

6. The Shkodra wetlands

Summary

The wetland complex of Velipoja, Buna / Bojana and Shkodra / Skadar Lake (Fig. 6-3) forms an integrated and functional unit with a transitional character in the broadest sense. The complex covering a surface of about 187 km² combines a unique range of habitats, communities and landscapes. They consist of the transitional habitats of the Velipoja wetlands and the Buna Delta (24 km²) (Fig. 6-1), the Buna River (26 km²) with the related freshwater ecosystems along it (7 km²), as well as Shkodra Lake (about 166 km²) (Fig. 6-2).

Nature in the Velipoja Reserve, the wetlands along the Buna River and the Shkodra lakeshores, was well protected in earlier times, mainly by the fact that it was close to the strictly controlled political border with Montenegro. Today, the Albanian part of Shkodra Lake and of the Velipoja wetlands hold the protection state of a Managed Natural Reserve (IUCN Category IV), as declared by the Government in 2005 (Fig. 6-17).

In 2006, the authorities of the Ramsar Convention added also the Albanian part of Lake Shkodra with the River Buna and the Velipoja Reserve (surface of 496 km²) to the Ramsar list.



Figure 6-1: Aerial view of the Buna / Bojana delta with the Ada and the Franc Jozeph islands (Photo: L. Kashta).

The Montenegrin part of the Skadar/Shkodra Lake is also protected as National Park since 1983 (area 400 km², Category II) and was accepted in 1995 in the Ramsar list.

6.1. How to reach the area

Shkodra town is a good starting point for visiting the Velipoja region located about 28 km away (Fig. 6-3). Shkodra is about 110 km far from Tirana) and Kopliku is about 20 km from Shkodra. Podgorica airport is about 60 km far from Shkodra. For more information on how to get to Shkodra town see Chapter 1 (Fig. 1-1).

6.2. Information about the most important sites

Shkodra town is one of the most ancient towns of Albania. It was the capital of the Illyrian state Ardians (3rd century BC) and houses many cultural and historical objects (Figs. 6-4 and 6-5), like the monuments and buildings of the Isa Buletini house and the democracy heroes.



Figure 6-2: Shkodra Basin with the lake, the town and the Albanian Alps from Taraboshi mountain (Photo: L. Kashta).



Figure 6-3: Satellite map of the Velipoja-Buna-Shkodra complex wetlands. The main inhabited centers, habitats and roads (red) are shown on the map. Also shown are the political borders (orange) and the river (blue) (Google Earth, 2008, modified).

It is also worth to visit the Catholic Cathedral (built in 1898), the Franciscan church (from 1567), the Lady of Shkodra church and the new mosque of El Zamili, the biggest mosque in Albania. All these sites are located close to the main center of Shkodra. Shkodra offers many facilities for accommodation and boarding (Figs. 6-7 and 6-8). Shkodra is also a good starting place to visit other attractive regions around. South of Shkodra the Rozafa castle attracts the visitors (Fig. 6-4). After the legend, Rozafa, the wife of the youngest of three brothers has been buried alive in the walls of the castle. From the top we enjoy an overwhelming view on the rivers Drini and Buna, meeting each other, and on the Shkodra lake (Fig. 6-6).



Figure 6-4: 1: The Rozafa castle, built in the 14th century on an Illyrian basement of the 2nd century BC; 2: Buna river and the Rozafa castle; 3: Shkodra lake and the Buna river (Photos: S. Beqiraj and A. Miho).



Figure 6-5: 1: The former house of Oso Kuka, a national hero (1810-1861), now the Historical Museum of Shkodra; 2: the Mesi Bridge (*Ura e Mesit*; 1768), located 6 km from Shkodra; 3 and 4: the Catholic cathedral (1898) (internal and external views) (Photos: A. Miho and J. Marka)



The lakeshore and Buna River (Figs. 6-4, 6-45; see also Fig. 3-4) incorporate rich and peculiar aquatic habitats. The Northern shores of the lake towards Kopliku and Hani i Hotit offer spots of wetlands and alluvial forests in the Dobraçi, Buze Uji and Kamica wetlands, while in the Kosani and Shegani villages unique wells (“spring eyes”) exist close to the lake (Fig. 6-17); the most famous is Shegani Eye (*Syri i Sheganit*). The Mesi Bridge (*Ura e Mesit*, 1768) is located 6 km north of Shkodra (Figs. 6-5).



Figure 6-6: 1: Junction of Drini and Buna, viewed from the Rozafa castle; 2: Drini meanders before joining Buna; the Lead mosque is seen on the bottom left corner (Photos: A. Miho).



Figure 6-7: Life and people in the Shkodra area:
above: traditional bakery oven; **left:** traditional carpet maker; **below:** fishermen at Shkodra lake
(Photos: S. Beqiraj and D. Bejko).



Figure 6-8: Life and people in the Shkodra area: tasting a fish 'tave' in Shiroka restaurants is a long lasting experience (Photo: A. Miho).



The Velipoja complex consists of Viluni lagoon, Velipoja Managed Reserve, Franz Josef promontory \ island and Buna delta. The freshwater marshes of Domni (Fig. 6-9) and Murteme extend along the road to Velipoja. Velipoja is also a touristic center with a wide range of accommodation, both to visit the natural values of the region but also as a relaxing place especially during summer.



Figure 6-9: The Domni freshwater marshes (Photo: A. Miho).

Shkodra is also a good starting place to visit the Albanian Alps (Fig. 6-11), outstanding by their natural and biodiversity values and perhaps among the most interesting alpine sites in the Balkan.



Figure 6-10: Life and people in the Shkodra area: **1:** Practice in agriculture; **2:** schoolboys; **3:** herd of goats in Hoti, Kopliku (Photos: S. Beqiraj, L. Shukaj and A. Miho).



Thethi valley with Thethi National Park and Cemi valley in the Vermoshi region are situated about 70 km from Shkodra. Valbona valley (Bajram Curri) (see Fig. 2-3) is about 90 km far from Shkodra and bears the famous cascade of Drini river with three big dams and reservoirs (see Figs. 5-1 and 3-8). The alpine region, named Highland, is attractive for its nature and beautiful landscape, as well as for its specific socio-cultural traditions (Figs. 6-11).



Figure 6-11: 1 and 2: The Cemi valley, Vermoshi; 3: Albanian Alps in Thethi NP, Shkodra (Photos: L. Shuka and A. Miho).

6.3. Physico-geographical characteristics

Geographically, the complex of Velipoja – Buna - Shkodra is part of the Nenshkodra lowland and the most important wetland complex in the Northern Albanian coastal lowland (see Figs. 2-1 and 6-3). About 180'000 inhabitants live in the area. The northern part of the Shkodra lake belongs mostly to Malesi e Madhe district (the Big Highland) with its centre Kopliku which has roughly 14'000 inhabitants, the southern part belongs to the Shkodra district with some 120'000 inhabitants. About 12 villages are located around the lake with about 11'000 inhabitants and 22 villages are spread along the Buna river and in the Velipoja zone (Fig. 6-12) with estimated 17'000 inhabitants.

The main activities of the population are agriculture with food crops, vegetables and fruits, livestock with cattle, sheep, goats, pigs and horses, fishing in Shkodra lake, Buna river and Velipoja lagoons, and tourism at Velipoja beach (see Fig. 4-2), Shkodra lake, Buna river and Shkodra town .

The geology of the region is dominated by carbonates and terrigenous formations. Mainly Cretaceous limestone form hills and mountains which surround the Velipoja plain, like the Kakarriqi (98 m a.s.l.), Rrenci (561 m a.s.l.), Kolaj, Gjymti, Suka and Reçi. Some low hills like Berdice, Bushati, Barbullushi and Pistull-Dajçi are composed of Flysh.



Figure 6-12: Wooden bridge over the Viluni, connecting Baks Rrjollli with Velipoja (Photo: A. Miho).

Alluvial-proluvial depositions and marshes have been formed during the Quaternary period, most of them as the result of the accumulation of solids by the rivers Drini, Buna and Gjadri. Hence, the plains of Velipoja, Kakarriqi and Zadrima are chiefly marshy deposits with a depth of 2 to 2.5 m. The zone is tectonically unstable due to the complex geology with detached and folded stratifications.

The main plains extend along the Buna riverbanks; they are at low altitude, filled with molasses and show a slight decline towards the sea. The Anamali plain is situated between the right flank of River Buna and the southern foot of the Taraboshi mountain, while the Trushi plain extends on the left side of the river to NW of the Rrenci-Kakarriqi hills. The Velipoja plain is one of the largest; it extends between the Buna River and the Rrenci - Gjymti hilly chain. The plain is less than 10 m in altitude. Some parts are even below sea level. Due to the low altitude and the repeated flooding by the Buna river, before 1980 Velipoja ranked among the largest marshy regions of Albania with a surface area of more than 20 km² and with Pentari, Belaj, Domni and Murteme (6.5 km²) as the main marshes (Figs. 6-3, 6-16 and 6-17). Between 1947 and 1980 about 36 km² of agricultural lands have been reclaimed or ameliorated from the marshy jungle, compared to only 2 km² farm land that existed before.

Kakarriqi or Torrovica plain with a surface of about 24 km² is another marshy plain; it is situated between Kakarriqi and Rrenci mountains. It is a graben-like depression and coincides with the former bed of the River Drini. As its altitude is less than 10 m, the plain was earlier a permanent marshland, maintained by the flooding of the rivers Drini and Buna. The plain was fully reclaimed and transformed into agricultural land between 1967 and 1973.



Figure 6-13:
Meadows in the surroundings of Nenshkodra
(Photo: A. Miho).

As the soil in the Shkodra plains is mainly of alluvium origin, it consists largely of marshy material obtained by reclaiming the former marshlands. In Torrovica we even find deep and very fertile peat soils. In contrast, the region around the Velipoja plain soils are saline.

The hydrographical network of Shkodra lake – Buna river – Drini river plays an important role and affects one of the largest plains in the South-Western Balkan. The system of Shkodra – Buna is located shortly downstream of the three hydroelectric reservoirs of Fierza, Komani and Vau Deja in the large mountainous watershed of the River Drini (see Figs. 5-1 and 3-8). On the other hand, Buna River (Figs. 6-15 and 6-16) drains the water from lake Shkodra, preventing or diminishing the flooding risks of peripheral lake areas and buffers the downstream part of the Drini River. The Velipoja wetland system serves as a compensating reservoir for the Buna, maintaining the water balance and reducing flooding.

Nevertheless, in recent times the Shkodra region often becomes flooded, due to a forced release of water from the reservoirs in Drini River as in January and December 2010. As the result of heavy rainfall in the Drini catchment, the water level in the three upstream reservoirs rose drastically; water had to be released from the dams for safety reasons leading to a water flow of up to $2900 \text{ m}^3 \text{ s}^{-1}$, almost 4 times more than the normal maximum. As a consequence the water level of the Shkodra Lake rose by about 5 m (Fig. 6-14).



Figure 6-14: The flooded area of Shkodra, Albania, on January 12, 2010 (<http://en.wikipedia.org/wiki/File:Albaniaflood3.jpg>).



Figure 6-15: Buna river at the Murriqani village, Shkodra (Photo: A. Miho).

Lake Shkodra and Velipoja marshes are also retention pools for sediments. The nutrients are taken up by the aquatic vegetation and bioaccumulate to higher levels in the food web. The sediments

of the Buna River play also an important role in the morphology of the seashore and the coastline with the strong coastal erosion in the Velipoja plain. A pine belt has been planted to stabilize the sandy dunes.

The open relief towards the sea boosts the marine influence on the climate. Hence, the average temperatures in January range from 6.2°C to 6.6°C, while they stay between 23.7°C and 24° in July. The annual mean temperature in Velipoja is 15.3°C. The annual average water temperature of Shkodra Lake is 1.4°C higher than that of the air. Air temperature may drop occasionally to -12°, especially when the *murlan* (the snow carrying wind from the North) blows but its strength is not very high. Velipoja exhibits the highest rainfall of whole of Albania with up to 1924 mm at Bahçalleku, Shkodra. The high evaporation from the aquatic systems and the transpiration from floodplain forests and aquatic vegetation mitigate effectively the typical Mediterranean summer dryness in Velipoja, with a positive impact on the everyday life of the local community, agriculture and livestock.

Beside the flooding, the human impact and pollution in the complex Shkodra lake - Buna river and Velipoja coastal zone seems far to be negligible. Hence, the pollution with organochlorine pesticides residues in water, fish and sediments in Shkodra lake, Buna river and its delta measured during 2005-10 by Nuro & Marku (2011) were not really low (see also § 5.5 in Chapter 5; Fig 5-6).

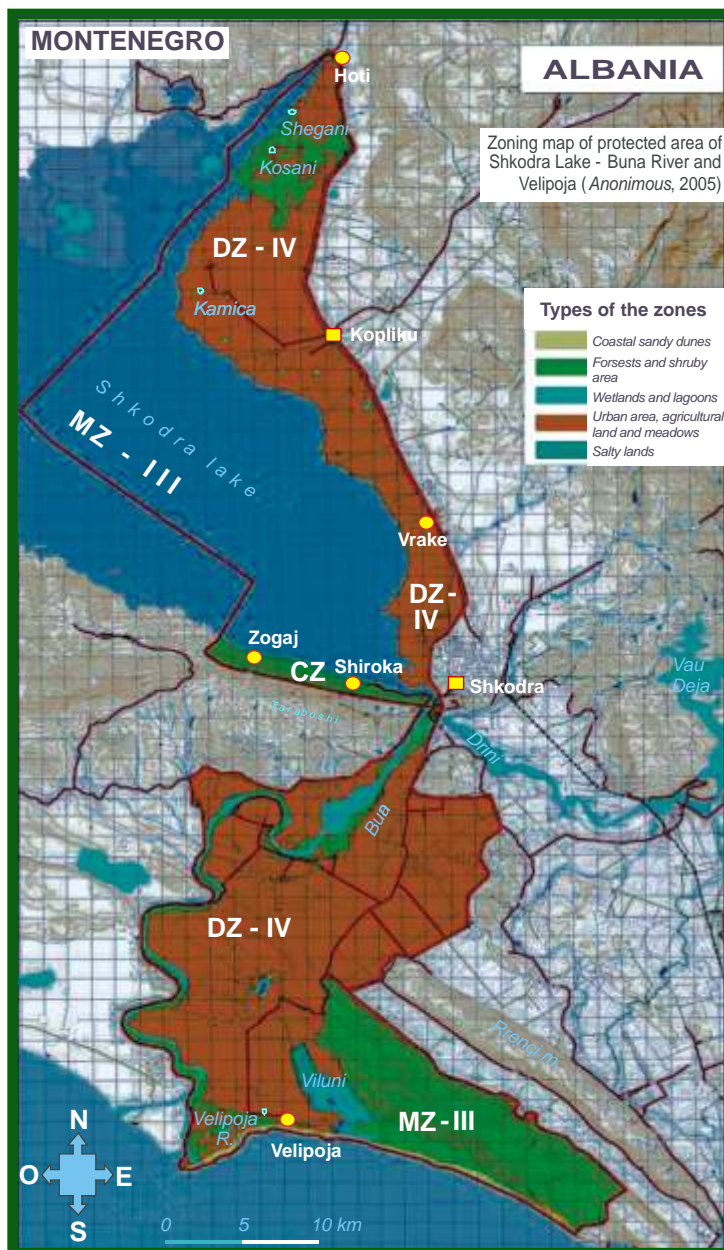
6.4. Description of the most important habitats

The complex of Velipoja – Buna - Shkodra includes a wide variety of habitats, communities and landscapes (Fig. 6-3), the whole complex has been declared as a Ramsar Site on the occasion of the World Wetlands Day in 2006 (Fig. 6-17).

The most important habitats in the Albanian part are Viluni lagoon, Velipoja Reserve, Buna delta with its islands, Baks Rrjoll coastal area, Buna river with the furcated freshwater marshes of Domni and Murteme, Reçi fishponds, Buna alluvial forests, and Velipoja and Pentari fields and pastures (Fig. 6-16) and coastal dunes of Rrenci. Most of these habitats in the Velipoja region belong to Velipoja municipality with more than 8'000 inhabitants.



Figure 6-16: Map of Velipoja wetlands (Google imagery, 2008, modified).



« « « **Figure 6-17:** Zone map of the protected area of Shkodra lake – Buna river - Velipoja (Anonymous, 2005, modified). **CZ**, Core zone (II); **MZ**, Managed zone (III); **DZ**, Development zone (IV).

In the Montenegrin part, particular sites of interest are Ada Island and Buna prodelta, the permanently water-covered part of the delta located beyond the delta front, the Great Beach, the Ulcinj salt-pan, the Ulcinj and Zoganje fields, the marshes, the Buna alluvial forests and the Lake Sasko (Fig. 6-16).

The Viluni lagoon

The Viluni wetland system including its marshes covers a total area of 16.3 km² (Fig. 6-16). It is situated about 2 km east of the Velipoja beach and 7 km away from the Buna estuary.

The Viluni lagoon is a large water body with a surface of 3.9 km² (Figs. 6-12 and 6-18). It is 3 km long and 0.9 km wide and represents the remaining part after the drainage of the former large wetland complex of Pentari – Domni – Murteme - Velipoja. Viluni is the most important transitional habitat in the whole Velipoja complex. The typical coastal lagoon is separated from the sea by two long shore barriers. It is characterized by mostly shallow water of 0.8 to 1 m depth, in a few parts occasionally rising to 2 to 3 m. It is connected with the sea by a channel, 300 m long and 30 to 40 m wide, and of 2 m depth, by which the brackish water exchanges with the seawater with a periodicity of the tide of 6 hours. The mean water temperature ranges between 20 and 22°C in July and 5 and 7°C in February. Large swamps of 3 km² are periodically flooded and natural dunes border at the seaside. Four small islands reside within the lagoon.

The watershed of Viluni wetland is large, about 38 km² extend up to Shkodra town. It comprises also the wide area of the marshes of Domni and Murteme. The natural zoning of vegetation in the northern part begins with the floodplain forests, followed by tamarisks and *Carex-Juncus* associations. A reed belt prospers only along the littoral parts, together with halophytic plants, mainly *Salicornia* spp.



Figure 6-18: Viluni lagoon (Photos: A. Miho).

A dam in the western part (Fig. 6-19) separates a swampy area with sand dwelling plants, so called psamo-halophytes.

The lagoon is the natural nesting site of the Kentish plover (*Charadrius alexandrinus*) and the only natural breeding ground of the Common redshank (*Tringa totanus*) in the delta. It is also an important feeding ground for the Pygmy cormorant (*Phalacrocorax pygmaeus*) and the Sandwich sterna (*Sterna sandvicensis*) and a significant spot for the waterfowl, especially in winter.

Figure 6-19: The main drainage channel close to Viluni and the pine belt on both sides (Photos: A. Miho).



The Viluni wetlands are rich in mollusks with 21 species, 12 gastropods and 9 bivalves. Most common are the gastropods *Ecrobia ventrosa* and *Rissoa labiosa*, and the bivalves *Cerastoderma glaucum* and *Scrobicularia cottardi*. A quite abundant

population of the Grooved carpet shell (*Tapes decussatus*) was present in the western part close to the outlet channels. It has been intensively harvested since 1990 and seems now strongly downsized. A further impact comes from the competition by the Manila clam (*Tapes philippinarum*), an alien species established intentionally in Viluni which became dominant during the past decade.

The Viluni area is a most sensitive ecosystem, but disturbed by environmental factors. The Domni and Murteme marshes collect large amounts of freshwater from the marshes of Buna in the eastern part, from where nutrients rich water from large agricultural and industrial areas is continuously discharged into the lagoon. Some algal blooms have been observed. In the past the lagoon was called Otter Lagoon for the high presence of this aquatic mammal. Today, the Viluni lagoon is also used for fishing, mostly grey mullets and eel. In the past decades, the afforested zone around the lagoon has been heavily damaged by human action, thus only about 0.37 km² of a sea-pine forest still exists.

The Baks Rrjulli coastal zone

The zone extends along 11 km of the coast (Figs. 6-3), from Viluni to Rana e Hedhun (blown sand) (Figs. 6-20) and passes the Baks Rrjulli village (Figs. 6-12) to the southern part of the Rrenci mountain.



Figure 6-20: The Blown Sand, known as *Rana e Hedhun*, northwest of Shengjini (Photo: S. Beqiraj).

It forms a specific combination of habitats along the coast with karstic caves, mountain slopes, sandy dunes, alluvial forests, tamarisk marshes, interstitial pools combined with a fine beach (total area 12 km²)

and a shallow prodelta (22 km²). The Blown Sand (Fig. 6-20), known by the local people as *Rana e Hedhun*, and the related sandy dunes are situated 2.5 km north of Shengjini town (see Chapter 7), at the foot of the Rrenci mountain. It represents an active dune of 50 m in height, 600 m in length and 100 m in width, accumulated by the wind on the rocky coast. For its special shape it was added to the checklist of Natural Monuments of Albania (geomonument). The zone is a typical virgin Mediterranean landscape with dolphins feeding near the coast and the golden eagle breeding on the karst galleries of the Rrenci mountain.

The Velipoja Reserve and the Buna prodelta

The Velipoja wetland complex with a surface of 8.2 km² has the shape of a triangle in the Buna delta east of the Buna river (Fig. 6-16). About 6.4 km² are fenced and protected as Managed Natural Reserve (Fig. 6-21). The Velipoja beach (see Fig. 4-2) and the dunes form the coastal profile of Velipoja, where large sandy beaches of about 10 km length and up to 200 m width extend along the coast. The adjacent prodelta areas on both sides of the river cover 8 km² with a depth reaching 25 m.



Figure 6-21: The entrance of Velipoja Reserve (Photo: A. Miho).

The wetland system is based on alluvial depositions forming a delta-like plain of 3 to 10 km length. It represents the remaining part of the former large swamp of about 23 km² of Viluni, Pentari and Reçi. The system was closely fused with the freshwater marshes of Domni, Torrovica and Zadrima, from which only parts of Domni and Murteme survived. These swamps offer excellent conditions to study the natural dynamics shaped by the coastal and fluvial processes.



Figure 6-22: Pertharia marsh in the Velipoja Reserve (Photo: A. Miho).

We find here a wealth of mosaic habitats with a rich biodiversity, from fresh and saline water bodies to open sandy dunes, from submerged vegetation to old alluvial forests and from numerous invertebrates to endangered groups of birds. About 3.5 km² of the reserve are covered with forests, the rest are marshlands canopied up to 60% with aquatic vegetation. The largest marsh, Pertharia (Fig. 6-22), represents one fourth of the system, it extends parallel to the coast with a water depth from 0.4 m in summer to 1.6 m in winter. During summer, the water is overgrown by the leaves and flowers of the European white waterlily (*Nymphaea alba*), but it houses also endangered plants like the Lesser water-plantain (*Baldellia ranunculoides*), the Common bladderwort (*Utricularia vulgaris*) and the Frogbit (*Hydrocharis morsus-ranae*).

Another typical habitat is the alluvial mixed forest with a size of about 1.7 km² (Fig. 6-23). Its largest part extends in the north towards the river with groups of tamarisks growing close to the shallow water; alder, White poplar, Narrow-leaved ash and willows mixed with shrubs develop on the riverbanks.



Figure 6-23: Pine forest in Velipoja Reserve (Photo: L. Kashta).

Moreover, more than 1.8 km² are covered with pines, mainly Stone pine and Aleppo pine, and with Canadian poplar, all cultivated mainly along the roads.

The marshes are strongly influenced by the dynamic processes of the Buna water regime with seasonal changes in the water flow as well as by the tides and waves of up to 3.5 m caused by strong winds. Several drainage channels link the marshland with the Buna allowing the control of the hydrological regime through special ports. Four roads starting from the main entrance facilitate the visitor to attend the different marshes and forest habitats.

Although the Reserve belongs to the strictly protected part of the newly declared Ramsar zone (Fig. 6-17), human pressure increased markedly after the economical change in the country. Woodcutting, illegal hunting and fishing jumped up, furthermore, deposition of solid and liquid wastes brought in by the Buna river increased.

Dunes of about 2 to 3 m height and small fluvial deltas are found in the southern part close to the Viluni lagoon. Efforts to stabilize the dunes in the past included the cultivation of a pine belt parallel to the coastline. As the seawater is of good quality the activity of the tides and waves regenerate the sand. However, urbanization of the coast between the Reserve and the Lagoon increased rapidly during the past decade, especially focused in tourism infrastructures - all this pressure with obvious negative effects on the erosion of the coast, deforestation and destruction of the sandy dunes, water pollution and resulting ultimately in a loss of biodiversity.

The Delta of Buna / Bojana

The delta (Fig. 6-1 and 6-16) has been formed by the masses of sediment brought in by the river Buna and the regime of the sea waves, which is governed mainly by strong winds with speeds of 10 to 20 m s⁻¹. The delta is also influenced by the low tidal currents with an average speed of 0.2 to 0.3 m s⁻¹ and the small tidal differences of only 20 to 30 cm.

Since 1970 the deposition rate by the river in the delta area has decreased, while the erosion process by the sea increased up to 1.5 to 2 m y⁻¹. Therefore, the dynamic of the delta is rather low when compared to other Mediterranean deltas. The estimated loss encompasses about 1 to 1.5 km in the past 100 years. The mouth of the river moved and became oriented more towards the Viluni lagoon.

The Buna delta is the most important habitat for the protection of fish. It is the entrance to lake Shkodra / Skadar, which is important as food source. Three species of sturgeon (*Acipenser* spp.) are key indicators of the high value in the riverine corridor. At least 50 fish species have been recorded in the Buna mouth; the most common are listed in table 6-5. Dolphins (i.e. *Tursiops truncatus*) have also been occasionally seen in the mouth of Buna.

The island Franz Joseph (Figs. 6-1 and 6-24) is about 4.5 ha in size, situated in the Albanian part at just about 1.2 m a.s.l. It is reached by crossing the reserve about 3.2 km distant from the main entrance (Fig. 6-21). Due to marine erosion, the island often changes its shape and size. The name originates from the Austrian ship Franz Joseph which sank there at the end of the 19th century. The island is famous for its rare flora and fauna and for the strictly protected borderland. Forest spots with poplar and alder cover its surface besides large aquatic reed beds. A specialty is the rare and notably hygrophilous oak tree (Skadar oak, *Quercus robur* ssp. *sautariensis*), unfortunately due to human impact cut back today to few individuals.

Figure 6-24: Terrestrial dam (isthmus) connecting the Franz Joseph island with the Veliopja reserve (April 2008) (Photo: A. Miho).



For its natural and biodiversity values, the island belongs to the checklist of Natural Monuments of Albania. It is a pity that the former colonies of herons and cormorants left the island during last decade due to increasing human pressure. They moved to more undisturbed habitats, probably in the Montenegrin part of the wetlands.

The Buna /Bojana river

The River Buna originates at the south-eastern part of Lake Shkodra and discharges its water at the Buna delta in Velipoja into the Mediterranean Sea (Fig. 6-3; *see also* Fig. 5-1), 44 km distant from Shkodra. The Buna joins the Drini River straight 1.3 km downstream of Shkodra Lake, resulting in a doubling in water flow from $320 \text{ m}^3 \text{ s}^{-1}$ to $680 \text{ m}^3 \text{ s}^{-1}$ (*see* Tab. 3-3). This ranks the river third after the Rhone and the Po in the Northern Mediterranean (*see* Figs. 3-1 and 3-2). The maximal flow of the Buna has reached in the past occasionally up to $7500 \text{ m}^3 \text{ s}^{-1}$, leading to flooding of the wide plain area. The situation changed after 1970 with the reclaiming process of most of the Shkodra plains and the construction of the three big dams in the Drini River. Furthermore the rivers Buna and Drini were artificially combined in summer 1963 which helped to prevent the flooding of the Zadrina plain and the town Lezha.

The river Buna dominates the water regime of the whole area. After joining with the Drini river (Fig. 6-6), the Buna is rather shallow, especially some km upstream, where even small islands have been formed. Further down towards its mouth the depth increases to 3 m which makes the river nearly navigable for small boats. Between the villages of Samrish in Albania and Gorica in Montenegro and the mouth, the river is shared between Albania and Montenegro and defines the border (Figs. 6-3 and 6-16). Due to the low inclination of the riverbed with about an average of 1.2 m per km, the water flow is very slow. The high amount of water and the soft nature of the riverbed favor erosion processes and the river forms several meanders. The river banks of Buna are made up by alluvial sediments.



Figure 6-25: Buna delta (*left*) and its habitats with Yellow iris *Iris pseudacorus* (*right*)
(Photos: A. Miho).

A characteristic of the river is its furcated bed within 16 km upstream of the delta, forming bare islands, sand walls and branches (Fig. 6-16), with succession stages of floodplain forest inside of an area of 4 km². This special habitat gives rise to a high occurrence of several bird species, like Sand martin (*Riparia riparia*), Common sandpiper (*Actitis hypoleucos*), Kingfisher (*Alcedo atthis*), Caspian terns (*Sterna caspia*) and Stone curlew (*Burhinus* spp.). It is also an important spawning area, especially for the sturgeon (*Acipenser* spp.). Following fish schools even Bottlenose dolphins have been observed in this part of the river. The furcating area is also a site for swimming by local people and as important local fishing area. Furthermore, it acts as filter for urban waste water carelessly disposed into the river.

The Domni freshwater marshes

About 7.2 km² of marshland and wet meadows between the mountains of Gjymti (west) and Kolaj (east) belong to the municipality of Dajçi in the northern part of the Velipoja plain (Figs. 6-16). They are remains of surplus water from the Zadrime plain which have been previously discharged into the Buna. Some decades ago this complex was well known for its richness in fish, ducks and aquatic vegetation.

The zone is still important for the diversity of plants, amphibians, reptiles and fish, mainly cyprinids that periodically migrate into the Buna river. The closely connected complex of Domni and Murteme marshes (2.5 km²) is the most important freshwater wetland in the Albanian part of the Buna delta. The marsh is covered by extensive reed beds which are used for grazing at its periphery (Fig. 6-9 and 6-26).

The Murteme lake represents controlled zones of water and riparian vegetation. A carpet of macrophytes covers the water surface at low water level. The two marshes are situated along the road from Shkodra to Veliopja, both suffer from the strong human impact, especially Domni marsh. Many trails through the marshes are used by the local people for livestock grazing.

Murteme is a breeding and migration site of the globally threatened Ferruginous duck (*Aythya nyroca*). The Common pochard (*Aythya ferina*) and the Garganey (*Anas querquedula*) breed also here. Both wetlands are important feeding sites for the Pygmy cormorant (*Phalacrocorax pygmaeus*) and the Squacco herons (*Ardeola ralloides*) from the Paratuk colony. The only known breeding site of the Little bittern (*Ixobrychus minutus*) in the Buna corridor spreads along the Velipoja Reserve.



Figure 6-26: The freshwater marshes of Domni and Murteme are often covered with the Thread-leaved water-crowfoot (*Ranunculus trichophyllus*) during

The Buna / Bojana alluvial forests

The Buna floodplain forests cover about 7.5 km², 6.7 km² in Montenegro and 0.8 km² in Albania. They spread along the river about 9 km upstream of Ada island. Together with the floodplain forests of the Velipoja reserve, Ada and the great beach form a spacious floodplain forest. It consists mainly of softwood trees in the upper part with a series of transitions down to a hardwood flood plain forest, from a unspoiled forest to a fragmented one.

The floodplain forests are distinguished for the richness of their flora and fauna and for many important ecological functions, especially water balance and climate mitigation as well as the protection from floods. The floodplain forests are inhabited by about 13 bird species in a detrimental conservation state, like the Levant sparrow hawk (*Accipiter brevipes*), the Roller (*Coracias* sp.), the Scops owl (*Otus scops*) and the Syrian woodpecker (*Dendrocopus syriacus*). Furthermore, there are mixed colonies of herons, ibises and cormorants, including the Pygmy cormorant on the islet of Paratuk.

The agricultural fields and pastures

Small scale agriculture is widespread today in the drained fields of Velipoja and Pentari, with a mosaic of arable crops and pastures surrounded by hedges. The Velipoja field extends to about 25 km², 21 km² of it is utilized for agriculture and 4 km² as pastures (Figs. 6-13 and 6-27). The Pentari field spreads over 8.5 km², 5 km² of it as pastures and 3.5 km² for agriculture. Open fields are important for the breeding and over-wintering of birds in a cultivated landscape and the zone is crucial for the survival of endangered European populations of farm birds in the Buna corridor, such as the Corn bunting (*Miliaria calandra*) and the Black-headed bunting (*Emberiza melanocephala*). Very large open pastures extend around Domni marshes with a size of 22 km² (Fig. 6-27). About 10'000 sheep from villages in the south of Shkodra have recently been estimated to graze there.

The area is regularly flooded and overgrazed on at least 75% of the surface; about 25 % becomes mown. Today the site is important as large-scale habitat for resting and nourishing birds, such as herons, spoonbills, waders and gulls. In the delta, some large scale pastures are most important breeding sites for the Yellow-wagtail (*Motacilla flava*) and for large populations of farm birds like the Corn and Black-headed buntings. The delta is the key wintering site for Wood larks (*Lullula arborea*) in the Mediterranean area with 1% of the whole European population. It would also be a key habitat for geese and cranes, if hunting were better controlled. The pastures with its channels are also rich in amphibians and the European pond terrapins (*Emys orbicularis*) and they are an important spawning ground for fish. The area is regularly used as feeding and hunting site of birds of prey, including the Golden eagle.

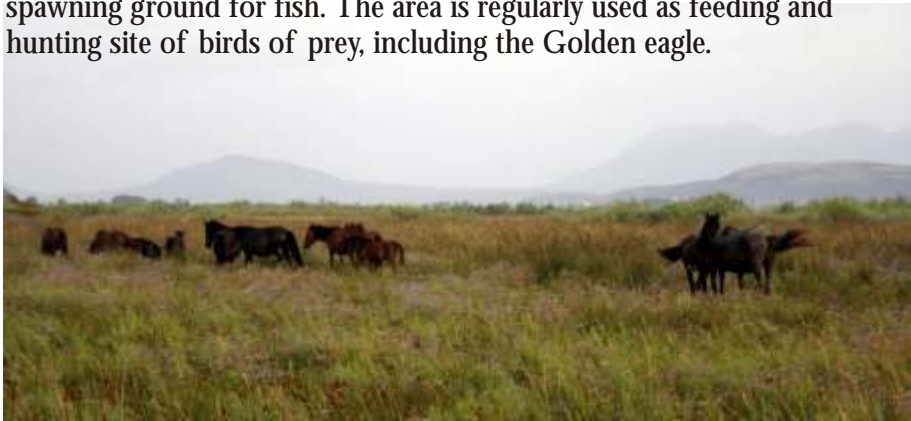


Figure 6-27: Meadows in the surroundings of the Viluni lagoon (Photo: L. Kashta).

The Reçi fishponds

Close to the Reçi village about 1.14 km² basins of fishponds were in use years ago. They were abandoned in 1990, but remained filled with shallow water of underground or meteoric origin. Emergent and floating vegetation still prospers, despite the great number of grazing animals. The basins are frequently toured by pigs, sheep, goats, cattle and horses from the village. The outer edge of the fishponds at the Buna River merges into flooded woodland.

Figure 6-28: Cormorant colony (*Phalacrocorax pygmaeus*) from Shkodra zone (Photo: REC-SHKODRA - D. Bejko).



The fishponds constitute the only large wetland that has remained after the drainage of vast parts of the delta; it is important for the colonies of cormorants, herons and ibises. These ponds are most important feeding site for the Squacco heron (*Ardeola ralloides*) in the delta with colonies of up to 40 individuals, and also for waders like the Black-winged stilt (*Himantopus himantopus*) or the small colony of the Collared pratincole (*Glareola pratincola*).

The Montenegrin habitats of Buna/Boja delta

Several important habitats extend into the northern part of Buna/Bojana delta in the Montenegrin part (Fig. 6-16), like Ada island, lake Sasko, the Ulcinj salt-pans, the Great Beach and some freshwater marshes and alluvial forests.

Ada Island is about 4.9 km² in size and situated in the middle of the Buna delta, it is characterized by small marshes mainly covered with reed and mixed alluvial forests. The island is a shelter for many waterfowl species of which some are highly endangered.

The Great Beach represents a large coastal habitat, 12.4 km² of it terrestrial and 9.9 km² as a prodelta, a shallow submersed sea area that extends into the northern part of the coastal zone of the Buna delta. It is highly dynamic, formed by accumulation processes of Buna/Bojana and erosion by the Adriatic Sea. The habitats gradually change and form a gradient, starting in the littoral zone with the beach, dunes and depressions with alkaline and freshwater habitats up to remaining forests of the indigenous Mediterranean pedunculate oak (Scadar oak *Quercus robur* ssp. *scutariensis*). Besides these natural habitats, semi-natural habitats, like pastures and meadows spread along the road to the villages Ada and Stoj.

Lake Sasko is located in a depression embedded within two karst chains in the Montenegrin part. It is surrounded by *maquis* and open deciduous forests. It is an oligotrophic freshwater lake with a salinity of 0.48 to 0.58‰, a surface area of 3.5 km² and a maximal depth of 9 m.

At times of high water of the Buna, Lake Sasko becomes connected with the river and inundated fields, its surface then increases to 3.8 km². The water level fluctuates by about 2 m and the temperature varies between 7.0 and 23.9°C. Underground sources from the Buna feed water into the lake. It is surrounded by a reed belt and touches developed flood plain forests (52 ha) towards the Brisko field. In the east it merges with the Fraskanje marshes (47 ha) which are overgrown by *Carex* and *Juncus*. The lake and its karst surroundings form a natural and pristine landscape. Twenty fish species live within the lake, including the eel (*Anguilla anguilla*), the European seabass (*Dicentrarchus labrax*) and two species of the mullet (*Mugil cephalus* and *Liza ramada*). The lake is an important fish spawning area and feeding site for aquatic birds. During flood periods, pelicans feed in its shallow waters.

The Ulcinj saltern evolved from a former lagoon, the Zogajsko Jezero (Zogaj lake) in the Montenegrin part of the delta, well known for pelicans that breed there for more than 100 years. The saltern of 14.5 km² in size was constructed 75 years ago and enlarged in 1970.

In some distance from the Buna, the saltern is linked to freshwater sources that have connections with the Buna and the wetlands along the Buna River. The marshes are characterized by floating meadows, submersed vegetation and reed, stuffed with suitable sites for nests of various bird species. Some of these are endangered on a regional scale. The saltern is the key site for breeding and roosting of many waterbirds in the Bojana delta. It is of global importance for the small colony of the Dalmatian pelican (*Pelecanus crispus*; Fig. 6-43) in the Shkodra lake; they regularly feed and roost here.

Three marshes are located in the Montenegrin part of the Buna delta: the small marsh (Mala Knetë, 1.27 km²) and the complex of the joined Curke and Darze marshes (2.34 km²). These marshes are also remains of the former lake Zogaj.

In its northern and western edges extensive grazing areas have been generated. The marshes represent 'extreme' habitats in the Buna delta, forming a gradient between brackish and freshwater wetlands. The small marsh is permanently flooded, but regardless grazed by cattle and even mown. Most characteristic are associations with *Carex* and *Juncus*, surrounded by an extensive and sharply separated belt of tamarisks. The deepest part of the Curke and Darza marshes is covered with reed (*Phragmites australis*).

These fields form an open landscape of 8 km² with wet meadows and pastures. They are regularly flooded at heavy rainfall. Settlements are mainly in the northern margin, with only stables and small farms and the fields are usually separated by hedges.

The Shkodra lake

The Shkodra lake is situated in the lower part of the Shkodra depression between the Taraboshi mountain, the fields of Podgorica and Kopliku, and of Shkodra town (Fig. 6-3). It is surrounded by karstic calcareous rock formations and dolomites of the palaeozoic, mesozoic and tertiary period.

The origin of the lake is not well known, it was probably formed during the tertiary or quaternary by dissolution of limestone in an active tectonic basin. It is the largest lake on the Balkan Peninsula with a surface of 370 km²; 150 km² of it belong to Albania (*see also* Tab. 3-2). The length of the lake is 45 km; its width is 26 km and the lakefront amounts for 207 km of which 57.5 km belong to Albania. Its average depth reaches 8 m, while the maximal depth in the Albanian part is over 40 m in karstic wells. The water level fluctuates by 5 m, resulting in a maximal surface area of 540 km² at high water level in winter. The mean lake surface is 5.6 m above sea level. The river Moraça with two branches is the main tributary, delivering about 62% of the total water input. About 30% of the water is provided by underground springs leaking from karstic wells, often called eyes, i.e. Syri i Sheganit (Shegani eye) and Syri i Virit (Viri Eye). The Buna river is the only outflow from the lake (Fig. 6-30).



Figure 6-29: Shkodra lake in Shiroka (Photo: L. Shuka).

The water temperature in August often reaches 26°C, while in January it drops rarely towards 0°C. The average water temperature in February is 6.4°C. The water is rich in dissolved oxygen (7 to 12 mg l⁻¹) and low in minerals; about 92% of the anions are bicarbonates and 96% of the cations are calcium. The transparency of the water varies between 2 and 3 m in summer and rises up to 5 m in winter. The nutrient content of the lakeshore water is higher than in the pelagic zones, the total phosphate fluctuates from 4 to 40 µg l⁻¹. Close to the Crnojevica mouth the content in phosphate may reach 100-350 µg l⁻¹, demonstrating a wide trophic spectrum from oligotrophic to eutrophic water depending on the site and the season. Polluting inflow originates from the Crnojevica and Moracha rivers in the Montenegrin part and from the runoff from different industrial activities of the towns of Shkodra and Kopluku.

According to the checklist of Albanian wetlands updated recently by Mima *et al.* (2003), the Albanian wetland area of Shkodra lake amounts for about 166 km². A high diversity of marshy habitats and plant communities exists along the lakeshores, dominated by submerse floating macrophytes and reed (Figs. 6-29 and 6-31). The most important habitats extend at the lakeshores in the Kopluku district, where several underwater springs are found (Syri i Sheganit, Syri i Virrit, Syri i Ushtarit and Radusit and Hurdhanat e Kosanit) (Fig. 6-17).



Moreover, there are also important floating meadows at Shegani, Shkodra - Bisht Qindi, Buze Uji, Hoti and the reed beds of Shkodra, Vraka and Buze Uji. Limited spots of freshwater alluvial forests with willows, tamarisks, white poplar and narrow-leaved ash are found in the regions of Shegani - Kamica, Shkodra - Vraka, Zogaj – Shiroka, and in some gravel beaches in Zogaj and Shiroka (Figs. 6-17, 6-29, 6-31 to 6-33).



Figure 6-31: Natural habitats with floating leaved macrophytes (*Nuphar lutea*, *Nymphaea alba*, *Ranunculus aquatilis*), in June 2005, at the spring Syri i Sheganit, Kopliku, Shkodra lake (Photo: L. Shuka).

6.5. Biodiversity of the Velipoja-Buna-Shkodra complex

With the many diverse habitats the wetland complex of Velipoja-Buna-Shkodra encompasses a large part of the biodiversity not only of Albania but of the whole South-Western Balkan (Tab. 6-1) This holds especially for aquatic plants, birds, reptiles, amphibians, mammals and fishes.

« « « **Figure 6-30:** The Buna river at the outflow from Shkodra lake; note the masses of water chestnut (*Trapa natans*) in the left small river arm (Photo:L. Kashta).

Table 6 -1: Number of species of biological groups in the Shkodra watershed and its wetlands, their percentage in the national scale (ANONYMOUS, 2006d; Dhora, 2005; MoEFWA, 2011a)

Biological groups	Number of species	Percentage in Albania
Vascular plants in the whole watershed	1900	unknown
Aquatic vascular plants	147	59
Microscopic algae	685	52 - 57
Microscopic zoobenthos	350	unknown
Mollusks in the whole watershed	115 – 130	22 – 25
Aquatic mollusks	54	10
Insects	6000	43
Crustaceans	87	76
Fishes	150	48
Amphibians	11	73
Reptiles in the whole watershed	31	86
Birds in the whole watershed	282	86
Aquatic water birds	112	34
Mammals in the whole watershed	57	48
Aquatic mammals	3	unknown

In the freshwater wetlands around the lake, along riverbanks and in the marshes four main types of aquatic vegetation are present:

✍ Submerse macrophytes, dominated by species of *Potamogeton*, *Myriophyllum*, *Najas* and *Vallisneria*;

✍ Floating leaved macrophytes, with *Nuphar lutea*, *Nymphaea alba*, *Nymphoides peltata*, *Trapa natans* and *Ranunculus aquatilis* (Figs 6-30 to 6-33); the presence of the Floating leaf plant (*Caldesia paranassifolia*) has recently been confirmed for the Shkodra lake.

✍ Duckweed (association with *Lemma* spp. and *Spirodela polyrhiza*) float on or just beneath the surface of still or slow-moving fresh water bodies and wetlands (Fig. 6-34).

✍ Reed beds, dominated by *Phragmites australis* and *Typha latifolia* (Figs. 6-29 and 6-33; see also 3-4), in association with species of *Saripus*, *Sparganium*, *Equisetum* and *Juncus*.



Figure 6-32: **Above:** Water chestnut (*Trapa natans*) in the Shkodra wetlands; **below:** Water chestnut and flowers of the European frog-bit (*Hydrocharis morsus-ranae*) (Photos: D. Bejko and L. Kashta).





««« **Figure 6-33:** Common plants in the Shkodra lake region: **1 to 3:** floating leaved macrophytes: Yellow water-lily (*Nuphar lutea*) and European white water-lily (*Nymphaea alba*) (Kamica and Shegani); **4:** Summer snowflakes (*Leucojum aestivum*) (Buna); **5:** Bulrush (*Typha latifolia*) (Shkodra lake); **6:** Chaste tree (*Vitex agnus-castus*) (Shiroka) (Photos: A. Miho, L. Kashta and D. Bejko).

About 147 species of aquatic plants have been recorded in the Shkodra aquatic habitats, 12 of them are stoneworts (*Charophyceae*), the others vascular plants. About 108 plant species are documented in the Red List of Peatlands of the International Biodiversity Conservation Importance in Europe, while 36 species listed in the Albanian Red Book (Tab. 6-2).

Woodlands in the region are represented by alluvial forests on the Buna banks, the mixed forest in the Velipoja reserve (Figs. 6-21 and 6-23), the coastal pine forest of Velipoja and Viluni and the freshwater wood at the eastern lakeshores.

Table 6-2: Checklist of endangered plant species in the Velipoja - Buna - Shkodra complex (ANONYMOUS, 2006d, updated).			
Vulnerable species	Endangered species	Rare species	Not sufficiently known
<i>Desmazeria marina</i>	<i>Adiantum capillus-veneris</i>	<i>Alnus glutinosa</i>	<i>Salix fragilis</i>
<i>Ephedra distachya</i>	<i>Baldelia ranunculoides</i>	<i>Caldesia paranassifolia</i>	<i>Salix pentandra</i>
<i>Hydrocotyle vulgaris</i>	<i>Butomus umbellatus</i>	<i>Hippuris vulgaris</i>	
<i>Hydrocharis morsus-ranae</i>	<i>Cladium mariscus</i>	<i>Lemna trisulca</i>	
<i>Laurus nobilis</i>	<i>Nuphar lutea</i>	<i>Leucojum aestivum</i>	
<i>Lycium europaeum</i>	<i>Nymphaea alba</i>	<i>Groenlandia densa</i>	
<i>Marsilea quadrifolia</i>	<i>Nymphoides peltata</i>	<i>Polygonum amphibium</i>	
<i>Olea oleaster</i>	<i>Sagittaria sagittifolia</i>	<i>Potamogeton gramineus</i>	
<i>Orchis laxiflora</i>	<i>Spirodela poly rhiza</i>	<i>Potamogeton nodosus</i>	
<i>Orchis palustris</i>	<i>Trapa natans</i>	<i>Rorippa amphibia</i>	
<i>Pancratium maritimum</i>	<i>Ulmus campestris</i>	<i>Vallisneria spiralis</i>	
<i>Quercus robur</i> ssp. <i>scutariensis</i>	<i>Ulmus laevis</i>		127

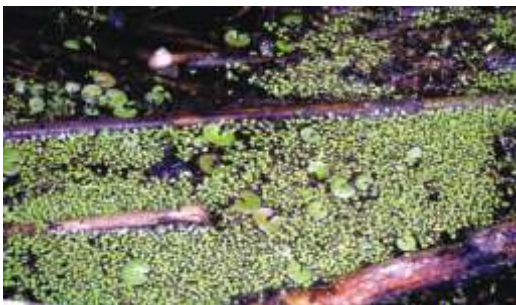


Figure 6-34: **Left:** *Ephedra distachya* (= *E. vulgaris*) at sandy dunes of Rrenci. **Right:** Duckweed association with *Lemna* spp. and *Spirodela polyrrhiza* in a drainage channel in Murteme (Photos: A. Mullaj and A. Miho).

The most frequent species are the White poplar (*Populus alba*), tamarisks (*Tamarix parviflora* and *T. hampeana*), willows (*Salix fragilis* and *S. alba*), alder (*Alnus glutinosa*), Narrow-leaved ash (*Fraxinus angustifolia*), Chaste tree (*Vitex agnus-castus*; Fig. 6-33), elm (*Ulmus campestris*) and Evergreen rose (*Rosa sempervirens*).

The coastal pine forest is composed of Stone pine (*Pinus pinea*) and Aleppo pine (*Pinus halepensis*) (Fig. 6-19). The presence of the previously reported endemic oak subspecies *Quercus robur* ssp. *scutiariensis* on Franz Joseph Island needs new confirmation.



The freshwater woods in the eastern lakeshores are mostly composed of several species of willows (*Salix alba*, *S. purpurea*, *S. fragilis*, *S. pentandra* and *S. incana*), tamarisk, White poplar and Narrow-leaved ash. Typical for the sandy dunes, especially at the foot of the Rrenci mountain, are *Ephedra distachya* (Fig. 6-34), *Pancratium maritimum*, *Euphorbia peplis* and *Convolvulus soldanella*.

Figure 6-35: Plant association with wild Pomegranate (*Punica granatum*) at Hoti (Kopliku) at the northern Shkodra lakeshore (Photo: L. Shuka).

The rocky habitats of Taraboshi and Rrenci mountains consist of limestone and are covered by a poor vegetation of woods and shrubs with only few species such as Brood-leaved mock (*Phillyrea latifolia*), Olive-tree (*Olea europaea* var. *europaea*), Macedonian oak (*Quercus trojana*), Christ's thorn (*Paliurus spina-christi*) and wild Pomegranate (*Punica granatum*) (Fig. 6-35). In contrast the sites are rich in herb vegetation of mesophytes and xerophytes.

The Taraboshi mountain is well known for large areas of sage (*Salvia officinalis*). The pleasant smell in the villages of Shiroka and Zogaj and along the western lakeshores was considered healthy and of curative values. Unfortunately the sage has been heavily harvested during the last decades which decreased its occurrence.

About 130 species of diatoms (*Bacillariophyceae*) were found in the lagoon of Viluni (Shkodra), either in periphyton or phytoplankton (Miho and Witkowski, 2005; Xhulaj, 2012; see Tab. 4-3). Most of the species were euryhaline (=capable of tolerating a wide range of salt water concentrations). The most common were *Achnanthes brevipes*, *Amphora holsatica*, *Ardissonia fulgens*, *Grammatophora oceanica*, *Cocconeis placentula*, *C. scutellum*, *Gomphonema parvulum*, *Gyrosigma acuminatum*, *G. balticum*, *Mastogloia angulata*, *Melosira moniliformis*, *Navicula gregaria*, *Nitzschia constricta*, *N. longissima*, *N. sigma*, *Pleurosigma angulatum*, *Striatella unipunctata*, *Suirella fastuosa*, etc.

In the brackish water of Viluni, *Zostera noltii* and less frequent *Ruppia cirrhosa* dominate among the aquatic macrophytes. The most common macrophyte algae are species of *Chaetomorpha*, *Cladophora* and *Ulva*. In the Buna delta a hydro-, hygro- and halophilic vegetation growing in the marshes is characterized by a high number of species belonging mainly to the genera *Potamogeton*, *Ceratophyllum*, *Phragmites*, *Pycnus*, *Typha*, *Salicornia*, *Limonium*, and *Halimione*.

The Shkodra lake is known also for rich plankton with a high diversity of species. More than 685 taxa of microscopic algae have been reported, mainly as phytoplankton. The wetlands of Kamica and Shegani (Kopliku) (Fig. 6-17) display the highest diversity.

In general the phytoplankton is dominated by oligo-mesotraphentic species (= preferring oligo- to mesotrophic water), like *Cyclotella ocellata*, *Asterionella formosa*, *Fragilaria capucina*, often accompanied by tolerant or eutraphentic species such as *Gomphonema acuminata*, *Navicula capitatoradiata*, *N. reichardtiana* var. *crassa*, *N. trivialis*, *N. cryptotenella*, *N. antonii*, *Nitzschia recta*, *Staurosira construens* and *Ulnaria ulna*.

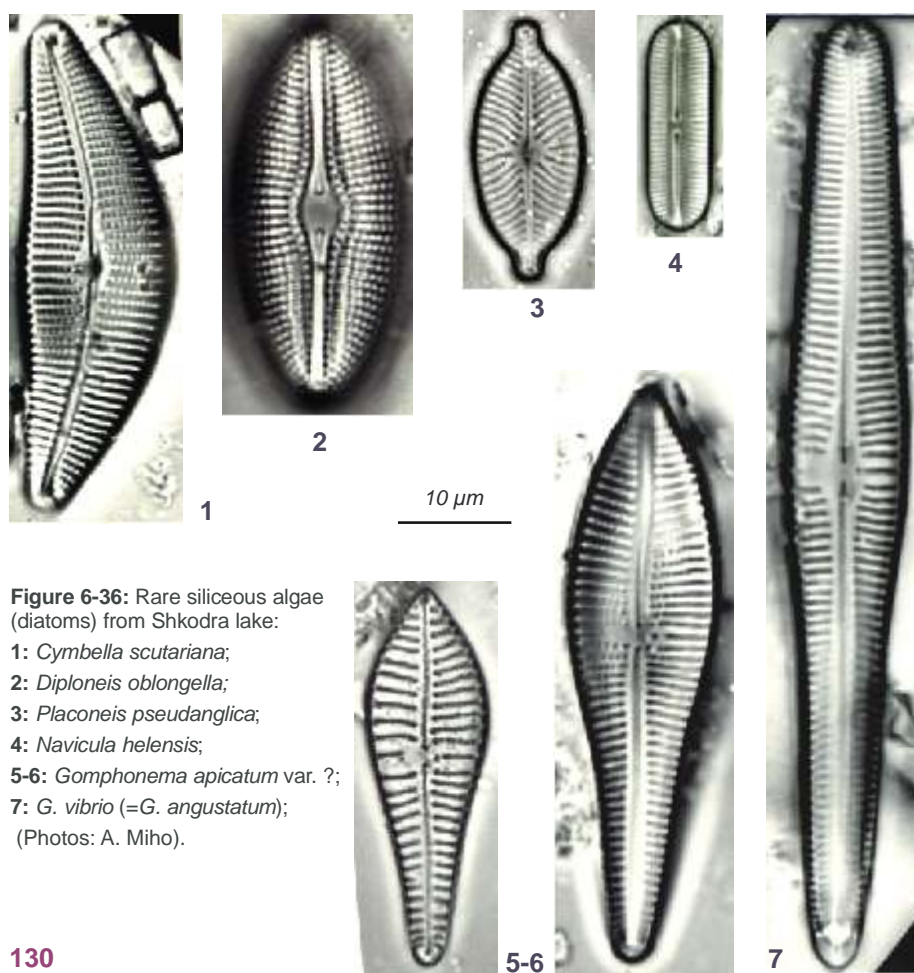


Figure 6-36: Rare siliceous algae (diatoms) from Shkodra lake:

- 1: *Cymbella scutariana*;
 - 2: *Diploneis oblongella*;
 - 3: *Placoneis pseudanglica*;
 - 4: *Navicula helensis*;
 - 5-6: *Gomphonema apicatum* var. ?;
 - 7: *G. vibrio* (= *G. angustatum*);
- (Photos: A. Miho).

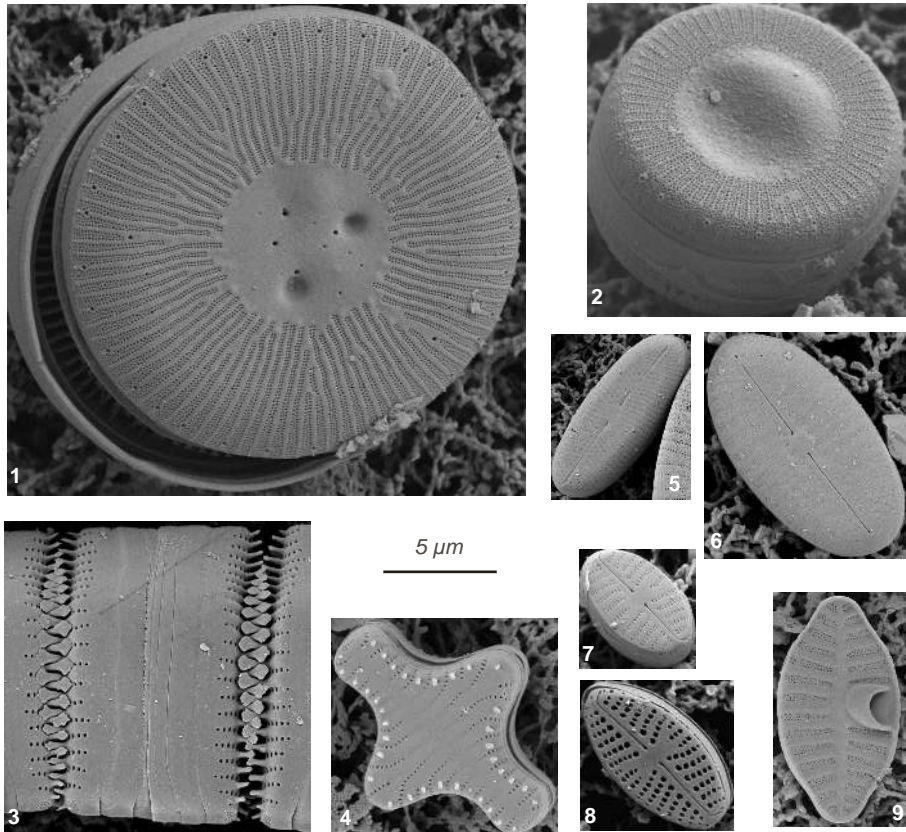


Figure 6-37: Frequent microscopic siliceous algae (diatoms) from Shkodra lake (Kamica) (3000x): 1: *Cyclotella ocellata*; 2: *C. distinguenda*; 3 and 4: *Staurosira construens* (girde and valve views); 5 and 6: *Diploneis oblongella*; 7 and 8: *Naviculadicta submuralis*; 9: *Achnanthes lanceolata* ssp. *rostrata* (SEM Photos: A. Miho).

The density of eutraphentic species increases during summer as seen in the Buna outflow and along the western shoreline of the lake (Shiroka and Zogaj). The diatoms *Cyclotella skadariensis* and *Cymbella scutariana* have been reported as endemic (Fig 6-37). Even in the Buna river the plankton becomes enriched due to the slowly moving water mass and the high quantity of nutrients present. The main groups of phytoplankton belong to *Chlorophyta*, dominated by species of *Pediastrum*.



Figure 6-38: International field investigation (Norwegian, Croatian, Montenegrin, Serbian and Albanian) in the Drini/Drim bay on May 2009, supported by the Norwegian project CPWB; **above left:** Prof. S. Stankovich and her student M. Jovic, from Serbia, on board of the Rozafa vessel; **above right:** Dr. I. Sondri (*left*) and Prof. M. Jura i (*right*) from Croatia, with the boatman in Buna (Murriqani); **below:** the international research group on board of the Rozafa vessel (the Captain in the middle) at midnight of 12 May 2009 during the marine transect at the south-eastern Adriatic shelf boundary zone, Drini bay (Photos: A. Miho and D. Vilicic).



The most frequent diatoms are *Cyclotella* and *Synedra*. Some rare or frequent species are reported in figures 6-36 and 6-37. Among cyanobacteria *Microcystis* and *Merismopedia* are dominant. In more eutrophic parts of the river *Oscillatoria* and *Navicula* develop to high abundance during the hot season.

The Velipoja-Buna-Shkodra zone is famous for a rich fauna, including several species of national and global conservation concern (Figs. 6-40, 6-42). For Shkodra lake about 350 species of microscopic fauna and zooplankton are known; about 39 molluscs and 35 insects have been identified as macro zoobenthos. Dhora (2006) reported the presence of about 6000 taxa of insects in the whole Shkodra watershed, 210 of them are closely bound to the wetlands and more than 100 are endemics of the region. Crustaceans are represented in the lake with 87 taxa of which 9 species of amphipods are confirmed as endemics. Recently, the presence of the Blue crab *Callinectes sapidus* has been recorded in Viluni. This invasive species is found also in other Albanian lagoons, i.e. in Patogu (see Fig. 8-14), Karavasta, Narta, Orikumi, Butrinti, as well as in the Erzeni mouth. The Blue crab belongs to the 100 “most invasive” species in the Mediterranean, with an impact on both biodiversity and socioeconomics.

About 216 animal species in the lake area belong to the Albanian Red List, 36 of them hold a global conservation status. The zone offers outstanding spawning and feeding grounds and migration pathways for fish. About 60 species of fish find shelter in the Shkodra lake, among them 6 trout species. Wetlands around the lakeshore and the freshwater marshes are major spawning grounds for cyprinids (*Cyprinidae*), while the coastal lagoons are important for e.g. the Flat-head mullet (*Mugil cephalus*) and the Thin-lip grey mullet (*Liza ramada*) and the Guilthead seabream (*Sparus aurata*). About 14 fish species and subspecies are known to have a status of global conservation concern (Tab. 6-3; Fig. 6-40).



Figure 6-39: Fisherman from Shkodra
(Photo: D. Bejko).

Table 6 - 3: Checklist of globally threatened animal species in the Velipja - Buna - Shkodra complex (Misja, 2006; IUCN, 2004).			
Mollusca - molluscs	<i>Unio crassus</i>	Amphibia - amphibians	<i>Emys orbicularis</i> <i>Hyla arborea</i>
Insecta - insects	<i>Cerambyx cerdo</i> <i>Marmaronetta angustirostris</i> <i>Lycaena dispar</i>	Aves - birds	<i>Anser erythropus</i> <i>Aythya nyroca</i> <i>Branta ruficollis</i> <i>Gallinago media</i> <i>Numenius tenuirostris</i> <i>Oxyura leucocephala</i> <i>Pelecanus crispus</i> <i>Phalacrocorax pygmeus</i>
Pisces - fishes	<i>Alosa fallax</i> <i>Chondrostoma nassus ssp. ohridanus</i> <i>Chondrostoma scodrensis</i> <i>Cyprinus carpio</i> <i>Lampetra fluviatilis</i> <i>Lampetra planeri</i> <i>Pachychilon pictum</i> <i>Salmo marmoratus</i> <i>Salmothymus obtusirostris</i>	Mammalia - mammals	<i>Glis glis</i> <i>Lutra lutra</i> <i>Myotis capaccinii</i> <i>Myotis myotis</i> <i>Rhinolophus blasii</i> <i>Rhinolophus euryale</i> <i>Rhinolophus ferrumequinum</i> <i>Sciurus vulgaris</i>





Figure 6-41: 1: Fishing boats at the Shkodra lakeshore in Zogaj. **2:** Dajlani (=fish trap) in the Buna river near Shkodra lake (Photos: L. Kashta and D. Bejko).



« « **Figure 6-40: 1:** rare individual of the European sea sturgeon (*Acipenser sturio*); **2:** Common carp (*Cyprinus carpio*) on the market (Photos: S. Beqiraj and L. Shuka).



Figure 6-42: Animal diversity in the Shkodra wetlands: **1:** Greek marsh frog (*Rana balcanica*; =*Pelophylax kurtmuelleri*); **2:** Dice snake (*Natrix tessellata*); **3:** Southern festoon (*Zerynthia polyxena*); **4:** Broad Scarlet (*Crocothemis erythraea*); **5:** Common tern (*Sterna hirundo*); **6:** Little egret (*Egretta garzetta*) (Photos: REC-SHKODRA, D. Bejko and A. Miho)

According to the bird census in different habitats, a high number of wintering water birds was counted in the zone. After Dhora (2012), the checklist of birds recorded for Shkodra lake comprises more than 280 species; about 178 species are wintering and 189 nesting ones. More than 110 species belong to waterbirds (Figs. 6-28, 6-42, 6-43 and 6-45), 68 of them are known as wintering birds, and 46 nesting in the region. Nine bird species are globally threatened. The Great cormorant (*Phalacrocorax carbo*), the Dalmatian pelican (*Pelecanus crispus*, Fig. 6-43) and the Spotted redshank (*Tringa erythropus*) cover here 1% of their worldwide population, fulfilling the criteria of the Ramsar Convention. The region is also an essential wintering area in the Eastern Mediterranean for the Woodlark (*Lullula arborea*), holding about 1% of the European population. It is a nesting site for many bird species of European conservation concern (Tab. 6-4).

Table 6-4: European birds nesting in the Shkodra region.		
Scientific name	Common name	Albanian name
Endangered in Europe		
<i>Accipiter brevipes</i>	Levant sparrow hawk	Gjeraqina kembeshkurter
<i>Caprimulgus europaeus</i>	European nightjar	Dallendyshe nate
<i>Coracias garrulus</i>	European roller	Grifsha e detit, Sorra e kalter
<i>Emberiza melanocephala</i>	Black-headed bunting	Cerla kokezeze, Fuga kokezeze
<i>Lanius minor</i>	Lesser grey shrike	Larushi i vogel, Laramani i vogel, Larashi i vogel ballezi, Çajma e vogel
<i>Lanius senator</i>	Woodshack shrike	Larashi kokekuq, Larushi kokekuq, Laramani kryekuq, Çajma kokekuqe
<i>Oenanthe hispanica</i>	Black-eared wheatear	Bishtbardha faqezeze
<i>Otus scops</i>	Eurasian scops-owl	Gjoni, Qokthi, Quku, Rutini, Qoku
<i>Platalea leucorodia</i>	Eurasian spoonbill	Çafka sqepluge, Çafka sqepluge,
<i>Tringa totanus</i>	Common redshank	Qyrylyku kembeqirize, Sqepkuqi
Large breeding populations		
<i>Actitis hypoleucos</i>	Common sandpiper	Qyrylyku i vogel
<i>Burhinus oediconemus</i>	Stone curlew	Gjelaci symadh
<i>Charadrius alexandrinus</i>	Kentish plover	Vrapuesi gushebardhe
<i>Charadrius dubius</i>	Little ringed plover	Vrapuesi i vogel
<i>Haematopus ostralegus</i>	Oystercatcher	Laraska e detit



Figure 6-43:
Dalmatian pelican
(*Pelecanus crispus*,
at Shkodra lake
(Montenegrin part)
(Photo: REC-
SHKODRA).



Figure 6-44: Sampling sediments and macroinvertebrates from the bottom of Shkodra lake at Shiroka (*left*) and at the Syri i Sheganit, Kopliku (*right*), in June 2005 (Photos: L. Shuka).



Figure 6-45:
Waterbirds at the
Shiroka lakeshore,
Shkodra
(Photo: D. Bejko).

Due to the special hydrographic network, one of the most distinctive ecological features is the potential for biological migration, especially for fish and birds, enabling their reproduction and feeding. Buna River is a migration road for 13 fish species (Tab. 6-5); it connects the Shkodra lake and Drini, including upstream Ohrid and Prespa lakes with the sea. Among migratory species, six are globally threatened, namely the European sea sturgeon (*Acipenser sturio*), the Adriatic sturgeon (*Acipenser naccarii*) and the Starry sturgeon (*Acipenser stellatus*), the Twaite shad (*Alosa fallax*), the River lamprey (*Lampetra fluviatilis*) and the Brook lamprey (*Lampetra planeri*).

The zone belongs also to one of three main north-south migration corridors for European birds, playing an important role for maintaining bird diversity at a regional level. Rrenci mountain in the south-eastern part has a significant bio-ecological role as a migration pathway for large mammals from the Montenegrin side of the Buna area to the Adriatic Sea in Albania. It plays the role of a natural bridge for terrestrial animals which cross the Buna, like the jackal (*Canis aureus*), the wolf (*Canis lupus*), the wild boar (*Sus scrofa*) and the fox (*Vulpes vulpes*).

Table 6-5: Fish species in the Buna mouth.

Scientific name	Common name	Albanian ame
<i>Aphanius fasciatus</i>	Mediterranean killifish, South European toothcarp	Çeliku me rripa
<i>Argyrosomus regius</i>	Shade-fish, Salmon-basse, Stone basse	Ameja, Orli i detit
<i>Atherina hepsetus</i>	Mediterranean sand smelt	Aterina, Terina, Gavoni
<i>Diplodus sargus</i>	White seabream, Sargo	Sargu i zakonshem, Sargu i bardhe
<i>Engraulis encrasicolus</i>	European anchovy	Açuga, Gavroja, Inçuni
<i>Gobius niger</i>	Black goby	Burdullaku i zi, Gobiti i zi
<i>Lichia amia</i>	Leerfish, Garrick	Lojba, Lica, Glica
<i>Lithognathus mormyrus</i>	Steenbras	Murra, Murra me rripa
<i>Sciaena umbra</i>	Bluestripe snapper	Korbi i zi
<i>Solea vulgaris</i>	Common sole	Gjuheza e zakonshme
<i>Symphodus cinereus</i>	Grey wrasse	Buzoçi i hirte
<i>Syngnathus tenuirostris</i>	Seaweed pipefish	Peshku gjelperë turiholle
<i>Thunnus thynnus</i>	Atlantic bluefin tuna	Toni
<i>Umbrina cirrosa</i>	Croaker	Korbi i bardhe, Korbi, Millokop



Figure 6-46: Sunset at Shiroka, Shkodra Lake, May 2002 (Photo: L. Shuka).