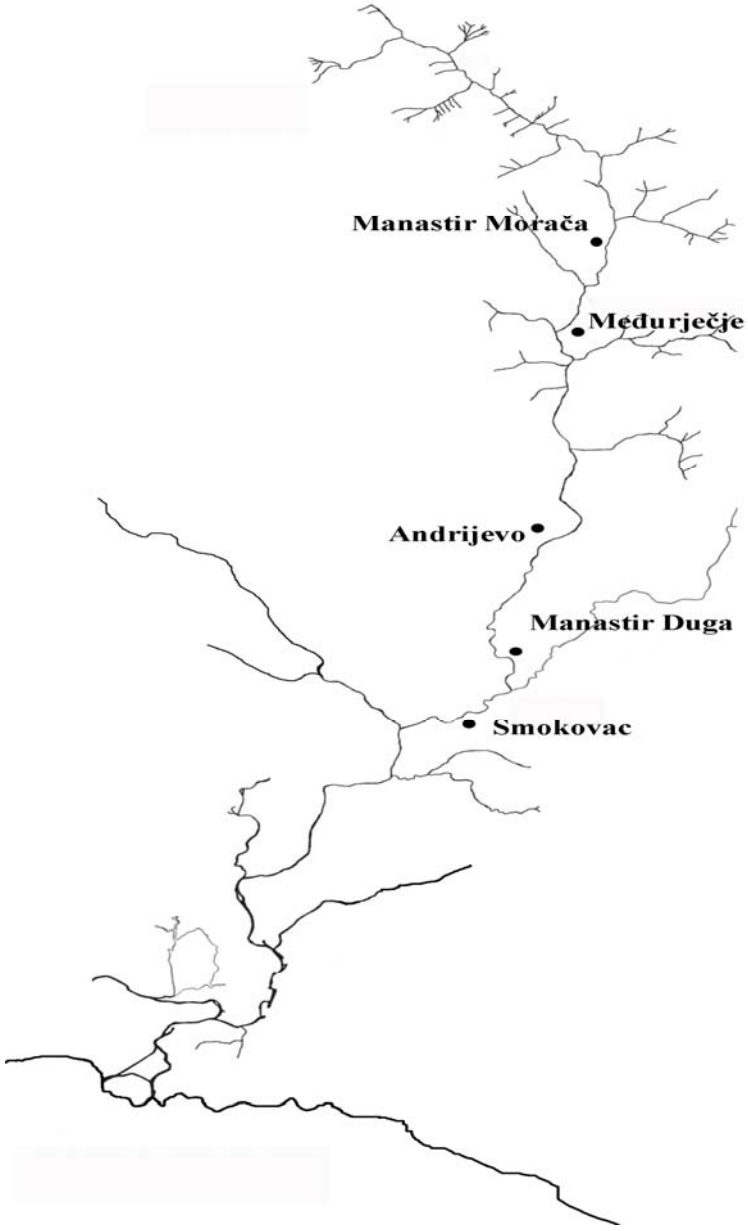
Newer research of Morača canyon was undertaken in the period from 1999 to 2005 with more often visits of Mrtvica canyon.

1.2 Ornithofauna of Morača river canyon

As already stated, there is no published literature providing data for birds of this canyon, but the overview of bird species observed is given on the basis of twenty records made by the author of this current study in the period 1999-2005 and 32 field-work days carried out in the period between March and December 2008.

For easier presentation, upper flow of Morača (above Zeta mouth) is separated into several observation points that would cover planned accumulations:

- Duklja - Smokovac
- Duga Monastery
- Andrijevo
- Morača Monastery
- Međuriječje



Map 1. River Morača and locations investigated in this study.

Duklja - Smokovac

The canyon is open on this profile; water is shallow out of season of spring-tide water levels. The exploitation of gravel is intensive on those places. That causes blocking of the river (Duklja) and creating small, isolated water surfaces.
During summer months, those places are bathing sites when disturbance of birds is intensive.
Birds registered in post-breeding period are the following: *Tachubaptus ruficollis*, Little egrett, *Egretta garzetta;* Grey Heron, *Ardea cinerea;* Pygmy Cormoran *Phalacorocorax pygmeus;* Cormorant, *Phalacrocorax carbo.*
Breeders in the river-bed are the following: Kingfisher, *Alcedo attis,* Common Whitethroat, *Sylvia communis.* In the canyon, the following species breed on this site: *Aquila chrysaetos, Delichon urbica, Hirundo daurica, Hirundo rustica, Merops apiaster, Lanius collurio, Lanius senator, Carduelis carduelis, Carduelis chloris, Fringila coelebs, Serinus serinus, Oenante hispanica, Columba oenas, Sitta neumayer, Monticola saxatilis, Passer domesticus, Upupa epops, Streptopelia turtur, Sturnus vulgaris, Pica pica, Corvis corax, Coelus monedula.*
It is interesting that both species of cormorant registered in Morača do not fly above this profile.

Figure 1. Bee eater (Merops apiaster) breeding in the lower part of the canyon. Photo: B. Rubinić.

Duga Monastery

This habitat is open and populated, having agro landscape and some places with prairie vegetation. It is characterised by field species: larks *Anthus campestris, Galerida cristata, Alauda arvensis,* Whinchat, *Saxicola rubetra,* and Northern House-martin *Delichon urbica* which breed in a significant number of surrounding rocks, Barn Swallow, *Hirundo rustica;, Ptyonoprogone rupestris,* hawks, *Accipiter nisus/gentilis,* falcons *Falco*

tinnunculus / peregrinus, Common Scops-owl, *Otus scops;* Little Owl *Athene noctua;* Eurasian Eagle-owl*, Bubo bubo.* In the summer 2008 it was breeding place for four pairs of *Burchinus oedicnemus.* During the work on the 23 May, adult Golden Eagle, *Aquila chrysaetos,* was registered flying upstream the canyon as well as Short-toed Eagle, *Circaetus gallicus*. Most probably we are talking about one pair of Golden Eagles only. To summarise, species registered on Smokovac are characteristic for this part of the canyon, considering similar geomorphology. There are many breeders as Red Rumped Swallow, *Hirundo daurica* in this part of the canyon.

Andrijevo

The only valuable record for this profile dates from 2002: Lanner Falcon, *Falco biarmicus.* Its presence in this part of canyon probably attracts a few pairs of permanently habited wild pigeons *Columba livia.* Here, the canyon is mostly closed which suits birds the least.

Figure 2. Andrijevo. Photo: D. Saveljić

Morača Monastery

This location, compared to others in the upper flow of the river is much more open. Dominant habitats are oak and beech forests on higher altitudes, planted forests of black pine and orchards.
The species of anthropogenic landscapes are dominant: Syrian Woodpecker, *Dendrocopus syriacus;* Euroasian Hoopoe, *Upupa epops;* European Turtle-dove, *Streptopelia turtur,* Red backed Shrike, *Lanius colurio;* Common Kestrel, *Falco tinnunculus.*
Other frequent species are the following: tits *Parus major/caeruleus;* Robin, *Eritacus rubecula;* Common Chiffchaff, *Phyloscopus collybita;* Green Woodpecker, *Picus viridis;* Common Redstart, *Phoenicurus phoenicurus;* Common Starling*, Sturnus vulgaris.* At this part, beside the species registered in Smokovac and Duga, the following species breed: *Emberiza cirlus, Parus palustris, Sylvia curruca, Sylvia cantillans* and *Luscinia megarhynchos.* Only White-throated Dipper, *Cinclus cinclus* has been registered as a water bird on this profile.

Međuriječje

This habitat is characterised by mixed deciduous forest and open space in the mouth of Mrtvica to Morača.
The only waterfowl registered in this profile in previous years is White-throated Dipper, *Cinclus cinclus.*
The other groups registered are the following: Chafinnich, *Fringila coelebs;* tits *Parus major/caeruleus/palustris;* Common Blackbird, *Turdus merula;* Chatterer, *Garullus glandarius;* Euroasian Nuthatch, *Sitta europea;* Blackcap, *Sylvia atricapilla;* pigeons *Columba oenas/palumbus;* European Turtle Dove, *Streptopelia turtur;* Cuckoo, *Cuculus canorus;* Grey Headed Woodpecker, *Picus canus;* White Wagtail, *Motacila alba.* All these species are linked to open and forest habitats of surrounding hills.
In 2002, in this part of canyon, Golden Eagle, *Aquila chrysaetos,* was registered. It probably inhabited surrounding rocks. Hawks *Accipiter nisus* and *Accipiter gentiles* were also registered.

From intensive research conducted in 2008 (excluding winter) a total of 115 species were registered in Morača Canyon (Tab.1) (and additionally 15 more species in Mala rijeka and Mrtvica – and thus the possibility that they exist in Moraca canyon is almost certain). There were registered in the canyon 84 nesting birds and 10 species whose breeding has not been confirmed. This represents 42% of the total number of species breeding in Montenegro (Puzović et al, 2004).

Table 1. Ornithofauna of Morača canyon, status, number, national legislation and international conventions (the list of ornithofauna of Morača canyon is made for the first time in the history of Montenegro).

Species	Status	no	BiE2 SPEC category	BiE2 European Threat Status	Birds Directive	Bern Convention	Emerald Network	Bonn Convention	AEWA	CITES
Tachybaptus ruficollis	ab	14	—	S		II				
Podiceps nigricollis	wm	s		S		II*				
Phalacrocorax carbo	ab	21	—	S		III				
Phalacrocorax pygmeus	ab	26	1	S	I	III	Yes	II	Yes	
Egretta alba	wm	8		S	I	III	Yes	II	Yes	
Egretta garzetta	ab	19		S	I	III	Yes	II		
Ardeola ralloides	ab	6	3	(D)	I	III	Yes			
Ardea cinerea	Ab,w	s	—	S		III				
Anas platyrhynchos	W	s	—	(S)	II/1; III/1	III		II	Yes	
Pernis apivorus	B	4p	-[e]	(S)	I	III	Yes	II		II
Gyps fulvus	r (ex)	2i	—	S	I	II	Yes	II		II
Circaetus gallicus	B	2p	3	(R)	I	II	Yes	II		II
Accipiter gentilis	B	3p	—	S	I*	II	Yes*	II		II
Accipiter nisus	B	s	—	S	I*	II		II		II
Accipiter brevipes	B	3p	2	(VU)	I	III	Yes	II		II
Buteo buteo	B	n	—	S		II		II		II
Aquila chrysaetos	B	2p	3	R	I	II	Yes	II		II
Falco tinnunculus	B	n	3	D		III		II		II
Falco biarmicus	B	>1p	3	VU	I	II	Yes	II		II
Falco peregrinus	B	n	—	S	I	III	Yes	II		I
Alectoris graeca	B	n	2	(D)	I*; II/1**	III	Yes*			
Phasianus colchicus	?	s		(S)	II/1; III/1	III				
Burchinus oedicnemus	B	4p	3	(VU)	I	III	Yes	II		
Charadrius dubius	?	s		(S)		III		II	Yes	
Charadrius alexandrinus	?	s	3	(D)	I	III		II	Yes	
Scolopax rusticola	?	s	3	(D)	II/1; III/2	III		II		
Actitis hypoleuctos	B	s	—	(D)		III		II	Yes	
Larus ridibundus	ab	8i	—[E]	(S)	II/2	III				
Columba livia	B	32p	—	(S)	II/1	III				
Columba palumbus	B	n	—[E]	S	I*II/1**; III/1		Yes*			
Streptopelia decaocto	B	n	—	S	II/2	III				
Streptopelia turtur	B	n	3	D	II/2	III		II*		
Cuculus canorus	B	n	—	S		III				
Otus scops	B	>4p	2	(H)		III				II
Bubo bubo	B	n	3	(H)	I	III	Yes			II
Athene noctua	B	n	3	(D)		III				II
Caprimulgus europaeus	B	>2	2	(H)	I	III	Yes			
Apus apus	B	n	—	(S)		III				

Alcedo atthis	B	>6p	3	H	I	III	Yes	
Merops apiaster	B	18p	3	(H)		III		II
Coracias garrulus	?	1p?	2	VU	I	III	Yes	II
Upupa epops	B	n	3	(D)		III		
Picus canus	B	n	3	(H)	I	III	Yes	
Picus viridis	B	n	2	(H)		III		
Dryocopus martius	B	n	—	S	I	III	Yes	
Dendrocopos major	B	n	—	S	I*	III	Yes*	
Dendrocopos syriacus	B	n	—[E]	(S)	I*	III	Yes	
Dendrocopos medius	B	n	—[E]	(S)	I	III	Yes	
Dendrocopos minor	B	n	—	(S)		II		
Galerida cristata	B	n	3	(H)		III		
Lullula arborea	B	n	2	H	I	III	Yes	
Alauda arvensis	B	n	3	(H)	II/2	III		
Hirundo rupestris	B	n	—	S		III		
Hirundo rustica	B	n	3	H		III		
Hirundo daurica	B	>7p	—	(S)		III		
Delichon urbica	B	170p	3	(D)		III		
Antus campestris	B	n	3	(D)	I	III	Yes	
Motacilla flava	B	n	—	S		III		
Motacilla alba	B	n	—	S		III		
Cinclus cinclus	B	>12p	—	S		III		
Troglodytes troglodytes	B	n	—	S	I*	III	Yes*	
Prunella modularis	W	n	—[E]	S		III		
Erithacus rubecula	B	n	—[E]	S		III		II
Luscinia megarhynchos	B	n	—[E]	(S)		III		II
Phoenicurus ochruros	B	n	—	S		III		II
Phoenicurus phoenicurus	B	n	2	(H)		III		II
Saxicola torquata	M	n		(S)		III		II
Oenanthe oenanthe	B	n	3	(D)		III		II
Oenanthe hispanica	B	n	2	(H)		III		II
Monticola saxatilis	B	n	3	(H)		III		II
Monticola solitarius	B	n	3	(H)		III		II
Turdus merula	B	n	—[E]	S	II/2	III		II
Turdus pilaris	W	n	—[E]W	(S)	II/2	III		II
Turdus philomelos	?	n	—[E]	S	II/2	III		II
Turdus viscivorus	?	n	—[E]	S	II/2	III		II
Cettia cetti	B	n	—	S		III		II
Hippolais pallida	B	n	3	(H)		III		II
Sylvia cantillans	B	n	—[E]	(S)		III		II
Sylvia hortensis	B	n	3	H		III		II
Sylvia curruca	B	n	—	S		III		II
Sylvia communis	B	n	—[E]	S		III		II
Sylvia borin	M	n	—[E]	S		III		II
Sylvia atricapilla	B	n	—[E]	S		III		II
Phylloscopus collybita	B	n	—	S		III		II
Muscicapa striata	M	n	3	H		III		II
Parus palustris	B	n	3	D		III		
Parus lugubris	?	n	—[E]	(S)		II		
Parus ater	w, m?	n	—	(S)	I*	III		

Parus caeruleus	B	n	—[E]	S		III	
Parus major	B	n	—	S		III	
Sitta europaea	B	n	—	S		III	
Sitta neumayer	B	n	—[E]	(S)		III	
Tichodroma muraria	B	n	—	(S)		III	
Oriolus oriolus	B	n	—	S		III	
Lanius collurio	B	9p	3	(H)	I	III	Yes
Lanius excubitor	W	n	3	(H)		III	
Lanius senator	B	n	2	(D)		III	
Garrulus glandarius	B	n	—	S	II/2		
Pica pica	B	n	—	S	II/2		
Pyrrhocorax graculus	B	n	—	(S)		III	
Corvus corone	B	n	—	S	II/2		
Corvus monedula	B	74p	—[E]	(S)	II/2		
Corvus corax	B	12p	—	S		III	
Sturnus vulgaris	R	n	3	D	II/2		
Passer domesticus	B	n	3	D			
Passer montanus	?	n	3	(D)		III	
Fringilla coelebs	B	n	—[E]	S	I*	III	
Carduelis chloris	B	n	—[E]	S		III	
Carduelis carduelis	B	n	—	S		III	
Carduelis spinus	W	n	—[E]	S		III	
Coccothraustes coccothraustes	B	n	—	S		III	
Emberiza melanocephala	B	n	—[E]	(S)		III	
Emberiza cirlus	R	n	—[E]	S		III	
Emberiza cia	R	n	3	(H)		III	
Miliaria calandra	B	n	2	(D)		III	

Breeding status: R-resident, R(ex) - resident, disappeared during the study period, B - breeding, M -
during migration, W - wintering; AB – after breeding season on Skadar Lake, ? - status uncertain; s- some individuals, n- no counted
Population estimation: p - pairs; i - individuals, empty – no estimation
SPEC Categories: 1 - SPEC Cat. 1; 2 - SPEC Cat. 2; 3 - SPEC Cat. 3; "—e" - non-SPEC in Europe; " —
EW" - non-SPEC in Europe for wintering populations; "—" - non-SPEC.
European Threat Status: EN - Endangered; D - Declining; R - Rare; H - Depleted; S - Secure, () – status

1.3 Morača river canyon, protection status

Besides a fishing ban (Podgorica, some hundred meters between Vojni/Vezirov most), Morača canyon does not enjoy other protection status in Montenegro.

Out of international categories previously implemented in Montenegro, it has not been recognised as IPA (plants), IBA (birds), IFA (fungi) nor as Emerald habitat of the Bern Convention.

Figure 3. Water quality and the conservation level of the habitats in Morača canyon deserve special scientific attention Photo: D. Saveljić.

However, Morača canyon / Platije was foreseen as a monument of nature by the Draft Spatial Plan of Montenegro from 2006.
After public debate, there were no remarks to the planned status of protection of this canyon.
The final document of Spatial Plan adopted in the Parliament of Montenegro in 2008, beside resistance of numerous institutions, civil sector, citizens and partially political parties, Platije area was erased from the list of potentially protected areas and was

foreseen for building of the following accumulations: Zlatica, Milunovići, Raslovići and Andrijevo (Ministry of economic development, 2007).

1.4 Morača river, activities impacting on birds

Pebble exploitation, done in the downstream area of Morača River, is a significant economic activity, impacting on bird population in the very river bed. Unlike sport fishing, which has minimal impact, pebble exploitation significantly influences species breeding or nourishing in the river bed.
Those activities, are carried out with the license issued by the Ministry of agriculture, forestry and water management and are not performed according to ecological standards. The river is being fragmented, isolated pools are being created as well as driving tracks for the transport of excavated material. The water downstream of the pebble extraction locations is always muddy.
The locations for pebble exploitation, upstream from Podgorica are the following: Zlatica, Smokovac, Veziste, Bioce, Moracica, Duga, Mravinja, Mrtanja, Sujaci, Dromira i Sjevernica, (Zlatičanin, 2007)
The results of uncontrolled gravel exploitation in the Morača river bed could be observed in August 2008, when Morača river bed under the railway bridge of Duklja was completely partitioned for the purpose of making a large pond, which was emptied through three high profile pipes.

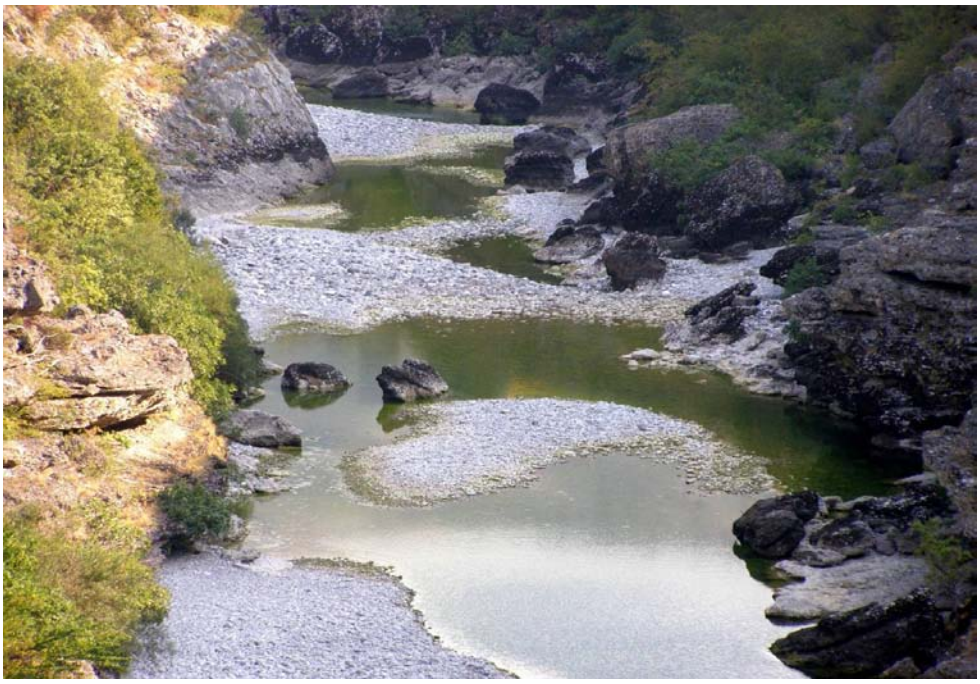


Figure 4. During summer months, in some areas, Morača dries out. Animals trapped in ponds are ideal food for birds. Photo: D. Saveljić

2. SKADAR LAKE

2.1 History of ornithological research

The first data on birds were recorded by the malacologist Küster in 1843, in his travelogue "Montenegro". He traveled from Cetinje to the lake and recorded simple species. The only species worth of attention is Eurasian Griffon, *Gyps fulvus* (Vizi, 1981).
In the age of Austria-Hungary, royal officers used to hunt on the lake. The Officer Brander created a small collection of birds of Skadar Lake (1890-91) and he granted it to the Land Museum in Sarajevo.
The same year, the custodian of the Zoological Museum in Zagreb, Spiridon Brusina organised a small collection exhibition for the Ornithological congress in Budapest in 1891, with the aim to show the birds of the lake to the world.
Montenegro, with its Skadar Lake and Ulcinj wetlands, became an obsession of Ludwig von Führer (Fuhrer, 1894), founder of Montenegrin ornithology. He visited the lake several times (in 1894, 1895, 1896 and 1934). Thanks to his work, Montenegro became one of the states with ornithofauna which was studied the most at the end of 19th and beginning of 20th century.
In 1896, together with the custodian of the Land Museum in Sarajevo, Otmar Reiser, he wrote the crucial work of Montenegrin ornithology „*Ornis balcanica Montenegro*" (Reiser, Fuhrer, 1896) that has not yet been surpassed for its seriousness, volume and exhaustiveness of data.

After World War II, a new era of research of birds of the lake started: the Siniša Stanković Institute, together with Sergej Matvejev, PhD in 1966 studied ornithofauna of Skadar Lake. Frequent findings of ringed birds were published by the Institute for Ornithology of the Croatian Academy of Science and Art in the scientific magazine „Larus".
Croatian ornithologists Renata and Dragutin Rucner visited the lake in 1968 and published their data in the scope of larger scientific papers.
The Institute for nature protection of Montenegro was established in 1961. Its employees Božina Ivanović, PhD and Miro Iličković created the environmental collection of the Institute. It was determined by Vojislav Vasić in 1967. In 1970, Ivanović, PhD published „Ornithological observations on Skadar Lake" (Ivanović, 1970).

The lake became more frequent destination of European ornithologists. They published their travelogues: in 1961 Michael Terasse, in 1970 Burri and in 1974 Kempf and Wersinger, and Ištvan Pelle and Obratil.

Travel agencies specialising in bird watching and ornithological destinations, such as the British „*Ornitholidays*", bring tourists and reporters who prepare valuable ornithological documentation.

Many youth organizations such as Young Researchers of Serbia and Biological – Research Association Josif Pančić from Belgrade, have organised camps on the lake and published data in the Gazette of the Institute, Larus, Biosisteamatica and Archive of biological sciences.

Vojislav Vasić was the first one to publish a check list of birds of Skadar Lake with 261 species. In the beginning of the 1970s, in the newly established Biological station on Skadar Lake, Ondrej Vizi began ornithological work. He made a great contribution to knowledge of birds and ecological regularities of the lake by publishing numerous works and observations of the state of the lake, not only from the ornithological perspective (Vizi, 1978, 1981, 1995, 1997, 2003).
In 1991, IWC was introduced at Skadar Lake IWC (see 2.7)
In 1999, the author of this paper and Nela Vešović Dubak, ornithologist in the NP Skadar Lake, joined intensive studies of Vizi.

In 2001, Saveljić and Dhora (AL) (Dhora, Saveljić, 2001) published the first ornithological bibliography of Skadar Lake which today consists of more than 200 works.

2.2 Ornithofauna of Skadar Lake

Beside Ulcinj wetlands in the south, primarily Salina „Bajo Sekulić“ and Durmitor in the north, it is hardly possible to find more literature documenting an ornithological object as for Skadar Lake elsewhere in this region.
In ornithological community, it is known as “European birds’ airport”. With its quality and quantity of ornithofauna, it stands equally with Danube delta, Po delta, Guadalquivir, Camargue and other European important bird areas.

So far, 281 bird species were registered in 18 taxonomic orders or 51 families (Dhora, Saveljić, 2001). More than 30% of this number stands for wintering birds, the same for passerines, more than 205 are breeding and residents are only 11% of recorded species (Vasić, 1983).

This clearly shows that 90% of total bird fauna on the lake is mobile, i.e. it is not exclusive ornithological asset of Montenegro but belongs to Europe, Asia and Africa.

All species are 100% protected on the lake due to hunting ban (NPM, 2001) (see 2.13). On other habitats in Montenegro, more than 95% of bird species of the lake are protected in some way: as permanently protected species or species protected by hunting bans (Official Gazette of Montenegro, 2006).

As will be described in the text, 150,000 birds winter on the lake. From this number, numerous species make several percentages of European population of wintering birds. More than one million birds fly over the lake in winter and during migrations.

The text provides the overview of ornithofauna of the lake belonging to the territory of Montenegro. Territorial waters and lake's shore in Albania are less important for the birds than the Montenegrin side, especially considering breeders.

2.3 Skadar Lake, protection status in national parks

- 1968 ornithological reserves: Pančeva oka (300 ha) and Manastirska tapija
- 1983 National Park (40.000 ha)
- 1989 IBA – international important bird area (40.000 ha)
- 1995 Ramsar – wetland of international importance (20.000 ha)
- 2006 Emerald habitat of Bern Convention (40.000 ha)

In Albania, the lake has the status of protected area V IUCN management category (see Annex 3) and from November 2005 it is on the Ramsar list.

According to standards set by International Union for Conservation of Nature IUCN, Skadar Lake belongs to the II management category (see Annex 3). Those waters, according to this category, are protected areas managed primarily for the purposes of protection of ecosystem and recreation. The aim is to:
a. protect ecological integrity of one or several ecosystems for today's and future generations
b. exclude exploitation or occupations which are contradictory to purpose of declaring the area and
c. provide base for scientific, educational, recreational and tourism potential, which all have to be ecologically compatible.

2.4 Ornithological reserves of Skadar Lake

According to the Law on nature protection and the Law on National parks, reserves are the littoral or sea areas with unchanged or slightly changed overall nature, intended only for conservation or genuine nature, scientific research without changing original elements and biological diversity, monitoring of nature and education which is not endangering realisation of free natural processes.
For research and visits to nature reserves for the sake of education, due to their importance for protection, it is necessary to obtain a license from the manager. Economic and other activities are forbidden in nature reserves.

The first nature reserves in Montenegro were declared in 1986: ornithological reserves Pančeva oka and Manastirska tapija. Their establishment was complete almost 15 years before declaring the Skadar Lake as National Park. This clearly shows their natural value and importance for protection of biodiversity.
Later, by the decree of NP Skadar Lake, Omerova gorica, Crni žar and Grmožur were added to the list.

All reserves of Skadar Lake National Park were designated as zones of special interest for protection, primarily as breeding areas for birds.

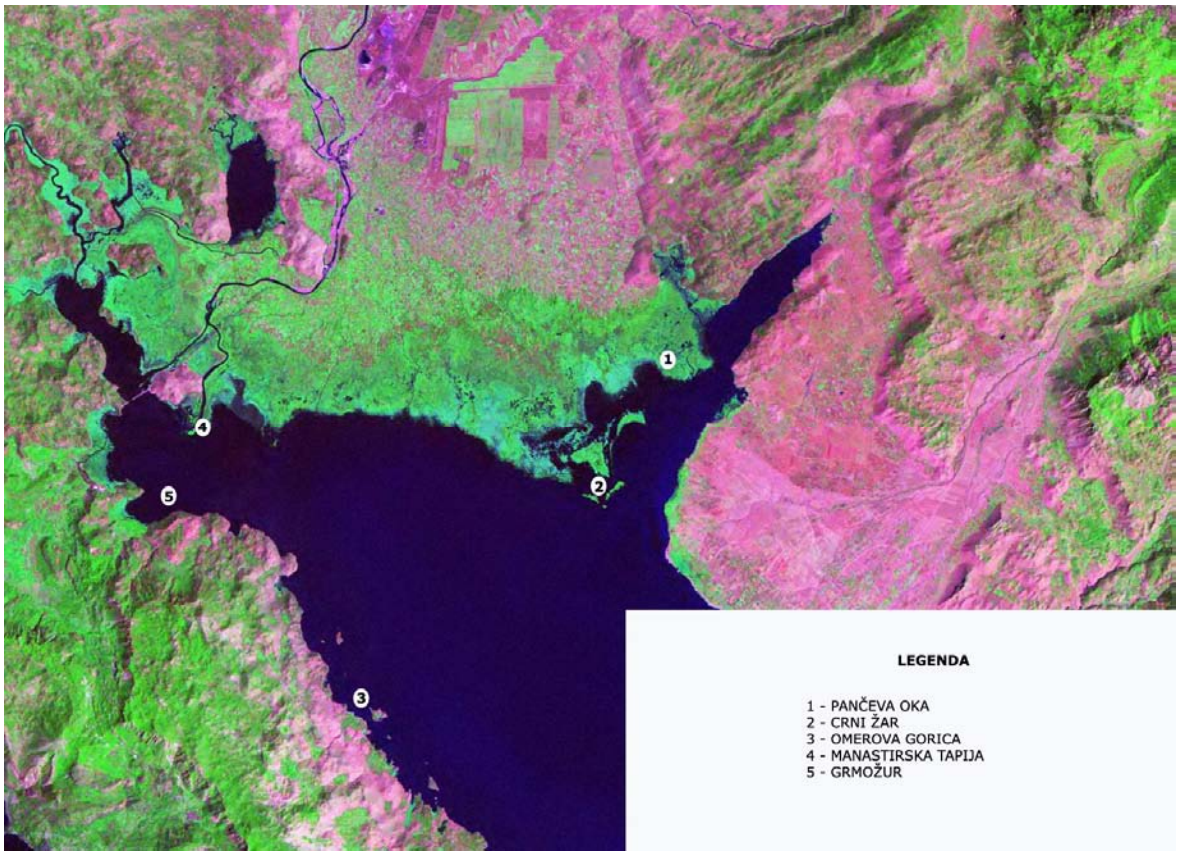


Figure 5. Ornithological reserves on Skadar Lake (G. Earth/ V. Bušković).

- **Pančeva oka** is mixed and globally important breeding area of cormorants, pelicans,terns, and herons.
- **Manastirska tapija** is occasionally colony of herons, cormorants, pelicans and terns
- **Crni žar** is breeding area of cormorants, herons, pelicans and terns
- **Omerova gorica** is the most important colony of grey heron on thelake
- **Grmozur** is important breeding area of terns, gulls, and pelicans occasionally

2.5 Indicator species and breeders of Skadar Lake

Aside from its global importance as one of the largest European wintering areas for birds, Skadar Lake is not lagging behind similar habitats in The Mediterranean when talking about breeders.
More than 80 of 281 bird species registered on the lake so far have the status of breeder.
Total number of breeding population on the territory of Montenegro is 204. Almost 40% of breeding population in Montenegro breeds on the lake.

The most important breeders of Skadar Lake are species selected as indicators:
Dalmatian Pelican, *Pelecanus crispus;* Pygmy Cormorant, *Phalacrocorax pygmeus* and Ferruginous Duck *Aythya nyroca.*

The most famous and one of the most endangered birds of Europe and trade mark of Skadar Lake National Park is the Dalmatian pelican, *Pelecanus crispus.* It has been breeding on the lake even since the first ornithological records were made. That is a species declared as (R(*rare*)) on the European continent, while globally it has status of (VU(*vulnerable*)) (BirdLife International, 2000)

The pelican *Pelecanus crispus* is a globally endangered species. Its status has been significantly improved by the largest European colony living in Mikra, Prespa Lake in Greece, counting more than 1000 breeding pairs (Malakou, 2008). By qualitative management in the breeding season (artificial islets that would prevent fluctuation of water destroying the colony and excluding disturbance as an important factor of breeding success) the pelican colony on Mikri Prespa has experienced a rapid increase in the number of pairs and represents the largest world wide colony of this species (see Annex 4.). This is the best example of protection of this species on the global level.

Figure 6. Dalmatian Pelican (*Pelecanus crispus)* breeds on few centimeters above water surface of the February water level Photo: B. Mitchell.

Pelicans breed in Southeast Europe, Middle East and Central Asia. On Skadar Lake, they breed on floating turf islets in Pančeva oka reserve (see photo 6). Those islets are located in vegetation of willow tree *Salix alba*, *S. fragilis* and other lake vegetation (*Typha angustifolia, T. latifolia, Phragmites australis).* The colony is always mixed with Great Cormorants, *Phalacrocorax carbo;* Pygmy Cormorants*, P.pygmeus,* and Little Egret and Squacco Heron *Egretta garzetta* and *Ardeola ralloides.* Nests are located close to open water because this heavy bird needs a runway for taking off and landing.
The second colony is occasionally located in Crni žar reserve. The colony is situated in vegetation made of water lilies *Nuphar luteum* and *Nymphea alba,* and reed *Phragmites australis* and water caltrop *Trapa natans*. Beside cormorants and herons, in colonial breeding, Common Tern *Sterna hirundo* and Whiskered Tern *Chlidonias hybrida* join pelicans.
The third location where pelicans used to breed (in the beginning of nineties) was Grmožur. This rocky island is overgrown with vegetation in its centre (fig, *Ficus carica,* pomegranate, *Punica granatum* and *Vitex agnus-castis).* Pelicans were breeding on the pebble ground, only few meters away from open water.
These are exclusively fish-eating species feeding with small fish, mainly *Scardinius erythrophtalmus, Rutilus rubilio, Anguilla anguilla* and *Carassius auratus gibellio*.

Year	No of pairs	No of nestlings	Successfulness	Disturbance type	Breeding site
1894	29	-	-	E, F	Pančeva oka
1896	20	-	-		Pančeva oka
1965	21	-	-	H	Pančeva oka
1967	30	-	-		-
1972	20	16-18	0.8-0.9		Pančeva oka
1973	24	18	0.7		Pančeva oka
1974*	16	0	0.0	P	Pančeva oka
1975	29	11	0.4		Crni žar
1977	52	46	0.9		Crni žar
1978*	-	0	0.0	F	Crni žar
1979	-	3	?		-
1983	11	6	0.5		Crni žar, Pančeva oka
1984	11	5	0.4		Crni žar, Pančeva oka
1986	8	9	1.1		Crni žar
1987	14	19	1.4		Crni žar
1989	29	7	0.2		Crni žar
1990*	21	0	0.0	G	Crni žar
1991	7	2	0.3	T	Grmožur
1992	15	11	0.7	T	Grmožur
2002	5	2	0,4		Pančeva oka
2003	7	10	1.4		Pančeva oka
2004					Pančeva oka
2005					Crni žar
2006	-	0		F	Pančeva oka
2007		13-16		F (first breeding)	Crni žar (Dubak, Vizi, 2008)
2008	5-7	0		F	Pančeva oka
2009	14-15	8-late breeding		F	Crni žar

Table 2. Number of breeding pairs of Dalmatian Pelican (*Pelecanus crispus)* on the lake since 1894 with successfulness of breeding, type of disturbance and breeding location. (F – flooding, H – hunting, E – eggs collection, P – predators, G – town, T – tourism). **–** year when breeding is completely unsuccessful (Saveljić et al.2004))

As presented in Table 2, the breeding success of this bird in Skadar Lake is not at an appropriate level for a viable population. A pair of pelicans successfully breeds a nestling very rarely. The key reasons for failure are the flooding of eggs due to fluctuation of lake water level, tourism and disturbance by fishermen, illegal hunters, birdwatchers and ornithologists. This table shows that in only two years few pelican pairs had breeding success higher than one nestling, which is unacceptable. Therefore, strict management of their breeding is recommended and the installation of floating islets made of reed in order to eliminate factors that might have negative impacts on their breeding success, water fluctuation above all other factors (see Annex 5).

Pelicans nest in colonies on floating turf islets. Eggs are just above the lake water. Every fluctuation of the lake water and disturbance of 12 kg weight breeders, causes flooding or crashing the eggs, thus unsuccessful breeding.

The breeding colony of pelicans in Skadar Lake is the most westerly on the planet and one of the most endangered. Having in mind that this population breeds in Europe with some 2,000 pairs and global estimation is about 5,000 pairs (BirdLife International, 2004, Wetlands International, 2002), the protection of pelicans in the lake and creating better conditions for their breeding is seen as an imperative. This is primarily related to preventing disturbance of the colony by fishermen, tourists and also scientists and preventing lake water fluctuation. The surface of Panceva oka is 300 ha, making it too difficult to install rafts that would be accepted as breeding sites. In photos 9 and 14 we can see that Panceva oka and Mikri Prespa cannot be compared by size nor vegetation distribution on the lakes. Unlike the Pančevačka oka and Crni zar, where during the summer, the large number of small lakes inaccessible to rafts are being formed, pelicans on the Mikri Prespa are nesting beside the open water, on the easily reachable micro locality which allows building and placing the rafts *in situ*

In the hope of removing the negative impacts of water fluctuation, in 2001, the Centre for protection and research of birds of Montenegro placed two floating platforms for their breeding. If the rafts are accepted after 5 years, the project can be considered as successful. Unfortunately, on the Skadar Lake the pelicans were nesting close to rafts just one year, while in the following years chose to make colonies in the far more distant places, even in the neighboring reservation Crni Zar. Anchored rafts made of wood are movable only in the period of the highest water level, when all the vegetation in reservation is under the water (and when the weather conditions do not permit navigation on the lake). As the pelicans make colonies in range of 5 km in the lake (mostly because of the disturbance), this creates problems for setting up floating rafts with 24 m2 in size on the location beside the open water or at the small lake within the reservation and also to be easily accepted.

Unlike pelicans, the state of the breeding population of Pygmy Cormorant, *Phalacrocorax pygmeus,* is much better. This bird is classified as “secure” (S) in Europe, while globally it is near threatened (NT) (BirdLife International, 2004, Wetlands International, 2002),.

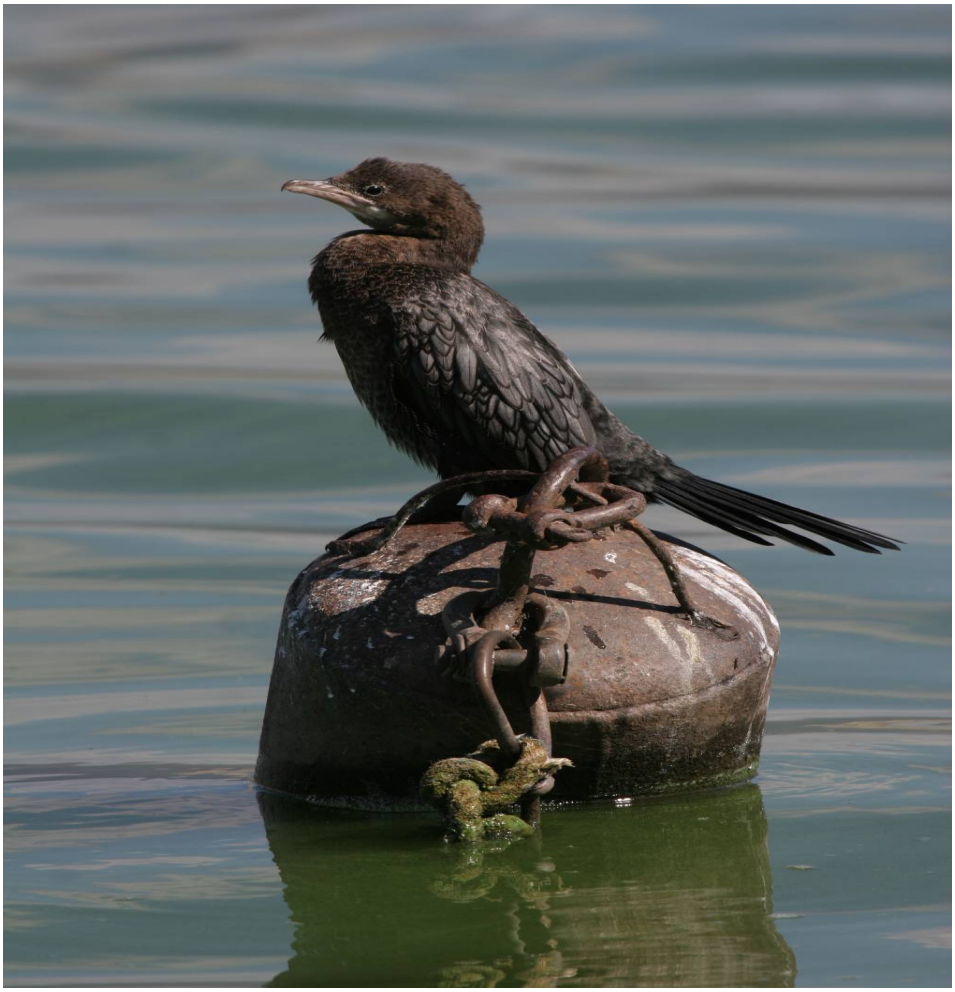


Figure 7. Pygmy Cormorant-*Phalacrocorax pygmeus* is one of the most important breeders of the lake. Photo: B. Rubinić

Pygmy Cormorant, *Phalacrocorax pygmeus* is the smallest European cormorant. It has limited range and breeds between Italy and the Caspian Lake. It is registered as nomadic in central Europe and other states of the Mediterranean. In 1990, the global population of this species was estimated at 21,965 to 27,285 pairs, out of which 2,500 pairs are registered in Mediterranean countries.

In most of the countries where this bird breeds, the population is stable or growing, in particular due to implementation of the Action Plan for protection of this species. The largest breeding populations are registered in Romania (max 14,000 pairs) (BirdLife International, 2004).

In Montenegro, Pygmy Cormorant breeds in three locations: Skadar Lake, Paratuk islet on Bojana River and on Ada Bojana peninsula.

On Skadar Lake, it breeds in mixed colonies with Great Cormorant, *Phalacrocorax carbo;* Little Egret, Grey Heron, Squacco Heron and Night-heron: *Ardeola ralloides, Ardea cinerea, Egreta garzetta, Nycticorax nycticorax,* and pelicans *Pelecanus crispus.* On the

lake, it breeds in Pančeva oka and Crni žar reserves and occasionally in Manastirska tapija reserve. In 2007, a small mixed colony with cormorants was discovered in Ckla.
The colony from Pančeva oka moves on average every third year to Crni žar and back. Most probably, the reasons are disturbance by tourists, setting fire to reeds in reserves and disturbance by fishermen.
Pygmy Cormorant breeds from the beginning of April until June. There are 4 eggs in a nest.
Nests are to be found in the trees of aider, *Alnus sp*. and willow, *Salix sp*., always on a level beyond or together with the colony of its relative Great Cormorant, *Phalacrocorax carbo.*
Water fluctuation can have impact on success of breeding if it is drastic, i.e. if it exceeds 30-40 cm in the period from March to June.
This bird eats only fish, mainly species less important from the economic aspect.

Ferruginous Duck *Aythya nyroca* has the status of vulnerable (VU) species in Europe, while globally its status is even worse near threatened (NT) (BirdLife International, 2004, Wetlands International, 2002),.

Figure 8. Ferruginous Duck (*Aythya nyroca)* suffered from hunting in Europe. Today it is one of the most threatened birds of the old continent. Photo:B. Rubinić.

Aythya nyroca nests in some 18,000 pairs in Europe. Its area spreads to Central and Eastern Europe, over Pakistan and India to Eastern China.
The global population of this bird does not exceed 120,000 pairs. The largest European population is situated in Danube delta in Romania with no more than 6,500 pairs.
Due to drastic declination of number and stability of populations, an action plan for this species was also prepared, as for pelicans and Pygmy Cormorant.
The number of breeding pairs of this bird on the lake is an estimation and does not exceed 50 pairs.
There is less data on ecology of breeding of this bird on Skadar Lake and their movements. It was less studied than other waterfowl.
Ferruginous duck breeds in vegetation of the northern part of the lake and is not strictly connected to already mentioned reserves.
Often, it suffered its belonging to families of other ducks on the lake.

Beside above listed species, significant colonies of herons: Little Egret, *Egretta garzetta; Grey Heron*, *Ardea cinerea* nest on the lake. Recently, two new species of herons, which are the new breeders of Montenegro, breed in lake reserves: Glossy Ibis, *Plegadis falcinelus* and Cattle Egret, *Bubulcus ibis*

2.6 Important breeding sites in the NP Skadar Lake

As already mentioned, Skadar Lake is one of the most important European and World breeding sites for certain bird species.
More than 600 pairs of Whiskered Tern *(Chlydonias hybridus)* make their nest on the lake (Saveljić, 2004). They make their nests on all surfaces of the lake characterised by floating vegetation. There are more than 20 colonies of this species on the lake. Based on research, conducted in 2008 on the Albanian and Montenegrin side, one could say that at least 1,600 pairs of this species breeds in the entire lake. This fact makes Skadar lake one of the most important European breeding sites.

Grmožur is an important resting place and breeding site, first of all for gulls and tern.

Omerova gorica is the most important breeding site for Grey Heron (*Ardea cinerea)* on the lake. This species nests on the laurel *Laurus nobilis.* Last years the colony has been mixed with colony of Little Egret, *Egretta garzetta.*

Golubovo Island is the biggest breeding site for Yellow-legged Gull (*Larus michahellis)*. Nests are in crevasse on the ground rocks, in scarce vegetation. The colony is mixes with couple of nests of the Common Tern *(Sterna hirundo).*

Ckla is breeding sites for cormorants.

Crni žar and Pančeva oka are the most important colonies for heron on the lake, as well as colonies for Pygmy Cormorant and Great Cormorant. Dalmatian Pelicans and Whiskered Tern are also nesting on both localities, and there are also the largest concentrations of nests of coot, moorhen, ferruginous duck and grebe.

Figure 7. Pančeva oka with winter water level, ornithological hart of the Skadar Lake. Photo: D. Saveljić.

Depending on the nesting ecology, it is important to point out the significant stratification of colonial breeding sites on Crni žar and Pančeva oka:

The first level is occupied by pelicans. Their nests are floating and near open water. Common coots, moorhens, grebes and terns are making floating nests directly on the water. On the lower willow tree levels little egret, Squacco Heron and Pygmy Cormorant are making their nests, while upper levels are left for Great Cormorant and Grey Heron.

The entire northern lake shore, which during the summer months gets overgrown, is a breeding site of other bird species, which are very interesting from a scientific point of view and in urgent need of protection. A dozen thousand coots breed in the reedbeds of northern shore.

2.7 Winter counting of birds on Skadar Lake – IWC

The winter counting of birds (The International Waterbird Census – IWC) has been conducted since 1967 under the supervision of *Wetlands International.* This counting is done in all water habitats worldwide.
Europe is the most efficient region in this activity and each year in mid January more than 10,000 ornithologists and volunteers – birdwatchers, take part in this activity. More than 15 million birds are counted during winter counting of birds in the wetlands of the old continent.
The counting is done according to certain scientific and standardised methods and the yearly results give an overview of the conditions of certain species and their population, as well as of the importance that specific wetlands have for different groups or bird species.
The results of IWC are sent to *Wetlands International (an international non-government* organisation). The organisation each three years publishes the "*Waterfowl Population Estimated"*, containing data on the condition of the population of 868 waterfowl species.

Results gathered through IWC are used for acquiring certain protection status in some wetlands:

- IBA – Important Bird Area, more than 5000 habitats in Europe
- RAMSAR – Wetlands of international importance, more than 1800 habitats on the planet
- SPA – Special protected area in European Union based on the Bird Directive

Winter census of birds on the Skadar Lake has been carried out since 1991 (Reports from IWC 1991-2009). The activity was initiated by the Institute for Nature Protection of Montenegro together with the Natural Museum of Belgrade. Later, when the Natural Museum of Montenegro was established, the activity was taken over by the museums in Podgorica and Belgrade, whereas now it is conducted by the National Park Skadar Lake.
Bird counters are professional ornithologists from Montenegro and Serbia, and IWC has been done by teams with at least 3 ornithologists, to make sure that data is collected accurately as much as possible. The counting is done with a small traditional canoe (čun) or with a bigger boat along the predefined path. If the weather conditions are good (no wind or rain) the counting on the Skadar Lake lasts continuously for 4 days. In case the counting is interrupted due to bad weather conditions the data are considered valid, since the flocks on the lake are quite steady and some of the species, especially *sp, Aythya sp.* and *Fulica atra* are linked to certain areas or zones of the lake water.
Practice has shown that big and important flocks on the lake are movable only if they are disturbed. As soon as the reason for disturbance stops, the flocks return to "their" waters.

Due to misunderstanding with the park administration regarding this activity, in 2005 counting was conducted by two teams: one from the museums in Podgorica and Belgrade together with the Institute for Nature Protection from Podgorica and the other team from Skadar Lake National Park together with the Institute for Nature Protection

from Serbia.
On 350 km ^{2} of the Skadar Lake two teams counted independently, along the predefined paths but on different days. The data they gathered confirmed the reliability of the method: the number of counted birds in two teams differed only in less than 2,000 birds, which confirmed the effectiveness of the counting method used for the IWC. Moreover, two teams counted the same number of species and birds in certain places (Reports from IWC, 2006).

The results of the census done in January 2009, as presented in Table 3, show that the number of birds in Montenegro, according to IWC, was one of the smallest since the census has been implemented. The decrease, compared to 2008, was about 60%. Approximately 49,000 birds were counted on Montenegrin side while in Albania, some 10,000 less birds were counted.

IWC on the Albanian part of the lake confirmed that large flocks, that used to stay on or near the border, have moved towards the Albanian shore today. All possible reasons of this kind of distribution of ornithofauna on the lake are at the level of speculations before the implementation of multidisciplinary research of the biodiversity of the entire lake, the water quality and quality of the lake benthos.

Year	Number of waterbirds
1991	150846
1992	178765
1993	222792
1994	160119
1995	207469
1996	192190
1997	164616
1998	244313
1999	250571
2000	96977
2001	No counts
2003	No counts
2004	85727
2005	35114
2006	32918
2007	107620
2008	148697
2009	49259

Table 3. IWC Skadar Lake 1991-2009. (Reports from IWC 1991-2009).

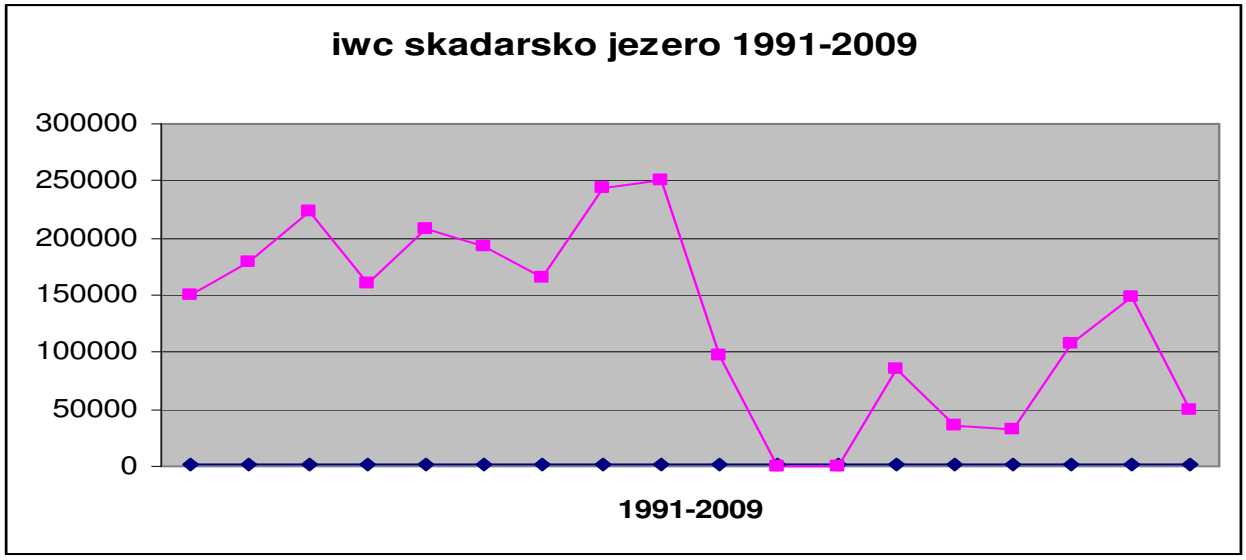


Figure 8. Waterbird counted in Skadar Lake from 1991 to 2009 / IWC programme.

IWC results clearly show the extreme importance of the Skadar Lake as a wintering site for birds; the fluctuation of number of birds indicates clearly that something is going on with the biodiversity of the lake which can be discovered only through multidisciplinary research of the national park.

The biggest number of wintering birds on the lake was counted in 1999: 250,571 birds. In relation to Ramsar criteria 3c, which set ≥20,000 of wintering birds as a criteria to be enlisted as wetland of international importance, it is almost 13 times more. The smallest number of birds visiting the lake was reported in 2006 when only 32,918 birds were counted.
Regardless of the drastic reduction of the number, especially compared to 1999, the Ramsar criteria 3c was not "broken-through". The disappointing counting result in that year did not reduce the importance of the lake as a wintering site.

On average, looking at the last 15 years IWC (without 2001/02/03), approximately 150,000 birds are wintering on the lake. That shows that the lake is one of the 5 most important birds' wintering sites in Europe.

Despite the large number of wintering birds almost thirty waterfowl species, the majority of which are wintering birds, belong to common coot, *Fulica atra*. In some of the years their number comprised 80% of the total counted number of birds.

Beside the total number of wintering birds exceeding the Ramsar criteria 3c (≥ 20,000 wintering birds), Skadar Lake takes more than 1% of global population of some species

of wintering birds for wintering. Species such as Black-necked Grebe, *Podiceps nigricollis*, exceeds 17 times the threshold set for declaring these waters as Ramsar site, i.e. water of international importance, first of all as birds' habitat.

The year 1999 has been taken as the most successful one over fifteen years of winter counting on the lake and the one casting light on the importance of Skadar Lake.

SPECIES	*IWC 1999*
Tachibaptus ruficollis	*1600*
Podiceps nigricollis	*14000*
Podiceps cristatus	*1750*
Pelecanus crispus	
Phalacrocorax carbo	*8600*
Phalacrocorax pygmeus	*2000*
Ardea cinerea	*60*
Egretta alba	*50*
Anas penelope	*30*
Anas srepera	*700*
Anas crecca	*1500*
Anas platyrhynchos	*15000*
Aythya ferina	*40000*
Aythya fuligula	*7500*
Busephala clangula	*800*
Fulica atra	*150000*
Gallinula chloropus	*100*
Larus chachinans	*950*
Larus ridibundus	*5000*
Gallinago gallinago	*100*
Circus aeruginosus	*25*
Alcedo atthis	*20*

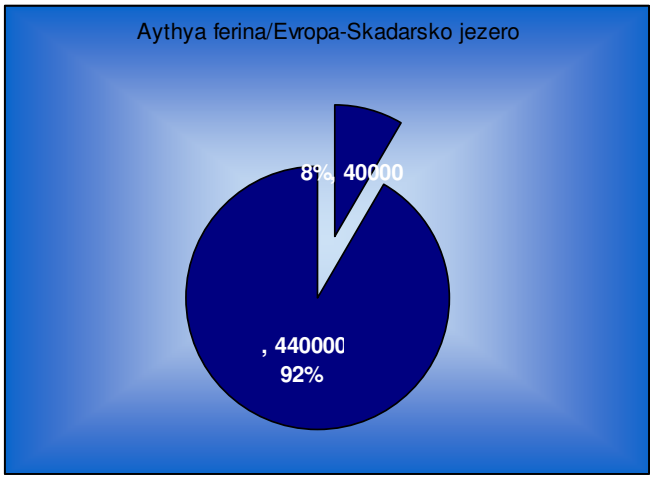
Table 4. IWC Skadar Lake 1999.

2.8 Share of individual species in bird population in 1999 compared to European wintering bird population

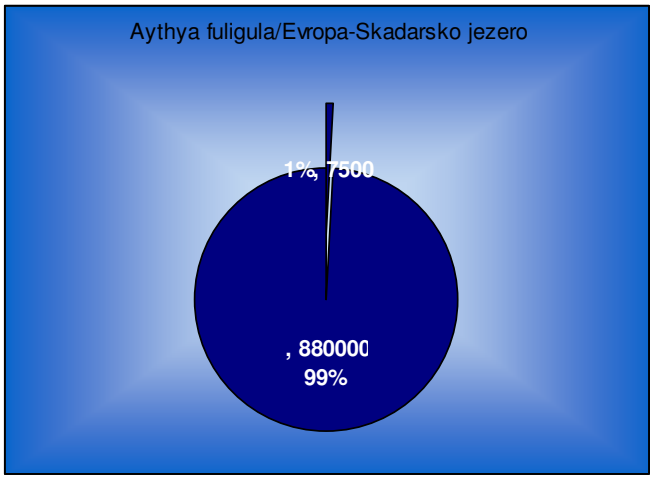
Black-necked Grebe*, Podiceps nigricollis*, 17% of the European population wintered on the lake in 1999.

Pygmy Cormorant, Phalacrocorax pygmeus, 3 % of European population wintered on the lake in 1999. The species is on the Red List of the globally endangered species of IUCN. Its share in 1998 was 5% of the European population.

Common Pochard*, Aythya ferina*, at least 8% of the European population wintered on the lake in 1999.



Tufted Duck*, Aythya fuligula*, at least 1% of the European population wintered on the lake in 1999.



Beside the ones aforementioned, it is important to point out the fact that also other species on the lake exceed threshold of 1% of European wintering population of White

Egret, *Egretta alba*; in 1995, 2.7% of European wintering population of Great Crested Grebe *Podiceps critatus;* in 1998, 4.1% of the European wintering population of Little Grebe, *Tachybaptus ruficollis.*

2.9 Migratory route over Skadar Lake and its international importance

With approximately 500 km ^{2} during autumn/winter/spring period, Skadar lake becomes one of the leading transition routes for migratory species of Siberia, Central and East Europe to and from Africa as well as one of the largest freshwater basins the birds use for resting and renewing of energy during migration.

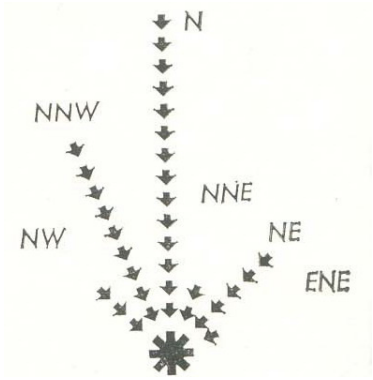
More than 1 million European and Asian birds passes over the lake during autumn and spring migration and during wintering.

Almost 90% of total ornithofauna of the lake belongs to mobile part of ornithofauna. And if they are not migrating they are considered as resident birds, however most of them has double citizenship. It is not a rare case, and it especially refers to pelicans and cormorants, that they make nests on the Montenegrin side (Crni žar, Pančeva oka) and feed in Albanian territorial waters.

The data show that Skadar Lake, during migrations and wintering, hosts minimum 10% of total East European and Central European population of certain species of water birds.

Forty findings of ringed birds from Skadar Lake, mainly killed by hunters or died in fishing nests point to their origin: most of the ringed birds come from Scandinavian countries, Central Europe and Pannonian Basin. Good part of them originates from Siberia.

Photo 10. Number of registered ringed birds caught on the Skadar Lake and corridors of their migrations from the ringing location (Vasić, 1980)



Ringed birds belong to group of grebe, cormorants, herons, gooses, ducks, moorhens, curlew and perching birds. Due to small number of findings and lack of ringing on the lake itself, it would not be serious to make any estimations of where do the greatest

flocks of certain species come from, but the fact is that one of the greatest migration corridors goes over the lake.

Mentioned facts clearly point to international obligations which Montenegro must fulfil by preserving population of those birds as well as of all ecosystems of the Skadar Lake National park.

2.10 Wintering of birds on the Skadar Lake

As already mentioned in chapter 2.7, Skadar Lake is one of the most important wintering birds' habitats in Europe.
At least 6 species of wintering birds exceeds threshold of 1% of European wintering population. Number goes up to 17%, as recorded on 1999 at Black-necked Grebe, *Podiceps nigricollis*.

Results of the winter counting of birds (since 1991, with an interruption in 2001/02/03) shows that on the lake water in the observed period at least 32,918 birds were wintering.
Official data from IWC are taken for interpretation of number of wintering birds. However, one should have in mind that IWC is only "the current" state in the observed period, usually during January.
Results of the observation for recent years point to the fact that often numbers on IWC do not reflect real condition of wintering population, having in mind the fact that period from December to beginning of February. i.e. the period when bird movements are the smallest, is considered as "ornithological" winter.
Divergence in number of certain species in the observed period can be significant and always in favour of larger number of birds.

Based on the previous research it can be concluded that on average the largest number of Common Pochard, *Aythya ferina* stays on the lake in February. The peak of number of Mallard, *Anas plathyrhynchos* is end of January and beginning of February; for Pygmy Cormorant, *Phalacrocorax pygmeus* it is end of December, beginning of January; for Common Black-headed Gull, *Larus ridibundus* it is end of February and beginning of March while number of Common Coot, *Fulica atra* is mainly unchanged during winter.

	Pygmy Cormorant	Ferruginous Duck	Dalmatian Pelican	Grey Heron	Common Pochard
	fendak	Crnka	pelikan	siva čaplja	glavoč
1991	5000	4	25	150	16000
1992	11000			300	19000
1993	3000	5		200	21000
1994	2500			100	55000
1995	3500			100	45000
1996	3000			100	30000
1997	2000	5		60	18000
1998	4950		20	50	35000
1999	2000	1		60	40000
2000	4000			150	17500
2001	-	-	-	-	-
2002	-	-	-	-	-
2003	-	-	-	-	-
2004	1500			200	18000
2005	1796		16	217	2450
2006	2050	2	6	110	2350
2007	423		13	78	1509
2008	921	62	8	146	18744
2009	231	-	11	20	2314

Table 5. Number of five most characteristic internationally important and indicatory wintering birds of the Skadar Lake National Park for the period 1991 – 2009.

Bird flocks on the Skadar Lake during wintering are quite fixed for certain parts of the lake and there is no special mixing between them. Weak mobility of flocks can be noticed at each winter visit. More drastic moving is caused by disturbance and flocks always return to their previous positions after the danger or disturbance is over.
Contrary to the nesting period when they are near vegetation, during winter flocks stay mainly on the open water. The position and density of the flock depends on disturbance, water level and wind strength. When wind is stronger, for example flocks of Common Coot *Fulica atra*, gather in very dense flocks which spread again after the wind stops.

The most dense flock of birds on the lake are registered in Pothum, all the way along the Albanian border (probably due to minimal disturbance), and along the islets between Petrova ponta and Beška, in aquatorium in front of Grmožur and in aquatorium below Lesendro/Gornje blato.

2.11 Ecological needs of some groups of birds on Skadar Lake

Depending on the ecology of a species, and based on the vegetation and water level, there are various ecological zones on the lake which host birds (Šoti, Vizi, 1978).
Those zones are divided into:

- Zone of permanent water/high-seas
- Zone of floating vegetation (water lilies)
- Zone of wetland with meadows of emerging vegetation (like reed)
- Zone of wetland with willow trees
- Zone with meadows dry in summer

Southern shores of the lake are steep and rocky and belong to the special **zone of macchia and rocky ground** gathering chordates and sometimes, during rest and hunt, halcyons, Cormorants, herons, gulls and woodcocks.

Zones of permanent water are inhabited by birds in the periods when they do not breed. All kinds of ducks *Anas sp., Aythya sp.,* gulls *Larus sp.*, and cormorants, *Phalacrocorax sp.* and all kinds of grebes and mergansers, *Podiceps sp., Mergus sp.* stay on the open waters out of breeding season and in winter. Common Coot, *Fulica atra* is also on the open waters but could be found in other zones too.

Zones of floating vegetation (as water lilies.) **and zones of vegetation with part in and the other part out of water** (emersive vegetation, such as reeds) are of great significance during breeding period of wetland birds. Majority of waterfowl breeders, except herons and cormorants, breed in those zones (see 2.6)

Zone of wetland with willow trees is situated along Morača on its estuary in the lake and along the northern shore of aquatorium. This zone is important as occasional breeding site of herons and cormorants (Manastirska tapija reserve, Bakine tigle) and overnight stay, mainly for cormorants.

Zones of flooding meadows are the most important feeding and residence area of herons and waders in migration and out of breeding season. In this zone, cormorants occasionally hunt too, while they are important gathering places for common coots and several kinds of ducks *Anas sp.* i *Aythya sp.* out of breeding period.
This is the key area for spawning of some fish species and breeding of amphibians in the lake. Having abundant food (fish, amphibians, shells and grass), the zone of flooding meadows has a key function in renewing the energy of birds tired of autumn and spring migration.
The largest flocks of Garganey, *Anas querquedula* occupy flooding meadows around Žabljak Crnojevića during spring migration wave.

The presence of birds in some zones is related to certain periods of the year: during the breeding time, mainly from February to July, birds are tied to shore areas and to the lake vegetation. Better conditions for breeding the nestling characterise those places: more food, peace and possible shelter in case of predators' attack.

Depending on the species, some of them are permanently connected to vegetation, as for example Common Moorhens, while some retreat towards the high-seas, as for example grebe.

The zonation is clearly visible in Skadar Lake, in particular in winter months. However, one should have in mind that birds are very mobile and that some birds use various habitats hence areas. They could feed in one area, rest on a second and sleep in a third one. Therefore, this division in zones has to be accepted conditionally and the fact that birds are not strictly connected to certain zones but can use various ones for their ecological needs should be kept in mind.

2.12 Impact of water level fluctuation to some birds of Skadar Lake

Several factors influence quantitative and qualitative state of the ornithofauna of Skadar lake. They could be divided into natural and anthropogenic.

Anthropogenic factors are mainly previous uncontrolled intensive hunting in the period from mid August to mid March, illegal hunting, fishing regardless protected zones on the lake, shipping and access of canoes and tourist boats to important resting, feeding or breeding areas, water pollution, exploitation of mineral resources, illegal and legal building on lake shores etc. Those factors have constant implications on the lake. In summary the most important impact among the anthropogenic factors is *disturbance* as a product of all human activities in the lake.

The most important natural factors are climate, trends of some species at a global level and water regime. The issue of food quantities in the lake is *a priori* excluded by multidisciplinary studies, due to the fact that Common Coot, *Fulica atra*, as an indicator species is vegetarian for which there is plenty of food in the lake. The population is stable in Europe and the number of Common Coot significantly varies from year to year.

Since more than 90% of ornithofauna of the lake is mobile (Vasić, 1983), climate has a strong impact on the state of wintering populations and time frames of arrival, passage and stay of birds at the lake.

A natural factor which has a negative impact, mostly referring to breeders, is the nest inundation in spring months. This negative impact is well know by experts in this sector and well documented in literature.

Figure 9. Water level fluctuation during a year significantly impacts on ecosystems and fauna of the lake, especially in breeding season. The photo shows natural scenario of "flood" of nest and fluctuations of water more that 1.5 m. Photo: D. Saveljić.

Pelicans breed on floating peat islets. Breeding starts already in February. Water fluctuation causes flooding of nests, eggs and nestlings and is a crucial factor in breeding success. The ecology of breeding of some waterfowl groups, beside pelicans, is connected to surface vegetation and lake water fluctuation and influences their breeding success (*Podiceps cristatus, Tachybaptus ruficollis, Anas plathyrhynchos, Aythya nyroca, Chlydonias hybridus, Fulica atra*). That is partially related to great cormorants and cormorants *Phalacrocorax carbo/pygmeus.*

2.13 Bird hunting within the borders of NP Skadar Lake

National parks, according to the current law on nature protection and the definition of International Union for conservation of nature (IUCN), are natural areas of land or sea, determined to protect ecological integrity of one or many ecosystems for current and future generations, to prevent inadequate utilization of natural resources or other damaging activities and to provide base for scientific, educational, recreational and

tourism potential, which all have to be compatible with environment and culture. Activities which do not endanger nature origins, landscape values are allowed in national parks. Also, tourism/catering and recreational activities having the role of visiting and sight seeing, agricultural and fishing in a traditional way are allowed. Any kind of bird hunting is forbidden.

According to IUCN categories, National Parks belong to the II category of management which support previously stated definition and role of national parks.

In the Law on National Parks, enacted in November 1991, hunting within National Parks is not mentioned at all, but the article 19 precisely stipulates that “in national parks, sanitary hunting of game” is allowed. However, going through the text, in article 36 is stated that park wardens have the right and duty to “check the catch and hunting and fishing tools and to verify if hunting, i.e. fishing is done in line with regulations”.

The lack of clarity of this law brought about many problems in managing hunting within national parks of Montenegro, thus in Skadar Lake National Park too.

Generally speaking, organization of hunting in Montenegro, beside existing local hunting associations and umbrella association – Hunting association of Montenegro, existing legislation (Law on hunting in Montenegro enacted in 1999, Resolution on protection of rare and endangered animal species, enacted in 2006) is not on a satisfactory level. This is confirmed by the state of big and small game in ecosystems of Montenegro; many species have all but disappreared.

An extremely long hunting season beginning on August 15 and ending on March 15, has created a lot of damage and loss to fowl and other, not-hunted bird species in Montenegro. At the end of summer, waterfowl shed and renew their feathers (mewing) and get ready for migration. In that period, they are not able to fly. In the same period, nestlings hatched in the respective year are still unable to fly and to avoid hunting bullets.

Skadar Lake is a landing runway during spring migration for all the birds that come to Europe via the Mediterranean and fly further to the north of continent or to Siberia. Many of them come in pairs from Africa. Hunting season which used to last until the middle of March has drastically impacted on the state of some species, due to the fact that if one bird from the parental pair was killed, the pair was not able to continue the species in the respective year.
Because of the damage which bird hunting can cause during the spring migration, in the EU a hunting ban is imposed from the middle of January (in many states even from 31 December). This fact is clearly underlined in the Second Environmental Review of the Economic Commission of the United States referring to Montenegro.

The Spatial plan of special purpose for Skadar Lake National Park, which is a planning document adopted by the Parliament of Montenegro in 2001, foresees a bird hunting ban in the zone of Skadar Lake National Park.

It seems that IWC results are a complex of negative impacts that have been registered on the lake for more than 20 years. With their cumulative effect, they drastically affected birds. Disturbance of birds by fishermen, hunters, illegal hunters, speedboats and tourist boats contributed to this state. Speculation about lack of food on the lake are not realistic because of the simple reason that the number of birds that eat plants (and by eutrophication – the plant area is becoming larger), is decreasing. Taking into consideration all the parameters, pollution of the lake water definitely becomes secondary reason, if presence of humans and their acting on the very lake is considered.

According to the official statistics, in 2001, the year when bird hunting officially became forbidden, Skadar Lake National Park earned 10,000 DEM (5, 128EUR) from local and 28,000 DEM (14, 358EUR) from international hunters (1 EUR = 1.95 DEM)
From the total income in 2001, Skadar Lake National Park earned 149,817 DEM (76, 829EUR) from hunting and fishing licenses, selling of confiscated hunting means, renting water surfaces and restaurants and incomes from other sources.
Income share from "hunting industry", if that could be considered as an industry at all, considering that only in one year artificial breeding and releasing of ducks in the hunting ground from the duck farm on Vitoja, was 25% or a quarter of total revenue.

Attempts of reactivation of hunting in the Park in 2005 failed because of a large public pressure and drastic decrease of number of wintering birds on the lake.

2.14 Activities in Skadar Lake National Park which impact on birds

According to current national and international legislation, national parks can collect income from tourism and recreation, i.e. exclusively on the base of sustainable and non-invasive utilization of resources.
Unlike previous years, when this Park was more oriented towards exploitation of natural resources, primarily fish and birds, newer Park policy is more oriented towards tourism and activities, which with necessary improvement – primarily adequate zoning of the lake – do not cause a threat to the bird population (catch/shooting).

That is why the year 2001, when 25% of financial income of Skadar Lake National Park was from bird hunting and last two years 2006/07 when the cashbox of Skadar Lake National Park was filled with the income from other tourism activities and exploitation of natural resources were taken for comparison.

Income source	***Amount in EUR***
Fishing licenses	23.076
Hunting licenses, local hunters	5.128
Hunting licenses, international	14.358
Selling of confiscated hunting means	2.051
Bleak catch/*Alburnus alburnus alborella*	15.384

Concessions	3.076
Renting of restaurants	10.256
Other incomes	3.495
TOTAL	**76.829 EUR**

Table 6. Income sources of Skadar Lake National Park in 2001 – including bird hunting (Source: Annual report of Skadar Lake National Park, 2002).

It is important to mention that National Parks in Montenegro are not financed from the state budget, therefore they are forced to self-finance. This fact significantly affected deterioration of the situation in National Parks, in particular during the crises of the 1990s. In order to provide salaries for the employees and functioning of parks, the administrations of National Parks were forced to allow exploitation of resources, sometimes illegal. Nature reserves were affected: Pančeva oka (oil transport), Mlinski potok (timber) etc.

Fishing licenses	***53.967,00***
Catchment of ukljeva	**18.448,00**
Gravel and sand exploitation "Bakine tigle i Ponari"	**83.500,00**
Visitors' tickets and fees for vessels	**13.164,00**
Fees according to the Program of temporary objects	**7.880,00**
Confiscated instruments, frogs catchment and others	**11.114,00**
I Own revenues	**188,073,00**
II Budget funds (personal incomes)	**59.298,00**
TOTAL	**247.371,00**

Table 7. Income sources of Skadar Lake National Park in 2005 – (Source: Annual report of Skadar Lake National Park, 2006).

Expenditures (costs for parks' activities, personal incomes, marketing etc.) 189,110.00 EUR
Total profit for 2005 is 58,261.00 EUR

The income from visitors' tickets collection was in the amount of 11,500 EUR. Division of this revenue according to types of tourists and income from bird watchers for 2005, was not made. Number of tourists who paid the entrance ticket was not mentioned in the Annual Work Report for 2005.

Fishing licenses
59.090,00
Catchment of A.alborella
26.800,00

Gravel and sand exploitation "Bakine tigle i Ponari"	**149.956,00**
Fees for vessels and temporary objects	**11.581,00**
Fees based on the Program and rent of business premises	**4.778,00**
Entrance tickets in the Park and Information Centre, souvenir shops and confiscated instruments	**28.315,00**
Other revenues	**24.642,00**
I Own revenues	**305.162,00**
I Budget funds	**38.805,00**
TOTAL	**343.967,00**

Table 8. Income sources of Skadar Lake National Park in 2006 (Source: Annual report of Skadar Lake National Park, 2007).

Expenditures (costs for parks' activities, personal incomes, marketing etc.) 227,560.00 EUR
Total profit for 2006 is 116,407.00 EUR

The total number of tourists that visited the lake on vessels in 2005 was 20,300. Total number of visitors of the Information Centre was not given in the Report but the revenue of 28,315.00 EUR together with confiscated instruments (used in illegal fishery) was recorded.

As it is shown, the administration of Skadar Lake National Park does not have special records of the structure of visitors. There is no information on number of tickets issued for specific groups of tourists such as bird watchers for example. There is no information on age structure of visitors (adults, students, pupils) nor on number of the tourists staying overnight on the lake shores.

In 2008, the amount for the entry ticket in the Skadar Lake National Park was determined at 4 EUR with the possibility of visiting Visitors' Centres in Vranjina and thematic centres in Rijeka Crnojevica and Murici.

Since 2000, the state regarding financing has significantly improved, primarily due to turning to tourism and sustainable use of resources.
Great interest of donors for the improvement of the state in Parks should be emphasised. This mainly refers to Skadar Lake which gathered all major world wide donors: World Bank, GTZ, Rockefeller Brothers Fund, GEF, WWF, UNDP, Euronatur and others.

In 2007, the lake was included in the national Biodiversity Research Program, mainly referring to bird fauna.

2.15 Legislation referring to protection of birds on Skadar Lake

- **Law on National Parks** („Official Gazette of Montenegro", no. 47/91)
- **Spatial Plan of special purpose for Skadar Lake National Park**(„Official Gazette of Montenegro", 46/01)
- **Law on nature protection** („Official Gazette of Montenegro", 2008)
- **Resolution on protection of objects of nature** ("Sl. list SRCG", no. 30/68)
- **Resolution of protection of rare, endemic and threatened animal and plant species** („Official Gazette of Montenegro", no. 30/06)
- **Law on environment** („Official Gazette of Montenegro", no. 12/96).
- **Decree on environmental impact assessment** 2006
- **Hunting law** („Official Gazette of Montenegro", 2008)
- **Law on forestry (**Official Gazette of Montenegro", no. 55/00)
- **Decree on protection from noise** („Official Gazette of Montenegro", no. 24/95, 42/00, 49/00).
- **Convention on biological diversity CBD**
- **Convention on protection of wild flora, fauna and their habitats, BERN Convention**
- **Conventions on international trade of threatened species of wild flora and fauna CITES**
- **Convention on wetland area of international importance RAMSAR**

3. BOJANA RIVER AND SKADAR LAKE

Bojana River is the main effluent of Skadar Lake. In its 44 km length towards the Adriatic Sea, Bojana receives water from Drim River and create the most important habitats on 800 km long Eastern coast of Adriatic.

Drim Rver that inflows Bojana few hundred of meters downstream from the lake, collects waters of Black and White Drim i.e. watershed area of part of Kosovo and Prespa and Ohrid Lake. Delta Bojana and Drim River is watershed for some 20% of overall water of Balkan Peninsula.

Albanian part of Bojana River, as integral part of Skadar Lake ecosystem, in November 2005 was declared as Ramsar site, together with Skadar Lake. This was the first time of official connecting of ecosystems of those areas which are indivisible by their characteristics and ecological impacts.

Delta Bojana complies with several Ramsar criteria. On Montenegrin side, it belongs to Emerald habitats of Bern Convention and IBA. Only in Ulcinj Salina, indivisible part of Bojana complex, 15 bird species which exceeds 1% threshold of world wide bird population are being registered.

Many species breeding on the lake in Bojana Delta find their peace in vagrancy and wintering. Almost 3% of overall northwestern population of threatened Dalmatian Pelican *Pelecanus crispus* visit Ulcinj Salina in post breeding period, between August and November because of low level of disturbance, size of habitat and good condition of feeding areas.

Bojana River has a strong impact on Skadar Lake. It is its only link with Mediterranean waters and the only corridor for migration of ichthyofauna.

Filling the Bojana River bed in 19th century significantly caused the increase of lake water level. Since this change occurred 150 years ago, the state of the Skadar Lake water surface as today could be taken as absolutely natural.
Every initiative for possible deepening of Bojana bed and lake water regulation would drastically affect flora, fauna and lake water quality. Flotage of Bojana would threaten the most important breeding sites of birds and permanently turn away dozens of dolphins *Trusciops truncatus* which go into Bojana up to 20km upper stream.

All activities on regulation of lake water are against national legislation and Ramsar Convention.

PART II

4. MORAČA CANYON AND SKADAR LAKE – FUTURE IN LIGHT OF NATIONAL AND INTERNATIONAL LEGISLATION, CONSTRUCTION OF DAMS ON MORAČA AND THEIR IMPACT ON BIRDS

4.1 Morača, potential IBA in Montenegro

There are about 9,600 bird species in the world. Among them, more than 1,100 are endangered. In the last 200 years, due to human activities, 74 species have already died out while many species are threatened by extinction.
Out of 526 bird species, so far registered in Europe, even 226 species or 43% do not have a bright future. Among them, 35 species are globally threatened and near extinction.
In Montenegro, around 380 species have been registered (approximately 4 % of the global bird diversity); more than 40% of them do not have satisfactory status. 297 species have been permanently protected since 2006.
Many endangered species will be preserved by preserving their habitats. That is also the best way to protect them. The world's authority for protection of birds and their habitats *BirdLife Inernational* tries to conserve birds' habitats through the implementation of a world-wide program for protection called Internationally Important Bird Areas – IBA. Montenegro has been part of the program since the beginning of its implementation in 1989.

Figure 10. Stone Curlew (*Burchinus oedicnemus)* nests in dry meadows of Morača river shore, it is one of the identification species for IBA. Photo: B. Rubinić.

In Montenegro, until 2007, 13 IBA areas were identified in accordance with strict international standards, that is approximately 10.6% of the total territory of the country (Saveljić et al., 2007). For the identification of IBA, the locations for which literature and recent scientific data were available were assessed. The surface under IBA in Slovenia is approximately 35%, in Croatia 30%. As Montenegro is highlighted in the region because of its geomorphologic features and climate diversity, it is expected that IBA covers the surface of minimum 30%.

The activities on extension of the IBA list in Montenegro are continuing; the areas for which data were not available are being researched. The result of this study is the list of species and their number in the canyon (Table1), which represents the basis for declaring Morača canyon a new IBA.

This canyon fulfils A1 and B2 IBA standards (see annex 2) due to 29 of 52 identification species registered for IBA Montenegro. Only on the basis of presence of globally endangered Pygmy Cormorant, *Phalacrocorax pygmeus* Platije canyon can be considered as GLOBALLY important area for birds, which expands the national interest for its protection.

If those standards are supplemented with the fact that 1,600 species of vascular flora exist in the area, that is almost half of total registered plant species in Montenegro (Bulić, 2008), with more than 60 endemics of Balkan and 85 permanently protected species by the Resolution of Nature Protection Institute, its is without any doubt that Platije canyon in its pristine form fulfils the standards of Natura 2000.

4.2 Morača canyon and nationally protected species

Intensive research of the canyon for the purpose of this study showed the presence of 112 protected bird species which is 37% of totally protected ornithofauna species in Montenegro. If this fact is supplemented with 85 permanently protected plant species and a number of representatives of *Chiroptera* order (bats), and other groups of plants, animals and fungi, this canyon deserves special attention of scientific public in the aim of its protection. Therefore, it was not surprising when the Draft Spatial Plan of Montenegro from 2006 recognised this area as potentially protected area with the status of monument of nature.

Research from 2008 in Morača canyon registered 115 bird species, while in the same year 88 bird species were registered in the Lovćen National Park (Saveljić, 2008). According to this, 61% of the total number of species seen in the Morača canyon is being registered in the Lovćen National Park.

Contrary to Morača canyon, Lovćen National Park does not fulfill the status of internationally important IBA.

According to the Resolution on protection of rare, endemic, and endangered species of plants, animals and fungi (Official Gazette of Montenegro 2006) and the Law on nature protection of Montenegro (Official Gazette of Montenegro 2008)**:** "Animal and plant species and their development forms, nests and hatches are forbidden to be removed from their habitats, to be damaged and destroyed, i.e. coursed, disturbed, caught or killed, and their habitats must not be damaged or destroyed".

4.3 Ornithofauna of Morača canyon, international conventions and directives

As already stated in part 1.2, according to intensive research in Morača canyon, excluding winter aspect, a total of 115 species were registered (Table1), (and additionally 15 more species in Mala rijeka and Mrtvica – and thus the possibility that they exist in Moraca canyon is almost certain). There were registered in the canyon 84 nesting breeders and 10 species of birds whose breeding was not confirmed, which is 42% of the total number of breeders in Montenegro (Puzović et al, 2004).
112 species registered in the canyon have a kind of national or international protection status: 32 species are listed in Annex I Bird Directive, 71 SPEC species EU, 23 Emerald species, 108 species listed in the Annexes of Bern Convention, 45 from Annexes of Bonn Convention, 14 species of CITES Convention and 7 species of AEWA Convention.

5. POTENTIAL IMPACT OF HYDRO-POWER PLANTS ON ORNITHOFAUNA OF MORAČA RIVER AND SKADAR LAKE

The construction of any energy source disturbs natural state of environment and, in case its impact is not carefully assessed, short-term and long-term consequences might be drastic. This does not refer only to non-renewable energy sources, that are not *eco friendly* but to each system for electricity production, either solar panels, windmills or hydro-power plants.

Because of the disruption of natural balance during the construction and eventual functioning, based on the most important EU acts related to nature protection (Habitat and Bird Directive), the obligation of environmental impact assessment is necessary during the installation of energy sources.

It was already mentioned (see 1.1) that no published data exist on the ornithofauna of Morača canyon before the elaboration of this study. In the meantime, two important doctoral theses were published in 2008 (Bulić, 2008, Dragićević, 2008) which presented numerous data on floristic values of Morača canyon (see 4.1).

Ornithological research realised during the course of one year and the published floristic findings made evident that this study had to focus not only on the potential impact of dams on Skadar lake but also on the potential impact on such an important biodiversity hotspot like Moraca canyon (as also recommended in the draft Montenegro spatial plan).

Designing measures for mitigation of negative impact of construction of dams on Morača on the Skadar Lake is unacceptable due to extraordinary high biological diversity values of the canyon – from both floristic and ornithological aspect. Morača canyon with its floristic and ornithological assets exceeds the significance of Lovćen mountain (declared a national park in 1952) in the number of species hence should be preserved as a unique natural asset of the country.
It was already mentioned that in Morača canyon, 115 bird species are being registered, while in national park Lovćen only 88. In Morača canyon approximately 1,600 plant species are being registered while in Lovćen the number is approximately 1,500 (S. Vuksanović, pers.com) (see graph.1).

5.1 Pelicans and dams on Morača river

The Dalmatian Pelican (*Pelecanus crispus*) is the most famous and charismatic bird of Skadar Lake National Park as well as the trademark of the park. It is one of the most endangered birds in Europe and its breeding in the lake has been reported since the first ornithological records were made. According to Birdlife it is a species classified as rare

(R) in the European continent, and vulnerable (VU) at a global scale (BirdLife International, 2000) (see chapter 2.5)
The breeding colony of pelicans on Skadar Lake is the most far western on the planet and one of the most endangered due to the very low population numbers and low reproductive success. The European breeding population accounts around 2,000 pairs and the global estimate accounts for about 5,000 pairs in total (BirdLife International, 2004, Wetlands International, 2002).

Unfortunately, every successful story on the protection of pelicans and increase of number of breeding pairs is linked to management, primarily the management of the wetland water level where they breed, and the management of the nests – by establishment of floating rafts. Two large colonies are in Romania (Danube Delta) and Greece (Mikri Prespa). A dramatic growth of number of pairs, especially in Mikri Prespa (see Annex 4) is exactly related to management. Construction of artificial islets for breeding, in order to prevent flooding of eggs, and limiting the access to colony in the breeding season lead to significant increase of number of breeding pairs. Thus, the colony on Mikri Prespa is the largest colony of this species. The growth of number of pairs and similar management is done on the Romanian side of Danube Delta.

It was already stated (see Table 2) that the main reason of bad result of breeding of Dalmatian Pelican on Skadar Lake is human disturbance and inundation of nests during the breeding season.

It is hard to predict the impact of construction of dams on Moraca River, because at the moment there is no public document that describes their operation, i.e. how the water will be managed. In other words it is not clear from the information released how the water will flow through Moraca river (the main inflow of Skadar Lake), how much water will be retained or released in which period of the year, and the resulting water regime during the pelican breeding season. In short it is unclear to what extent all those activities will influence the lake water level fluctuation. All these are unknowns that have to be solved when planning the dams management and operation.

At the moment the only possible management response for improving the state of the pelican colony is i) the active protection of the colony, disabling any kind of access to it (even ornithologists and bird watchers) until the beginning of July (building on the successful experience in Mikri Prespa); ii) preventing disturbance from illegal hunters/fishermen; iii) patrolling the lake with guards; and iv) building floating rafts that will prevent the negative impact of precipitation (hence flooding of nests) during the breeding season. More investigations on the impact of dams on Moraca on the water regime in the pelican breeding sites are needed.

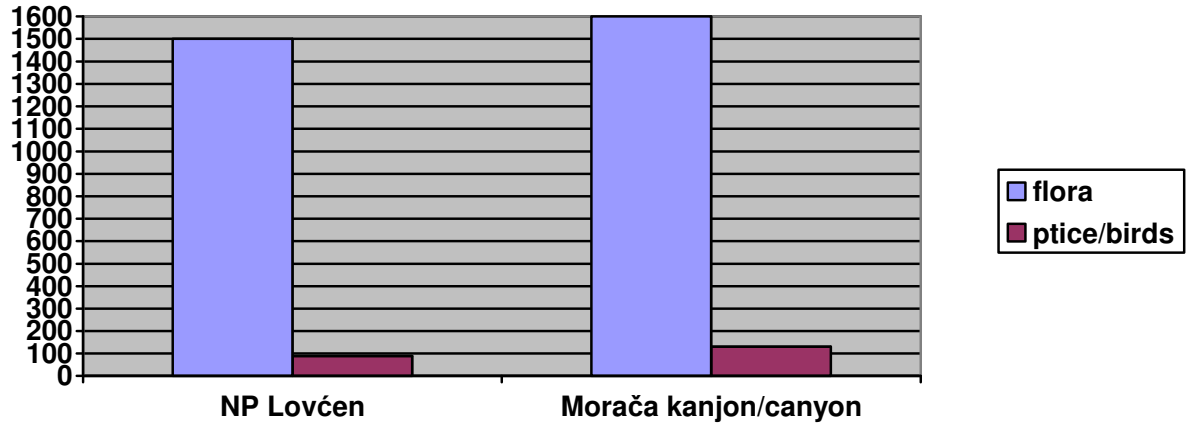


Table 11. Ratio of registered bird species and vascular flora in Lovčen National Park and Morača canyon.

Based on results obtained through the work of this study, and based on the floristic data published in 2008, the following findings are made:

- The canyon fulfills A1 standard of globally important bird area;
- 115 species were registered in Morača Canyon (Tab.1);
- 84 bird species have been recorded to breed in the canyon;
- For 10 bird species the breeding is not confirmed but potentially expected;
- 29 out of 52 species eligible for declaring an Important Bird Area of Montenegro are registered in the canyon
- 112 protected bird species or 42% of the total number of protected bird species in Montenegro are found in the canyon
- 32 species are listed in Annex I of the Bird Directive
- 71 species are Species of European Conservation Concern (SPEC) (see annex 1)
- 23 species are Emerald species
- 108 species are listed in Bern Convention
- 45 species are listed in Bonn Convention
- 14 species are listed in CITES Convention;
- 7 species are listed in the AEWA Convention;
- The canyon is habitat for app. 1600 species of vascular flora (which is half of the number of total number of registered species in the country);
- More than 60 Balkan endemic plant species;
- More than 85 permanently protected plant species;
- Mrtvica River canyon and Mala rijeka canyon (affluents in Morača canyon) are Emerald site, protected according to international standards.

6. CONCLUSION

The construction of dams in Morača would drastically impact on the condition of flora and fauna of the canyon upstream of the dams and have enormous consequences on the environment downstream.

The flooding of the canyon upstream would permanently cause the loss of habitats for resting, reproduction and feeding of birds and would drastically change the qualitative and quantitative state of ornithofauna in the canyon. First of all, the species breeding in the cliffs and feeding on river streams or pebble excavation locations would vanish. Then the species breeding on high rocks and hunting in the more open section of the canyon, such as eagles, hawks, owls, numerous songsters breeding in the river bed and in low vegetation or trees above the water, would also vanish.
An example of this type of impact and consequent destruction of plant and animal life is the nearby river canyon beside Piva river and Pivsko lake, where no birds can be found today due to loss of permanently flooded habitats.

The whole river course of Piva river was assessed for the identification of Emerald habitats in Montenegro (Emerald data base from 2008), but only the part downstream of the dam, which is today in pristine form, was declared as “Emerald European network”.

The question is how the change of micro climate and geomorphology, caused by the flooding of Morača, will influence two already declared Emerald habitats in Montenegro – Mrtvica river canyon and Mala rijeka canyon. The flooding of parts of these habitats due to the inundation of Morača itself is unknown. The loss of habitats and change of vegetation cover, due to change of climate, will impact on the composition of ornithofauna of these two canyons, already acknowledged as valuable by the Council of Europe as Emerald sites.

In the hydrological study for Moraca river and Skadar Lake carried out within the project Sharing Waters (Knežević, in prep.) it is explained that the construction of the Hydro Power Plant “Zlatica”, with a dam approximately 75 m high, will imply the creation of Bioče reservoir. From the information collected on the geomorphology of the area this reservoir is condemned to lose water due to its karst terrain and the several underground connections which are unlikely to be interrupted even with serious cement injection works. This fact would significantly impact the levels of surrounding underground water systems and potentially create new swamps, vegetation cover and alike, which would in turn result in changes to the ornithological-faunistic composition. In that case, it is hard to foresee the future condition downstream, without additional hydro-geological research.

The construction of HE Zlatica would permanently stop the inflow of pebbles through the Morača canyon which, in addition to the already existing pebble exploitation, would imply a significant change in the morphology of the waterbed. Zeta river,,the main tributary, does not bring any sand in fact. Beside the fact that the pebble islets, where *Charadriiformes* breed and nourish (*Charadrius alexandrinus*, Kentish Plover, the most important breeder of Morača banks, listed in Annex I of Bird Directive) would vanish, the

erosion of Morača river banks in the location of the inflow into the lake and the loss of the biggest breeding site of Sand Martin, *Riparia riparia,* in Montenegro located in Zabljacke meadows would take place. The level of erosion of the banks at the inflow into the lake and the number of flooded meadows that would be lost by flooding of Morača River are unimaginably high.

This study is based on field research of ornithofauna carried out in 2008 (without using literature data).

Based on the facts presented in Part II and summarised in Table8, it would be intolerable to accept the impacts caused by the construction of dams on Morača River in the river canyon and Skadar Lake. Such construction would, in fact, be in contradiction with the national legislation and international conventions that forbid the "destruction of protected wild species, disturbance, reduction in number of population of protected wild animal species, destruction or damaging of their habitats or changing of their living conditions", which would result from the construction of dams.

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ANNEX 1:

Annex 1: IBA criteria

European IBA Criteria
Twenty IBA criteria have been developed for the selection of IBAs in Europe. These allow the identification of IBAs, based on a site's **international** importance for:

- Threatened bird species
- Congregatory bird species
- Assemblages of restricted-range bird species
- Assemblages of biome-restricted bird species

Criteria have been developed such that, by applying different ('staggered') numerical thresholds, the international importance of a site for a species may be categorised at three distinct geographical levels:

- Global ('A' criteria)
- European ('B' criteria)
- European Union ('C' criteria)

A: Global

A1. Species of global conservation concern
The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.

A2. Restricted-range species
The site is known or thought to hold a significant component of the restricted-range species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area (SA).

A3. Biome-restricted species
The site is known or thought to hold a significant assemblage of the species whose breeding distributions are largely or wholly confined to one biome.

A4. Congregations

i. The site is known or thought to hold, on a regular basis, ≥ 1% of a biogeographic population of a congregatory waterbird species.
ii. The site is known or thought to hold, on a regular basis, ≥ 1% of the global population of a congregatory seabird or terrestrial species.
iii. The site is known or thought to hold, on a regular basis, ≥ 20,000 waterbirds or ≥ 10,000 pairs of seabird of one or more species.

iv. The site is known or thought to be a 'bottleneck' site where at least 20,000 storks (Ciconiidae), raptors (Accipitriformes and Falconiformes) or cranes (Gruidae) regularly pass during spring or autumn migration.

B: European

B1. Congregations

i. The site is known or thought to hold ≥ 1% of a flyway or other distinct population of a waterbird species.
ii. The site is known or thought to hold ≥ 1% of a distinct population of a seabird species.
iii. The site is known or thought to hold ≥ 1% of a flyway or other distinct population of other congregatory species.
iv. The site is a 'bottleneck' site where over 5,000 storks, or over 3,000 raptors or cranes regularly pass on spring or autumn migration.

B2. Species with an unfavourable conservation status in Europe
The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe (SPEC 2, 3) and for which the site-protection approach is thought to be appropriate.

B3. Species with a favourable conservation status in Europe
The site is one of the 'n' most important in the country for a species with a favourable conservation status in Europe but concentrated in Europe (SPEC 4) and for which the site-protection approach is thought to be appropriate.

ANNEX 2:

Standards for Important Bird Areas (IBA)in Montenegro

VRSTA LAT	SPEC	POP CG		POP EUR		0.5 % POP EUR		NO. IBA	KRIT
		min	max	min	max	min	max		
Pelecanus crispus	1	10	12	1600	2000				A1
Phalacrocorax pygmaeus	1	2000	2500	28000	39000				A1
Ixobrychus minutus	3	150	200	60000	120000	300	600		B2?
Ardeola ralloides	3	200	400	18000	27000	90	135	1-2	B2
Nycticorax nycticorax	3	150	250	63000	87000	315	435		B2?
Aythya nyroca	1	50	100	12000	18000				A1
Circaetus gallicus	3	5	8	8400	13000	42	65		B2?
Accipiter brevipes	2	20	30	3200	7700	16	39	2	B2
Buteo rufinus	3	15	20	8700	15000	44	75		B2?
Aquila chrysaetos	3	5	10	8400	11000	42	55		B2?
Hieraaetus fasciatus	3	2	5	920	1100	5	6		B2?
Falco tinnunculus	3	3400	4500	330000	500000	1650	2500	1-2	B2
Falco naumanni	1	0	2	25000	42000				A1?
Falco eleonorae	2	1	2	5900	6200				biom
Falco biarmicus	3	0	5	480	900	2	5		B2?
Crex crex	1	5	10	1300000					A1?
Porzana pusilla	3	5	10	760	3200	4	16	5-10	B2
Alectoris graeca	2	250	350	40000	70000	200	350	1	B2, biom
Charadrius alexandrinus	3	60	80	22000	35000	110	175		B2?
Glareola pratincola	3	50	70	10000	18000	50	90	1	B2
Sterna albifrons	3	70	80	35000	55000	175	275		B2?
Chlidonias hybrida	3	1500	2000	42000	87000	210	435	4-5	B2
Otus scops	2	500	800	210000	440000	1050	2200		B2?
Athene noctua	3	500	750	560000	1300000	2800	6500		B2?
Caprimulgus europaeus	2	250	400	470000	1000000	2350	5000		B2?
Picoides tridactylus	3	2	5	350000	1100000	1750	5500		B2?
Picus canus	3	130	175	180000	320000	900	1600		B2?
Jynx torquilla	3	300	450	580000	1300000	2900	6500		B2?
Upupa epops	3	10000	14000	890000	1700000	4450	8500	1-2	B2
Coracias garrulus	1	5	10	53000	110000				A1?

Merops apiaster	3	140	200	480000	1000000	2400	5000		B2?
Galerida cristata	3	50000	70000	3600000	7600000	18000	38000	2-3	B2
Lullula arborea	2	5000	7500	1300000	3300000	6500	16500		B2?
Prunella collaris	non-spec	150	250	100000	180000				biom
Oenanthe hispanica	2	500	1000	1400000	3300000				biom
Monticola saxatilis	3	300	400	100000	320000	500	1600		B2?
Monticola solitarius	3	200	500	120000	260000	600	1300		B2?
Hippolais olivetorum	non-spec	5	10	11000	23000				biom
Sylvia cantillans	non-spec	5000	10000	1400000	3200000				biom
Sylvia melanocephala	non-spec	2000	3000	3100000	8100000				biom
Sylvia hortensis	3	300	600	170000	480000	850	2400		B2?
Parus palustris	3	15000	25000	3000000	6000000	15000	30000	1	B2
Parus cristatus	2	1500	3000	6100000	12000000	30500	60000		B2?
Sitta neumayer	non-spec	400	600	2100000	6100000	10500	30500		
Tichodroma muraria	non-spec	20	25	38000	100000				biom
Lanius collurio	3	10000	20000	6300000	13000000	31500	65000		B2?
Lanius senator	2	80	100	480000	1200000	2400	6000		B2?, biom
Pyrrhocorax graculus	non-spec	1000	1500	130000	310000				biom
Passer domesticus	3	300000	600000	63000000	130000000	315000	650000	1	B2
Montifringilla nivalis	non-spec	35	60	520000	1600000				biom
Emberiza cia	3	1500	2000	1300000	4100000	6500	20500		B2?
Emberiza melanocephala	2	300	400	2800000	9300000				biom

ANNEX 3:

IUCN categories of protected areas

Category Ia
Strict Nature Reserve: Protected Area managed mainly for science.
Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
Category Ib
Wilderness Area: Protected Area managed mainly for wilderness protection.
Large area of unmodified or slightly modified land and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
Category II
National Park: Protected Area managed mainly for ecosystem conservation and recreation.
Natural area of land and/or sea, designated to
a. protect the ecological integrity of one or more ecosystems for this and future generations:
b. exclude exploitation or occupation inimical to the purposes of designation of the area: and
c. provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
Category III
Natural Monument: Protected Area managed for conservation of specific natural features.
Area containing one or more specific natural or natural/cultural feature which is of outstanding value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
Category IV
Habitat/Species Management Area: Protected Area managed mainly for conservation through management intervention.
Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.
Category V
Protected Landscape/Seascape: Protected Areas managed mainly for landscape/seascape conservation and recreation.

Area of land, with coast and seas as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, cultural and/or ecological value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
Category VI
Managed Resource Protected Areas: Protected Area managed mainly for the sustainable use of natural ecosystems.
Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

ANNEX 4

Mikri Prespa in Greece, successful story of pelican protection and a model for Skadar Lake

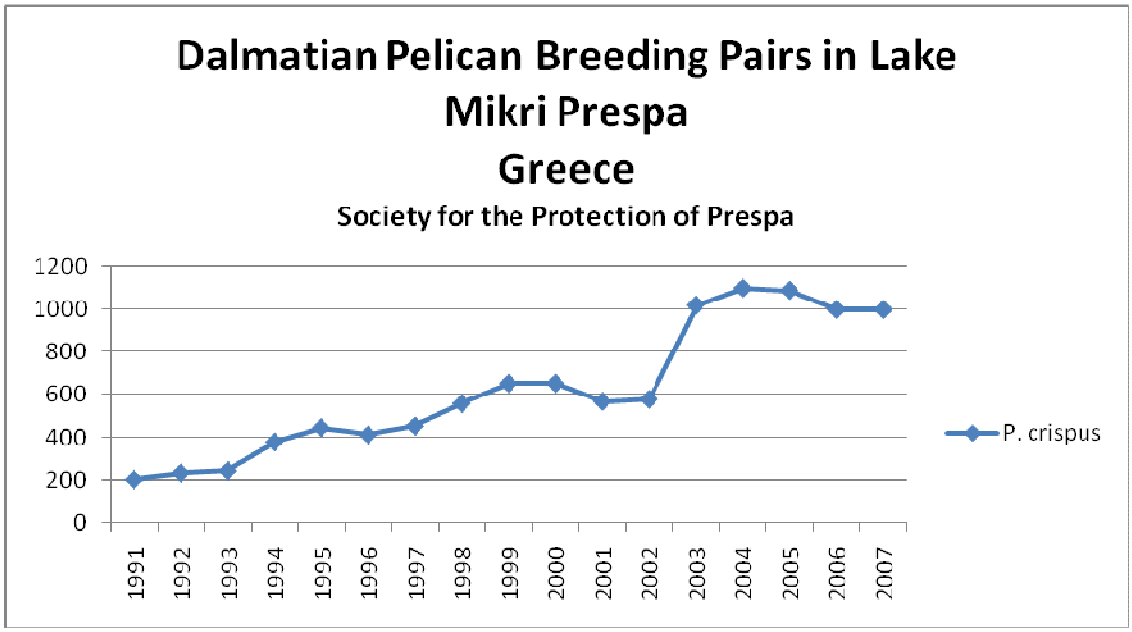
Mikri Prespa is located in Greece, at an altitude of 850 meters, with the surface of 54 km^2 and average depth 6.7m.
First data on pelicans' breeding in Mikri Prespa date from 1968 (Terrasse et all, 1969)
Before the active protection of this species started on the lake, main protection problems and successfulness of breeding of this species used to be disturbance, in particular by fishermen and visitors, variations of water level causing erosion and destroying natural islets for breeding. If the list would be supplemented with disturbance by hunters, one could say that we had rather similar starting position for protection of pelicans.

Figure 14 : The biggest colony of Dalmatian pelican in the word: Mikri Prespa, Greece. Photo: M. Malakou.

In 1990, 500-550 pairs of pelicans (two large colonies in Mikri Prespa and Amvrakikos Bay) bred in the whole Greece, (Crivelli et al, 2000). By active protection of pelicans on Mikri Prespa that included reduction of disturbance, strict restriction of access to the colony and zoning of the lake, especially for fishermen and visitors, colonies management and establishment of water level management, number of breeding pairs increased from a hundred pairs in 1988 to more than 1000 pairs in 2008. Mikri Prespa became the largest world colony of this species (see table). Impact of water level

variations is reduced to minimum by construction of platforms for breeding. As Pančeva oka and Crni žar cover the entire surface of Mikri Prespe, in that case is not possible to talk about construction of artificial breeding sites but it is better to tackle the cause which means regulation of water level variations.

Tab. Number of breeding pairs of Dalmatian Pelican, *Pelecanus crispus* on Mikri Prespa in the period 1991-2007



In order to prevent any kind of disturbance of the colony during the breeding period, Greek ornithologists ceased any entry in the colony until the beginning of July, which also contributed to significant successfulness of this species breeding.
This opportunity was used by White Pelicans, *Pelecanus onocrotalus* whose colony grew to more than 400 pairs.