

Additional information

General ecological features

Surrounding alluvial forests in Pokupski Bazen represent one of the largest remained complexes of the Common oak (*Quercus robur*) in Croatia and in Europe. Apart from already mentioned habitat type occurring in Crna Mlaka site (*As. Leucoio-Fraxinetum angustifoliae* Glavač 1959), this wider area additionally supports following forest habitat types:

From the HD class of 91F0, the most of the oak forest complex is composed of:

- *As. Genisto elatae-Quercetum roboris* Ht. 1938 with characteristic species being the Common Oak (*Quercus robur*) and the Greenwood (*Genista elata*, syn. *G. tinctoria*)

More wet depressions of Pokupski Bazen contain European Alder forest of HD habitat type: *91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) - * indicates a priority habitat type for protection or EUNIS corresponding:

G1.21 Riverine [*Fraxinus*] - [*Alnus*] woodland, wet at high but not at low water

- *As. Frangulo-Alnetum glutinosae* Rauš 1968 with the Alder Bucktorn (*Frangula alnus*) and the European Alder (*Alnus glutinosa*)
 - *As. Carici brizoidis-Alnetum glutinosae* Ht. 1938 with the Alder Bucktorn (*Frangula alnus*) and the sedge *Carex brizoides*

On somewhat higher localities, mostly out of reach of floods, the forest of the Common Oak (*Quercus robur*) and the European Hornbeam *Carpinus betulus*) is developed, belonging to the HD class:

9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli

or EUNIS corresponding:

G1.A1 [*Quercus*] - [*Fraxinus*] - [*Carpinus betulus*] woodland on eutrophic and mesotrophic soils

- *As. Carpino betuli-Quercetum roboris* /Anić 1959/Rauš 1969

Physical features of the site

Crna Mlaka fishponds are situated in the middle of Pokupski Bazen that is the lowland alluvial area along the Kupa River. This central part of Pokupski Bazen is called Tectonic depression of Crna Mlaka (Vukelić et al., 2005) and represents the lowest part of the whole wider area (Zagreb County). Because of depression and the high underground water level, here is developed clay alluvial soil, highly dependent on water regimen.

Fishponds have been artificially made in 1905 after clearing the part of alluvial oak forest complex of Pokupski Bazen. A number of ponds have been dug in depression of Mala Mlaka, between watercourses of Okićnica on the west and Brebernica on the east. Several small watercourses supply fishponds with water. In the middle of fishponds their first owner has built a castle called “Ribograd” (“Fishtown”) in the style of Viennese Secession, which has been designated as national monument of cultural heritage. In this core area of Crna Mlaka there is a small settlement where traditionally the employees of fishery organization live with their families. Crna Mlaka is probably the most representative example of typical carp fishponds built in the alluvial oak forest in Croatia.

Continental Croatia with lowland forests has a moderate warm and rainy climate characterized by diversity of meteorological fluctuations and frequent and intensive changes of weather throughout the year. According to the Köppen classification system, the “*cfwbx* climatic type” is

represented here. Climate characteristics of this area are (Zagreb County, 2002): annual precipitations range from 800 – 900 mm and are relatively evenly distributed during the year; the least precipitation is in winter while the rainfall maximum is in spring (June), late summer (September) and autumn (October – November); the air temperature ranges between -3°C and +22 °C while the humidity is largest in winter (average of 87%) and the minimum is in summer (average of 74%); the winter is characterized by frequent fog and NE winds while warm and humid winds blow during the spring.

Hydrology of fishponds depends on several small watercourses: Okićnica – flowing from near-by hills of Samoborsko Gorje (Plešivica) and bordering the western part of fishponds; Brebernica – flowing from hills of Vukomeričke Gorice to the eastern part of fishponds, with its tributaries Lipovec and Botića. Additionally, the small river of Volavčica is flowing from SW. All these watercourses are entering the larger Kupčina River that flows into the canal Kupa - Kupa and finally into the Kupa River.

Generally, water in fishponds should be cca 1.5 m deep that is optimal for fish production. Anyway, during last years the problem of lack of water is constantly growing because watercourses that fishponds depend on have been captured and used for water supply of near-by settlements. On different ponds there are fluctuations of water level depending on fish production technology.

These fluctuations contribute to diversity of vegetation and species of the site. On ponds that are being emptied (usually for couple of months), amphibious vegetation develops. Migrating waders feed in fresh mud while herons, spoonbills, storks and other waterbirds use small ponds remained in depressions of emptied fishpond. Some ponds have well developed marsh vegetation (reedbeds, water vegetation, willows along the dams) that are also important breeding, feeding and hiding habitats for many species. Ponds that have been cleared from overgrowing vegetation, deepened and filled with the high water, become convenient for ducks, coots, grebes, geese, cormorants and other waterbirds. These are also hunting areas of the White-tailed Eagle that feeds on fish and waterbirds.

Water in ponds is mainly eutrophic due to fish production activities, especially fish feeding.

Physical features of the catchment area

Physical features of the catchment area are mostly the same as already mentioned for the Crna Mlaka site in Chapter 16. The area of Pokupski Bazen represents the most extensive depression along the Kupa River and collects a number of watercourses flowing from adjacent hills into the Kupa River or its tributaries. It was formed by tectonic movements and by alluvium material up to 10 m deep, which was drifted through time by water. The soil of such relief depressions is eugley, very heavy soil, saturated with water for the most part of the year. The forest composed mostly of the Common Oak (*Quercus robur*) and the Narrow-leaved Ash (*Fraxinus excelsior*) has developed in this depression, while the Black Alder (*Alnus glutinosa*) inhabits micro-depressions with staging water and high level of underground water.

Some climate related data of wider area is available from meteorological station in near-by town of Jastrebarsko, some 8 km straight line from Crna Mlaka fishponds. According to 10-year monitoring results, annual average humidity is 82% while monthly/annual precipitations in mm are as follows (Zagreb County, 2002):

Meteorological station	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	Annual	In veget. period
Jastrebarsko	60	62	68	59	77	110	75	83	87	86	87	48	900	489 (54%)

The area of Zagreb County is cloudy with average of 47 sunny days and 130 cloudy days. Annual average of insolation is 1,794 hours. Number of days with the strong wind ranges from 4-47 during the year.

Ecosystem Services

Hydrological values:

Hydrological values of wider area of Crna Mlaka (Pokupski Bazen) are connected to the catchment area of the Kupčina River (621 km²), a tributary of the Kupa River. Kupa makes the southern border of Pokupski Bazen ecological network site. A number of smaller watercourses are flowing from adjacent hills of Žumberak and Plešivica (NW of Pokupski Bazen) and Vukomeričke Gorice (NE of Pokupski Bazen) and entering Kupčina River. It flows into artificial canal of Kupa-Kupa that cuts through Pokupski Bazen and the Kupa River in its SE part. Watercourses coming from Samoborsko Gorje have been cut in early 1970's with the highway Zagreb-Karlovac (NW border of Pokupski Bazen), their water being collected into the canal along the highway and transferred into the Kupa- Kupa canal. For the purpose of fishpond water supply, a passage under the highway was left, allowing watercourses of Okićnica and Gonjava to reach fishponds directly.

Depressions in Pokupski Bazen are being flooded during abundant rainfall and the whole area has a significant **role in flood control as a natural retention**.

The fishponds have a primary **role of fish production** and they are using the water from nearby watercourses. Fish production is highly dependent on their water. As they are being more and more used for water supply of settlements and in the same time the climate in this part of Europe becomes dryer, the shortage of water supply becomes an ever-growing problem for fishponds and fish production.

The significant **ecological role** of fishponds is that they represent artificial wetlands extremely valuable for large number of wetland species and habitat types.

Scientific research:

Currently there are no facilities in Crna Mlaka for research purposes like field research station. Several bird-watching towers can be used for bird monitoring activities.

There are not many current research projects in Crna Mlaka. The only systematic work is done by the Croatian Ornithological Society since 2004, related to birds monitoring of the whole Pokupski Bazen that includes also annual monitoring in Crna Mlaka of breeding and post-breeding dispersal of the Ferruginous Duck (*Aythya nyroca*), breeding of the Whisked Tern (*Chlydonias hybridus*) as well as of breeding of the White-tailed Eagle (*Haliaeetus albicilla*) in Pokupski Bazen and using of fishponds for its feeding.

Current recreation and tourism:

Tourism and recreation on Crna Mlaka are poorly developed. In the lack of the management plan for ornithological reserve and financial support from county and state level, the initiative is left to the fishery firm “IHOR PARK Crna Mlaka”. Potential for such activities is very high, especially because Crna Mlaka is situated very close to Zagreb - the capital of Croatia as well as to the exit from the highway Zagreb – Karlovac. Currently the most visits to Crna Mlaka are paid by school excursions, ornithologists and anglers. Visits must be announced to the fishery firm because of EU veterinary sanitary regulations that are implemented here and request strict control of visitors on the entrance of fishpond area.

The situation regarding tourism and recreation could be improved with more promotion, investment in visitor’s facilities and effective control of visitors on the entrance of fishponds related to veterinary safety regulations.

Current land (including water) use:

The main land and water use in Crna Mlaka is connected to **fish production** on productive area of 520.69 ha. Previously the fishponds have been state-owned and run by the state company but in 1993 they have been privatized and the firm “IHOR PARK Crna Mlaka” was established. The firm has the concession for using the water of fishponds as well from watercourses Okićnica, Gonjeva, Lukavec and Brebernica for fish production. About 80% of fish production goes for the Common Carp (*Cyprinus carpio*) and the rest consists of the Grass Carp (*Ctenopharyngodon idella*), the Silver Carp (*Hipophthalmichthys moltrix*), the Wels Catfish (*Silurus glanis*), the Pike (*Esox lucius*), the Tench (*Tinca tinca*) and the Zander (*Stizostedion lucioperca*).

Production is extensive, ranging between 500 and 1000 t/ha per year. The fish is fed by natural food (grains) and not with pellets like in intensive production. The most of produced fish is exported to several European countries. Fish production faces a lot of problems. Besides economical ones, the most significant is the shortage of water because of regulation of watercourses that bring water into fishponds and their more intensive use for water supply of upstream settlements.

Tourism and recreation on Crna Mlaka are not well developed. In the lack of the management plan for ornithological reserve and financial support for such activities from county and state level, all initiative is still left to the fishery firm “IHOR PARK Crna Mlaka”.

Hunting is forbidden in the ornithological reserve. **Forestry** is not important on the level of Crna Mlaka because this site contains only one department of the state-owned forest that is protected as ornithological reserve and not commercially exploited.

Traditionally, employees in fish production have been living in the **settlement** of Crna Mlaka. From 134 inhabitants in 1961, now days only 30 are living there, 16 of them being employed in fish production (Croatian Bureau of Statistics, 2011).

Social and cultural values:

Crna Mlaka has socio-economic importance on local and national level because of its role of **fish production** (mostly the Common Carp *Cyprinus carpio*). It is one of 14 carp fishponds in Croatia with extensive or semi-intensive production that contribute to nature protection as man-made wetlands with all values and functions of similar natural wetland habitats. It has also significance **for tourism, recreation, education and scientific research**, although these activities are not developed at larger scale. **Cultural value** of Crna Mlaka is connected to the

castle "Ribograd" ("Fishtown") built by the first owner of fishponds Kornelius Zwilling at the beginning of 20th century. It is designed in the manner of Viennese Secession and protected as national cultural monument. Around the castle a very nice park was created, following the "British" style of horticultural parks. The castle and the park are situated in the middle of the fishpond area. They represent the core of the small settlement Crna Mlaka that occupies the area of cca 15 ha.

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