

Monitoring the Ichthyofauna in nature park Kopački Rit (Croatia) in 2008

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1 Introduction

Nature Park "Kopački rit" is one of the largest natural areas for spawning and breeding of freshwater fishes in Europe. It is located in the south-eastern part of Baranya (45°15' – 45°53' N, 16°06' – 16°41' E), on the flooded area of two largest Croatian rivers, the Danube and the Drava, and is directly exposed to their water regime.

Biological productivity and ichthyofauna diversity of Kopački rit depends on the Danube River and its flooding. Water level oscillations caused by physical barriers, such as hydroelectric power plants, significantly affect the flooding of Kopački Rit. Also, the river course was often modified, curves were cut and the river bank is reinforced with stone in order to enable safer river navigation and transport. Migratory fish routes from the Danube to Kopački rit are limited during low water levels (below gauge +500 cm at Apatin measurement station), especially because many hydrological connections, channels (so-called "Foks") and side-arms ("Dunavci") are being narrowed and covered up with different materials (sand, gravel and wood). All this reduced the Danube flooding at lower water levels and disrupted migratory fish routes to Kopački rit.

As a part of the management program for Nature Park "Kopački rit" it was decided to carry out research for assessing the current status of ichthyofauna (Fulton condition index and ABC curve) as baseline for future monitoring. Based on the previous research and older literature (Aničić et al., 2000; Mrakovčić et al., 2006), area of Kopački rit inhabitates 37 to 44 freshwater species from 12 families.

2 Material and methods

The ichthyofauna was monitored at 8 sites (Figure 1) in June and October 2008, using fishing nets and electro-fishing gear. Fishing nets about 100 m long, with different mesh size (10, 12, 14, 16 and 18 cm²) were set in the afternoon (6-7 pm) and retrieved the next morning (6-7 am). Electro-fishing was done with boat-mounted electro-fisher (EL 65 II, manufacturer AGK kronawitter, 13 kW DC output, without pulse for 30 minutes) by sampling a 200 m long river bank area of Lake Sakadaš and Vemeljski Dunavac. Taxonomic identification of catch was carried out according to Vuković (1982). Fish length, weight and biomass were measured by standard technique (Murphy & Willis, 1996). The ratio of sexes in prussian carp (*Carassius gibelio*) was determined by a dissection of sexually mature individuals.

3 Results and discussion

The total catch of fish was 371 individuals, classified in 6 families and 12 species (Table 1). Total biomass was 468 kg. The most diverse family was Cyprinidae with 7 species. Prussian carp dominated in abundance (76%) and biomass (47%), followed by common carp (30%), and predatory fishes, such as pike and catfish (7% and

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9%, respectively). Beside fish, 3 individuals of crayfish *Astacus astacus* were recorded. The American crayfish (*Orconectes limosus*) was not found, although its occurrence in Kopački rit was confirmed in 2004 (Maguire & Gottstein-Matocec, 2004).

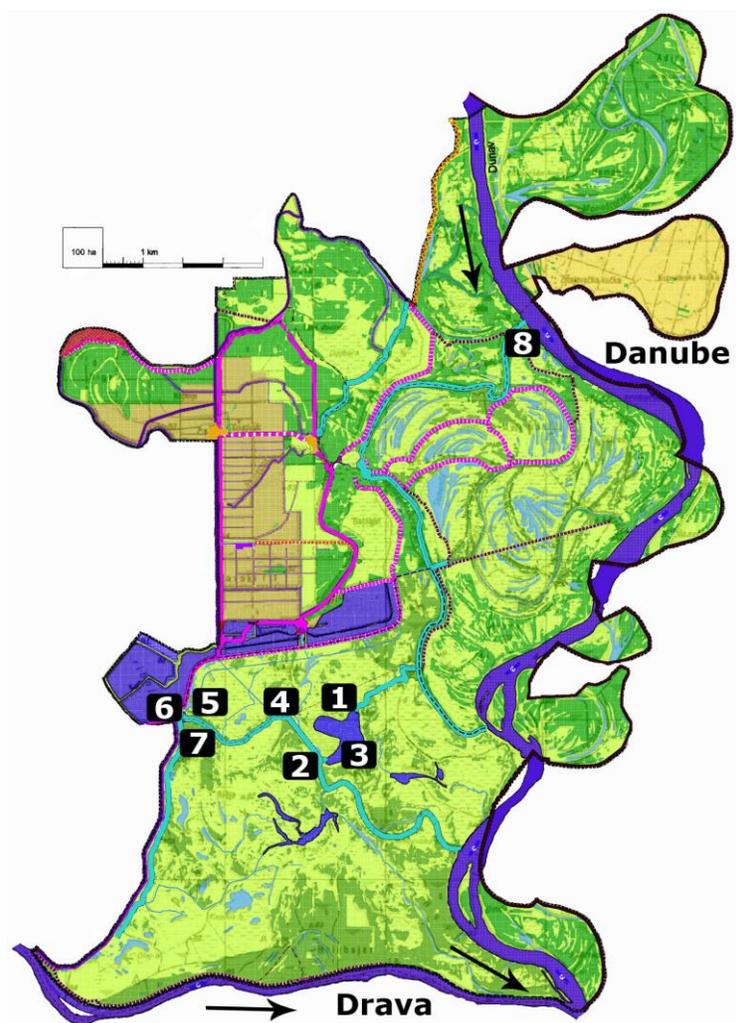


Figure 1. Map of Nature Park Kopački rit with marked sampling sites (1,3 Lake Kopačko; 2,4,7 Channel Čonakut; 5 Channel Novi; 6 Lake Sakadaš; 8 Vemeljski Dunavac)

Absence of fishes in size up to 20 cm and weight up to 300 g was noticeable in the catch, caused by direct impact of the predating Great Cormorant (*Phalacrocorax carbo sinensis*) colonies. Based on fish size and individual mass (Opačak et al. 2004), and size of cormorant throat, we can conclude that after certain time following the flooding, only very small fish or very large specimens remain in Nature Park Kopački rit. Neither group is of interest to cormorants, so most birds daily migrate to local fishponds and cause high damage to the commercial production. Cormorant nesting population in Kopački rit is estimated around 2000 to 2500 pairs. Population is far more than Kopački rit can support. Cormorant is protected species in Croatia, so there is no legal method for controlling the cormorant population, and there are no natural predators of cormorants.

Table 1. Qualitative and quantitative composition of the catch in Nature Park Kopački rit in 2008

Family / Species	Abundance		Biomass	
	pcs ²	%	kg	%
Cyprinidae				
Common carp (<i>Cyprinus carpio carpio</i>)	37	9.97	139.10	29.73
Ide (<i>Leuciscus idus</i>)	3	0.81	7.14	1.53
Asp (<i>Aspius aspius</i>)	3	0.81	7.30	1.56
Bleak (<i>Alburnus alburnus</i>)	10	2.70	0.10	0.02
White bream (<i>Blicca bjoerkna</i>)	6	1.62	1.00	0.21
Common bream (<i>Abramis brama</i>)	11	2.96	19.10	4.08
Prussian carp (<i>Carassius gibelio</i>)	281	75.74	217.90	46.58
Esocidae				
Northern pike (<i>Esox lucius</i>)	8	2.16	31.00	6.63
Siluridae				
Wels catfish (<i>Silurus glanis</i>)	8	2.16	44.26	9.46
Percidae				
European perch (<i>Perca fluviatilis</i>)	1	0.27	0.50	0.11
Lotidae				
Burbot (<i>Lota lota</i>)	1	0.27	0.30	0.06
Cotidae				
Bullhead (<i>Cottus gobio</i>)	2	0.53	0.10	0.02
TOTAL	371	100	467.8	100

In order to estimate stress-level on fishes, the ABC (Abundance Biomass Comparison) diagram (Figure 2) was made according to Clarke (1990). ABC curves have a theoretical background in classical evolutionary theory of r- and k-selection. In undisturbed states, the community is supposed to be dominated by k-selected species (slow-growing, large, late maturing), and the biomass curve lies above the abundance curve. With increasing disturbance, slow-growing species cannot cope, and the system is increasingly dominated by r-selected species (fast-growing, small, opportunistic), and the biomass curve will be below the abundance curve (Yemane *et al.* 2005).

² pcs - number of caught specimen

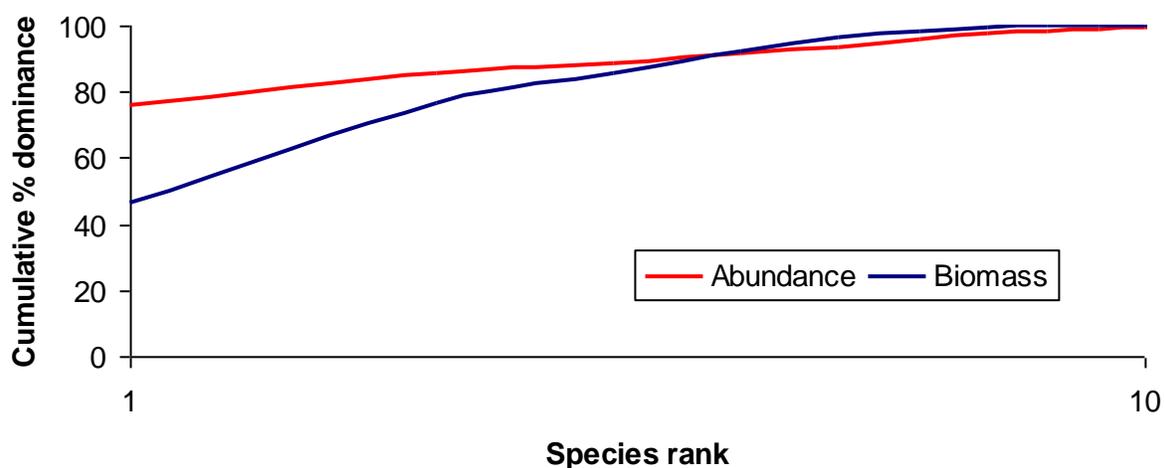


Figure 2. Abundance biomass comparison diagram

Our comparison between abundance and biomass indicated high disturbance (left part of Figure 2) to moderate disturbance (right part of Figure 2); hence, we conclude that fish communities in Nature Park Kopački rit are exposed to moderate stress. From data gathered during research, Fulton condition index (K_{TL}) is calculated according to Murphy & Willis (1996) for commercially important fish species (Table 2).

Table 2. Fulton condition index (K_{TL}) of the catch in Kopački rit 2008.

Species	Fulton condition index (K_{TL})		
	minimum	maximum	average \pm SD
Common carp (<i>Cyprinus carpio carpio</i>)	1.139	2.261	1.496 \pm 0.31
Prussian carp (<i>Carassius gibelio</i>)	1.094	2.500	1.466 \pm 0.34
White bream (<i>Blicca bjoerkna</i>)	1.736	1.924	1.875 \pm 0.28
Asp (<i>Aspius aspius</i>)	1.926	2.400	2.174 \pm 0.24
Wels catfish (<i>Silurus glanis</i>)	0.529	0.700	0.609 \pm 0.06
Northern pike (<i>Esox lucius</i>)	0.583	0.823	0.734 \pm 0.10
Common bream (<i>Abramis brama</i>)	1.600	2.344	1.951 \pm 0.37
Ide (<i>Leuciscus idus</i>)	0.888	1.435	1.211 \pm 0.29

Average condition index indicates satisfactory general condition of ichthyofauna within the Kopački rit, and it is similar to ichthyofauna in surrounding rivers. In prussian carp females dominated by 61 % (n=36) over males (39 %, n=23). Based on previous research, it is obvious that males were slightly increasing over the years, which is in accordance to adaptive capabilities of this allochthonous species.

4 Conclusion

Although we tried to avoid selectivity by using different fishing gears, number of species in the catch were below that recorded in literature. So, based on given results, further research and monitoring on ichthyofauna in Nature Park Kopački rit are suggested, in order to make timely measures for ensuring protection of habitat and endangered fish species. The existing hydrological connection between Kopački rit and the Danube is far from optimum for fish migration under low water levels in the Danube. Even at medium water level, during the spawning period of Cyprinidae (April - June), the flooding of Kopački rit by the Danube is missing. Thus, the spawning of migratory fish in Kopački rit is possible only in years with extremely high water level. Since high water levels in the Danube and the Drava are rare and short, the flooding area and water volume in the Nature Park are reduced. All that impairs fertilized fish eggs during the incubation and reduce survival chance for larvae and fingerlings. For the optimum function of the unique hydrological system of the Danube and the Drava under low water levels, maintenance and deepening of channels in Nature Park Kopački rit are needed. That will provide sustainability of Kopački rit and optimum conditions for growing and spawning, not only for fish, but also for other members of fauna in the Nature Park. Recreational fishing associations suggest management with cormorant population in a way that is already implemented for the brown bear (*Ursus arctos*), which is also under protection in Croatia. However, national scientific institutions do not have consensus on this issue, and the problem with cormorant population is still unresolved.

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