

## The Neretva Delta: Green Pearl of Coastal Croatia

The lower course of the Neretva river is a marshy valley. This bioecological complex is divided between two countries: the delta-shaped river mouth, with the lakes of Modro oko, Desne, and Kuti belongs to Croatia, while the Nature Park of Hutovo blato belongs to Bosnia and Herzegovina. In many ways, the Neretva delta is different from other parts of coastal Croatia. Its unique landscape is a result of digging and depositing of the marsh soil, so-called "jendečenje." Furthermore, Neretva is the only river in this region with a delta at its mouth. At the same time, it is also the area of the most intense man-made landscape transformation. In spite of the conversion of wilderness into tamed waters and arable land, the landscape around the Neretva delta has preserved its beauty and romance. The alluvial plains in the carst setting have become both the inspiration for artists and a topic of scientific research.

In the Pleistocene, the region around the present river mouth of Neretva looked significantly different. It was occupied by the then middle course of the Neretva river, the bed of which stretched along the today's peninsula of Pelješac. The river flew into the sea in the proximity of today's town of Vela Luka on the island of Korčula. With the end of the ice age, the sea level rose about 100 m, which resulted in shortening of the river and formation of a new mouth, situated approximately at the location of the present river mouth and in the proximity of three triangular widenings. These

widenings are not the result of erosive activity of the river, but of tectonic predisposition (1). From then on, the material eroded in the upper course of Neretva has been depositing there, thus forming the today's delta.

The unique landscape and the specific culture have made the Neretva delta an attraction for both Croatian and international tourists. However, this has not always been the case. In the eighteenth century, this region was beset by fever that grew particularly strong in autumn. The Padua professor and physician Giuseppe Pujati termed it neretljanska bolest (the Neretva disease) in his treatise *De morbo Naroniano* (On the Neretva disease) (2). For the fear of contagion with a disease of an unknown cause and treatment, sailors who accompanied Alberto Fortis on his voyage to Dalmatia at first refused to travel to this region. Pujati believed the disease to be a kind of plague, from which one could hardly be saved. He described it in the following way: "The water that stagnates at certain places becomes so pestiferous that it kills the fish that swims in it; marsh birds that live there in large numbers often fall down poisoned by lethal evaporations." It is debatable if these birds died from bird malaria. At the same time, Fortis' observation raised suspicion of the prevalence of human, mosquito-transmitted malaria in this area (2): "Each inhabitant of the region has a small tent as a protection from mosquitoes and related insects during sleep... A priest once told me that he suspected

the fevers troubling them were caused by insect bites, because after these insects had sucked the blood of fish, dead four-legged animals, or noxious herbs, they came to suck people's blood." It is known today that the Balkans once had Pannonic and Mediterranean malaria zones, and that the regions of Istria-Kvarner, Zadar, and Neretva were the foci of malaria in the coastal Croatia (3). Today the Neretva region, as well as other parts of Croatia, are free from this disease. It, however, continues to be widespread worldwide; according to 2002 estimates, there were half a billion cases of the lethal form of malaria in the world, which is 50% more than the estimates of the World Health Organization (4).

In the past, Neretva delta was not only well known because of malaria, but also because of the abundance and diversity of bird and fish fauna, as well as by the activities of hunting and fishing, partaken by almost all inhabitants of the region. Dense marshlands were overgrown with hydrophilic vegetation, which provided excellent conditions for fish spawning and bird nesting. This explains why this region was in the past a home to various species of herons, cormorants, ducks, and other water-birds, as well as colonies of the today regionally extinct species of Dalmatian pelicans, *Pelecanus crispus*. In that period, Neretva branched into 8 armlets near the town of Opuzen and made a wide delta; Opuzen itself was located on the island of Posrednica. Over the last 100 years, 310 bird species, out of which 115 were breeding birds, were registered in this region. Around 35 species are water-birds (5). The Central and Northeastern European bird populations used the delta for wintering. The shallows and shoals of the Neretva river mouth were of great importance for the migration of waders, terns, and gulls, and so were reed beds and water surfaces for the migration and wintering of geese and ducks.

Although the region of Neretva delta has always had an extraordinary biological and ecological importance, it is still relatively insufficiently

explored. This greatly hinders an accurate assessment and protection of this highly endangered region. It is particularly worrisome that the extensive melioration, which took place about thirty years ago with the financial support of the Food and Agriculture Organization (FAO), was conducted in the absence of any biological-ecological studies. As a result, a significant proportion of the area has been completely transformed from wetland into agricultural land. At the same time, the protection of nature was not taken into account.

The most significant transformation of the delta took place in the recent decades with the intense and long-term melioration, the purpose of which was to create agricultural land and to protect the region from floods. A significant assault on the marshes was the drainage of Modrič lake and the entire lagoon. A large part of the wetland was thus lost for migrating birds and spawning fish. The further expansion of the port and settlement of Ploče, building of holiday homes, industry, and the pollution of water from Mostar and other sources, still endangers marshy valleys of the Neretva river.

An important problem in this region is bird hunting, which is a part of traditional culture and customs. Čukanje, a specific method of hunting the coot (*Fulica atra*), resulted in almost complete extinction of this species of bird. There is also illegal hunting of other species of wild birds. In addition to the loss of fauna component of the wetland ecosystem, hunting is also accompanied by emission of various pollutants into the ground and water. This aggravates the life quality of the human population and has a negative effect on the flora and fauna. The current state of bird fauna in the Neretva valley requires a thorough assessment and a change of the entire bird-wetland-humans relationship.

It is a contradiction of the Neretva delta that this region, although highly endangered, is a home to many protected "objects of nature." Protected areas occupy the surface of 1624 hect-

ares (13% of the entire region) and are grouped into five protection categories: ornithological and ichthyological-ornithological reserves, "Horticultural Monument-Tree," Significant Landscape, and Park Forest. The ornithological reserves Orepek (100 hectares), Podgrede (587 hectares), and Prud (250 hectares) are the remnants of the Mediterranean wetland crucial for the bird migration and wintering. The southeastern part of the Neretva delta is an ichthyological-ornithological reserve (250 hectares) where fish spawn and birds arrive in the periods of migration and wintering, with some of them breeding there. In Metković, cypress (*Cupressus sempervirens* var. *pyramidalis*) is protected as a "Horticultural Monument – Tree." Modro oko and the lake Desne (370 hectares) are protected within the "Significant Landscape" category, because of their features characteristic of the lower course of Neretva. These include alluvial carst depression with an abundance of water and wetland biotopes. Predolac – Šibanica (67 hectares) is the protected area east of Metković in the Park Forest category, which includes aleppo pine and Mediterranean cypress with macchia elements.

The list of specially protected objects of nature, composed in 1991 by the Ministry of Environment, does not mention the protected regions of the municipality of Ploče. These are Parila (410 hectares), Baćinska lakes (286 hectares), and part of the region around Modro oko (145 hectares). Furthermore, the list does not include the area of the lake Kuti (ornithological reserve, 490 hectares), because of the lack of agreement between conservationists and the local businesses. The Kuti area combines wetland, lakes, and carst landscape, and is abundant with marshland vegetation and freshwater fish, in particular eel. Numerous strong streams supply the area with water.

Today, the region of the Neretva delta is subjected to agricultural exploitation, but the draining of wetland is less intense. The deserted agri-

cultural areas, by some perceived as neglected, have reverted to the old natural state and immediately started to attract birds and fish. The rest of the area is cultivated land in the square form, sown with modern commercial crops. Agrarian cultures between the marshlands give the area a green visual identity and make it different from the rest of the coast. This is why the Neretva delta is called the green pearl of the southern Croatian coast.

In spite of the large-scale disturbance of birds, as well as the destruction and degradation of wetland in the past and today (6), the delta of Neretva still presents a biologically valuable area. There is a diversity of landscapes and wetlands, such as streams, rivers, lakes, marshes, and numerous springs. There are both natural and man-made biotopes: meadows, agriculture land, numerous channels (jendeci), dams, and settlements connected by roads. There are proposals to include the Neretva delta and its population into a future Nature Park to protect it from further devastation. The protection of natural resources should be combined with the needs of further development and it should take into account regional traditions.

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