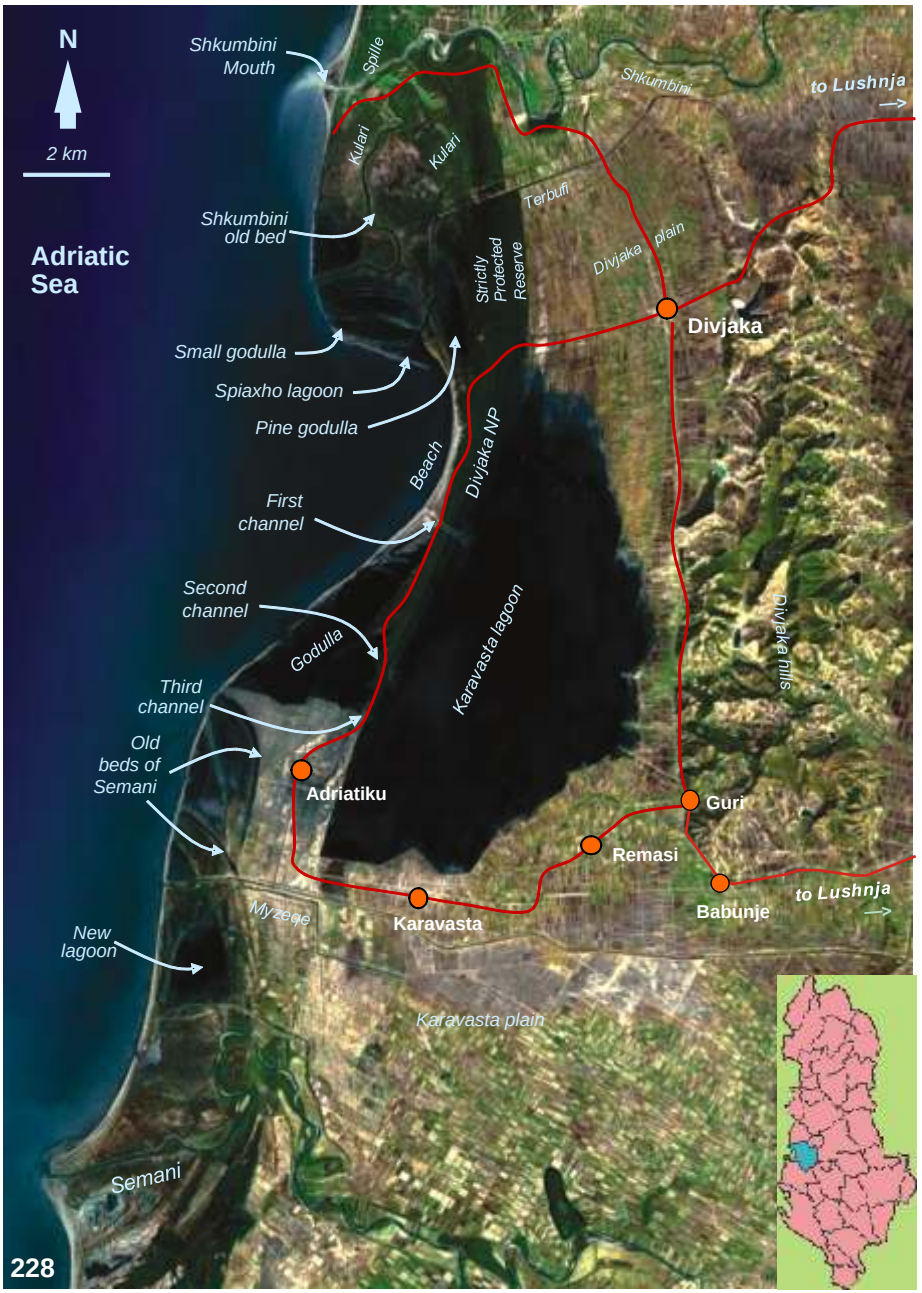
10. The Karavasta-Divjaka complex

Summary

The Karavasta – Divjaka natural complex in Central Albania at the Adriatic coast is declared in 2007 as extended national park (II cathegory) with a total surface of 222 km^2. It is encompassed by the two rivers, Shkumbini in the north and Semani in the south, and borders with the Divjaka hills in the east (*see* Tab. 5-4). The site is a main part of a continuum of the transitional wetland belt that extends from the northern delta of the Shkumbini (Spille, Kavaja district) to the Narta lagoon (Vlora).

The Divjaka Pine Forest (7 km^2) was denoted in 1966 as a Strictly Protected Reserve. Due to its particular values, the Albanian government declared the whole Karavasta - Divjaka wetland complex (145 km^2; see Tab. 5-4; Fig. 10-1) as a special protected natural ecosystem (1994) and shortly later it was declared as a Wetland of International Importance by the Ramsar Convention Bureau (1995). Three types of protected areas are comprised actually within the complex, the strictly natural reserve of Karavasta lagoon (42 km^2), the Mediterranean pine forest of the Divjaka (12.5 km^2) and Kulari (8.5 km^2).

Figure 10-1: Karavasta-Divjaka wetland complex (Photo: S. Beqiraj).


N
2 km
Shkumbini Mouth
Spille
Kullari
Kullari
Shkumbini
to Lushnja
Terbufi
Shkumbini old bed
Adriatic Sea
Strictly Protected Reserve
Divjaka plain
Divjaka
Small godulla
Spiaxho lagoon
Pine godulla
Beach
Divjaka NP
First channel
Second channel
Godulla
Karavasta lagoon
Divjaka hills
Third channel
Old beds of Semani
Adriatiku
Guri
Remasi
Babunje
to Lushnja
Myzeqe
Karavasta
New lagoon
Karavasta plain
Semani
228

Divjaka, founded as municipality only as recently as 1996, is the most important inhabited centre in the complex counting more than 6500 inhabitants. About 12 small villages with a population ranging from 500 to 1700 inhabitants are spread around the Karavasta lagoon. Only Divjaka town with Divjaka beach are accessible on paved roads, the other villages are linked by rural roads (Fig. 10-2).

The lagoon is surrounded by drained fertile agricultural land, cultivated mainly with vegetables, fruits, fodder, cereals and sunflower. Thus, agriculture is the main subsistence farming for the local population around Divjaka. Livestock is fundamental, with sheep, buffalos, pigs, horses, goats, geese, turkeys and chicken. Bathing tourism increased enormously during past decades. It has been reported that the Divjaka beach is visited each year by more that 300'000 visitors, with often more than 8000 visitors per day during summer. Fishing is organized by several cooperatives working separately in the Karavasta lagoon, in Kulari or in the sea zones. Although hunting is either prohibited or regulated, such restrictions are not strictly applied, which also holds for fishing. More detailed information about the complex is given in http://www.ramsar.org/_.

10.1. How to reach the area

The wetland zone is situated in the Lushnja district; it is about 20 km far from Lushnja (Fig. 10-2), a small agricultural town with 30'000 inhabitants. Lushnja is regularly interlinked with Tirana (120 km), Durresi (80 km), Vlora (83 km) or Fieri by normal busses and by train. The road to Divjaka starts from the main national road from Lushnja to Rrogozhina at the Çerma crossing. Regular busses or minibusses link Lushnja with Divjaka town or with the beach and the protected zones.

«««« Figure 10-2: Map of the Karavasta-Divjaka complex (Lushnja) with the main inhabited centers, habitats and roads (red) (*adapted* from Google Imagery, 2008).

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Figure 10-3: Modest restaurants offer fish and other meals according to the tradition (Photo: A. Miho).

The Karavasta – Divjaka complex and the northern part of the Semani delta wetlands can also be accessed through rural roads leaving the main national road from Fieri - Lushnja at Kemishtaj or Libofsha villages.

At the Divjaka beach some old and new guest houses offer a warm hospitality with traditional food and accommodation during the whole year (Fig. 10-3).

Useful contacts

For group visits to the restricted zone of the National Park or to special habitats of interest in the lagoon, a special permit must be obtained from the Forestry Directorate in Lushnja. A forest engineer at the visitor centre in the Divjaka National Park (Fig. 10-4) close to the police station may give additional assistance. Special permits are also issued by the Directorate of Environmental Protection, MoEFWA, Tirana.

Figure 10-4: Posters explaining details about the protected zones in Karavasta-Divjaka complex (Photo: A. Miho).

10.2. Information about the most important sites

The substantial wetland and natural reserve sites are the Divjaka National Park (NP) with the Karavasta and the Godulla lagoons, the Kulari and the dead river bed of the Shkumbini and the delta.

Besides these some cultural sites are worth to be visited. The Ardenica monastery (*see* Fig. 11-4) from the 13th/14th century near Lushnja town with the Church of Saint Virgin Mary was built under the Epirus governance regime. The oak forest and the Mediterranean cypresses around it belong also to the checklist of Albanian Natural Monuments. The hill allows an excellent view on the Myzeqe plain (Fig. 10-5), the sea and the Karavasta lagoon, but also on the oil pumping wells the Roskoveci and Patosi plains and the Tomorri mountains with the Tomorri NP. The famous museum town Berati has been named in 2008 as a World Cultural Heritage (UNESCO) and is just 35 km far from Lushnja.

Figure 10-5: Myzeqe plain from Ardenica hills (Lushnja) (Photo: O. Nika).

Figure 10-6: Habitats at the Godulla lagoon (Photos: A. Miho).

Some ancient rests and historical monuments witness that Divjaka has been inhabited since the antiquity. Examples are the settlement in Bishtçukasi from the 4th century BC and the remains of the ancient city of Babunja on the Divjaka hill from the Iron Age to 1st century BC. The zone was later inhabited by the Illyrian tribe of the Taulants, living between the two centers of Durresi and Apollonia (Fieri; *see* Chapter 11). Also the important antique road, Via Egnatia, crossed this region. The church or the temple of Saint Nicholas, known since the 18th century, is found in Xengu, a Byzantine church, constructed in 1778, is located in New Karavasta.

Figure 10-7: Habitats at the Shkumbini river in the Kulari zone (Photos: A. Miho).

A trip along the sandy belt between the Karavasta and the Godulla lagoons in the southern part of Divjaka is fascinating and full of surprises (Figs. 10-6). Three channels connect the two lagoons, brackish water habitats can be studied on both sides and all forms of Mediterranean forests and shrubs are present.

Travelling from the Divjaka town along the eastern part of the Karavasta lagoon is challenging both for the natural and transitional values (Fig. 10-2), as well as for cultural and traditional aspects. We pass some small villages and exciting brackish water habitats with water birds. Moreover, the typical agricultural landscape is handled by hard working local people for vegetables and fruits, supported by the fertile soils and the mild climate.

10.3. Physico-geographical characteristics

The Karavasta – Divjaka wetlands spread within the Myzeqe plain (1800 km^2) in the central part of the Adriatic Western Coastal Lowland (*see* Figs. 2-1 and 5-1). Specifically they are part of the Big Myzeqe plain (or the Myzeqe of Lushnja) stretched between the Semani and Shkumbini rivers. There the coast is the most dynamic of the whole Albanian sea shore, the result of the large masses of sediments

Figure 10-8: Terbufi drainage channel (Photo: A. Miho).

The Myzeqe plain represents a big geological depression ranging from Patosi and Marinza (Fieri) to Kavaja. At present, it is in a raising process as documented by the tendency of the rivers to deepen their beds in the plain and to form terraces, and also by the displacement of the coastline towards the sea. The geology reveals molasses from the Miocene and Pliocene with Quaternary marine and alluvial accumulations in the surface layers. Gas deposits are found along the coastline. Most of the gas collected is used by the fertilizer factory at Fieri. Some gas extraction takes place in the coastal plain, west of Divjaka. Furthermore, titanium deposits have been detected along the Shkumbini estuary.

Figure 10-9: ***Left:*** Sampling on the Karavasta lagoon; ***below:*** Terbufi drainage channel and Spiaxho wetlands (Photo: L. Kashta and A. Miho).

The relief of the Myzeqe plain is characterized by its very low altitude, generally not higher than 20 m a. s. l., with a slight inclination towards west. At some sites the altitude is below sea level. This makes the draining difficult during the wet season, as it is the case in the former marshes of Terbufi and Divjaka (Lushnja). Besides the east-west slope of the plain, there exists a deepening between the two adjacent riverbeds. The riverbanks are normally higher than the plain between two rivers due to the massive deposition of solids. These features combined with the torrential regime of the water flow after rainfall and the muddy-clayey and hardly permeable soil provoke the flooding of the lowlands between the rivers, swamps and marshes are formed. Embankments alongside the rivers protect the agricultural fields from floods. Surplus stagnant water is drained by pumping stations.

Man made constructions, like reservoirs and irrigation systems, play a vital role for the hydrography of the Myzeqe plain. The largest irrigation reservoirs of Albania have been built here, like the Thana / Murrizi (Kuçova) reservoir with a water volume of 65 million m^3 and the Kurjani with 30 million m^3 (Fieri). The Thana has an irrigation capacity of 350 km^2, including the plains around the Karavasta - Divjaka zone.

Figure 10-10: Karavasta - Divjaka wetlands, in the northern part close to the main channel (second *dajlan*) (Photo: A. Miho).

Two large drainage channels drain the agricultural plain landwards of the Karavasta – Divjaka region with Tërbufi in the north and Myzeqe in the south (Fig. 10-2). Therefore, the catchment area of the Karavasta lagoon is rather small, stretched between the two drainage channels and the Divjaka hills in the east. Several small reservoirs have been constructed in the hilly zone for the supply of irrigation water. The coastal plain contains a rich alluvial groundwater aquifer, allowing to gain drinking water from a large number of individual wells.

Several rivers cross the Myzeqe plain, Shkumbini and Semani are the most significant for the the Karavasta – Divjaka wetlands. Shkumbini has a large catchment basin of 2445 km^2, a mean annual flow of 61.5 $m^3 s^{-1}$ and transports yearly 5.7 million tons of sediments (*see* Tab. 3-3).

The Semani river drains a watershed of 5649 km^2 and has a mean annual discharge of 95.7 $m^3 s^{-1}$, delivering 12.6 million tons of sediments to the sea. Both rivers meander for several kilometers through the coastal plain. There their beds are unstable due to large flow variations and the marginal slope of the base. Therefore the sites of the estuaries are rapidly and continuously changing, leaving behind dead meanders. During the past 100 years the Semani river has displaced its estuary 5 or 6 times, always moving southward. The last change occurred in 1962 near the Kallmi village, but the bed has been restored immediately by the reclaiming enterprise.

In 1963 Shkumbini river formed a new bed between the Sulzotaj and Kulari villages towards Terbufi and the Karvasta lagoon, but it was refilled soon afterwards and the river also turned back to the old bed. Again in winter 1995-96 Shkumbini changed the bed about 5 km north. As a consequence the Kulari zone was cut off by the new riverbed and it joined with the Karavasta – Divjaka complex. As no interventions were undertaken a new wetland was formed (Figs. 10-2 and 10-13), the Kulari area.

Figure 10-11: Shkumbini river outlet (Photo: A. Miho).

Until 1991 the Shkumbini River was heavily polluted by the metallurgic complex of Elbasani, as liquid waste with a high content of toxic compounds and solid waste had been disposed on the riverbanks. The situation has been improved since then, but many pollution sources still exist in Elbasani town with the remains of the former metallurgic complex. The content of heavy metals in the water of the Shkumbini seems to be negligible two decades after the mining activities had ceased. In contrast the Semani is persistently contaminated by industrial and urban liquid waste from the towns of Ballshi, Patosi and Fieri, as well as by leakages from the oil drilling fields in the zone (Miho *et al.*, 2005).

The marine currents in the coastal region move counterclockwise as given by the general circulation scheme (*see* Fig. 4-1) with a speed of 0.15 to 0.26 m s^{-1}. Wind-driven currents can be very strong, persisting over several days. The average tidal rise is 0.2 to 0.4 m and depends on the wind speed. The highest tides are recorded in autumn and winter. The highest waves are caused by the NE off-shore wind, the *murlani*, while the SE wind *shiroka* generates smaller on-shore waves.

In coastal bays, waves may still reach a height of 3.5 m, in the open sea up to 4.5 m. The water depth increases slowly with distance from the shore and the sandy sea bottom becomes muddier with increasing depth. Strong currents affect the bottom flora and fauna.

The climate in the Myzeqe plain is milder than in the other parts of the coastal lowland. The mean annual temperature in Lushnja is 16.1°C, with a range from 8.2°C in February to 24.3°C in August. An absolute maximum of 41.7°C and a minimum of -8.9°C have been recorded. Precipitation fluctuates between 950 and 1200 mm yr^{-1}, but snow is a rare phenomenon. July is the driest month with 24.7 mm precipitation, while November is the wettest period with 143.5 mm. Winds blow mainly from the east, often also during summer.

10.4. Description of the most important habitats

The Karavasta – Divjaka wetland complex is among the most significant and the largest coastal ecosystems in the Mediterranean region. The natural habitats are located essentially along the coast. They include the land belt between the sea and the Godulla and Karavasta lagoons (Fig. 10-2). These sites are still fully exposed to the natural dynamics and are influenced by the coastal storms and river floods. Most natural inland habitats have been replaced by arable land in the reclaimed part of the coastal plain. The following types of natural habitats are found in the zone: brackish and freshwater wetlands, open salt marshes and grassland, shrubs and woodland (Fig. 10-12).

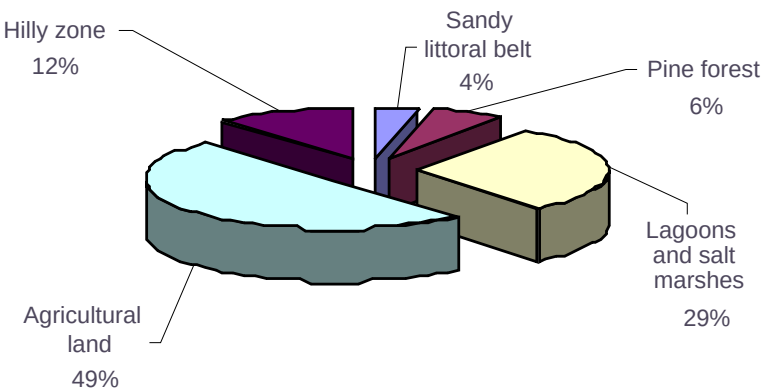

Figure 10-12: Percental composition of the habitats of the Karavasta – Divjaka zone (data from http://www.coastalguide.to/karavasta/index.html).

The vegetation is characterized by different successions from the terrestrial vegetation of sandy beaches and young dunes towards the development of shrubs and woodland. The distribution of such natural habitats is not constant over time, but undergoes a natural dynamics with a slow change in the course of a vegetation succession.

The Divjaka National Park comprises a dense forest of pines and deciduous trees established on the old dunes, mainly in the northern part of the lagoon between the sea beach, agricultural fields and the river Shkumbini (Fig. 10-2). The protected forest is fenced and permission is required to visit it from the Visitor Centre in the Park. The forest extends about 10 kilometers parallel to the sea and is more than 1 km wide. Shallow depressions (dune slacks) are often present in the sandy dunes. Several channel-like slacks run parallel to the forest (Fig. 10-10). From the two main entrances, some tracks are labeled. The northern part was originally a strictly protected Reserve, thus its natural state is better preserved. It is characterized by old pines, one of them, the wild pine, is a Natural Monument with 34 m in height and a 2.4 m trunk diameter. The tree is estimated to be older than 410 years. In the northwest, the Pine Godulla (Fig. 10-2) is a lagoon hidden in a pine forest of 1.8 km length and 400 m width. It is in contact with the Terbufi wetland where the Dalmatian pelican is nesting .

In the southern part the forest borders the Karavasta lagoon. There, towers allow watching of waterbirds. The Dalmatian pelican nests on small islands formed from rests or decayed vegetation (called *sope* by the local people).

The sandy belt and the beach extend for about 10 km in the northern part of the Divjaka beach towards the Shkumbini delta. The Kulari zone (Fig. 10-2 and 10-13) is reached by boat through Terbufi or Shkumbini outlet, or through the fields of Divjaka. The dead river bed with the Shkumbini meanders is hidden inside the Kulari wetland system. It is nearly an island and belongs to the Albanian natural monuments.

Figure 10-13: The Kulari area: ***above*****:** fields with alfalfa; ***right:*** grazing cows; ***below:*** Shkumbini river (Photos: A. Miho).

The lagoons are the most crucial habitats of the whole complex, comprising up to 60 km^2, with two main parts, the large Karavasta lagoon and the outer Godulla lagoon (Fig. 10-2). The smaller wetlands, some newly formed during the past like the Spiaxho and other small *godullas* and channels are located both north and south near the rivers Semani and Shkumbini.

The Karavasta and the Godulla lagoon are connected by channels (Figs. 10-2 and 10-16). The northern inlet connects the Karavasta lagoon directly with the sea. Its surface area is about 42 km^2, its length and width about 10.6 km and 4.3 km, respectively. The average depth is 0.7 m, with a maximum of 1.5 m. The bottom is rather uniform missing bottom channels directing the water flow.

The Godulla lagoon has a surface of 8.5 km^2 with a similar bathymetry, except for the north-eastern part where a channel has been dredged with a depth of up to 1.8 m. The water exchange from the Karavasta lagoon to the sea is limited to maximal 36.6 $m^3 s^{-1}$, largely determined by the tides and strong winds. Because of the small tidal range and the long connecting channels, tides raise the water level in the lagoon only by few cm.

Long time data of the physico-chemistry of the Karavasta lagoons are lacking. Some information is presented in tables 10-1 and 10-2.

Interestingly, during the wet period in spring the salinity in the two lagoons differs, in the Karavasta lagoon it ranges between 19‰ in the littoral part and 25‰ near the connecting channels. This is lower than in the Godulla lagoon, probably due to more freshwater input from the catchment. High temperatures increase the evaporation during summer, the water exchange with the sea declines and the inflow from the watershed stops completely. As rainfall is negligible, the water level drops by up to 30 cm bringing the salinity to 60‰, with an upward gradient with distance from the inlets.

The central part of the Karavasta lagoon is characterized by a slimy layer which is bordered by peat, sand, sub-sand and sub-clay in the peripheral zone. Phanerogam remains below a layer of pure silt of about 10 cm have been observed in core samples.

Table 10-1: Physico-chemical parameters in the Karavasta lagoon (mean values of 20 stations), Godulla lagoon (mean values of 15 stations) and the sea (1 station) in April and August 1993 (adapted from Guelorget and Lefebvre, 1994).

t, temperature; Cond, conductivity; S, salinity; O_2, oxygen concentration; TSS, total suspended solids; Tu, Turbidity unit; OM, organic matter; Chl a, chlorophyll a; Phe a, pheophytin a; nr, not reported.

Time / Parameters	27 April 1993			20 August 1993		
	Karavasta	Godulla	Sea	Karavasta	Godulla	Sea
pH	7.7	7.6	7.6	8.3	8.3	8.2
Cond (mS cm^{-1})	43.5	45.2	41.5	50.0	38.4	36.8
t (°C)	25.3	22.8	19.5	26.7	27.5	27.2
S (‰)	29.7	33.1	32.6	33.1	24.4	23.3
TSS (mg l^{-1})	11.4	8.1	1.3	12.1	23.7	43.3
OM (mg l)	1.9	0.9	0	4.2	5.6	8.7
OM TSS^{-1} (%)	16.6	10.6	0	35.1	23.8	20.1
Turbidity (Tu)	nr	nr	nr	17.3	5.1	6.0
O_2 (mg l^{-1})	nr	nr	nr	6.7	9.8	10.3
Chl a (mg m^{-3})	nr	nr	nr	2.8	0.2	0.1
Phe a (mg m^{-3})	nr	nr	nr	6.8	0.7	0.5
Phe/(Chl+Phe) (%)	nr	nr	nr	68.7	81.8	80.6

Table 10-2: Mean values of some physico-chemical parameters at two stations in the Karavasta lagoon in November 2004 and April 2005.

t, temperature; Cond, conductivity; TDS, total dissolved solids; S, salinity; DO, oxygen saturation; O_2, oxygen concentration (data after INTERREG IIIB CADSES project)

Parameter / Time	t (°C)	Cond (µS cm^{-1})	TDS (g l^{-1})	S (‰)	DO (%)	O_2 (mg $^{-1}$)	pH
Nov-2004	8.8	70'283	45.7	47.5	116.3	9.9	7.4
Apr-2005	14.9	48'430	31.5	31.6	98.0	8.1	8.4

Figure 10-14: Biologists from the universities of Tirana (Albania) and Lecce (Italy) sampling in the Karavasta lagoon in November 2004 (Photo: M. Pinna).

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The silty sediment was well oxygenated in the top few millimeters along the shore and in the top centimeters in the center of the lagoon. Organic matter stayed between 7 and 18% of dry weight in the sediment. The sediment was largely made up of fine particles, more than 50% of them as clay. The sediments of the Godulla lagoon ranged from silty to silty-sandy and were also oxygenated at the surface. They were sandy around the central channel between the sea and the Karavasta lagoon. The organic content was in a range between 2.8 and 7% with the lowest values in organic matter in the sandy edges of the outer part of Godulla, north of the central channel.

The structure of the coastline of the Karavasta region changes within a short time scales, provoked by the activity of the rivers, their flow, the transport of solids and the coastal currents. This is easily seen by comparing maps of different publication date. The outer Godulla lagoon has been formed during the last century while the main Karavasta lagoon lost large parts by land reclamation. Currently the southern part of the sandy littoral cordon that separates the Godulla lagoon from the Adriatic suffers from erosion, probably because of the small amount of sediments brought in by the Semani. Hence, the Godulla lagoon tends again towards an open marine bay. The sedimentation progressed southwards in the northern part, mostly by the activity of the old bed of the Shkumbini; as a consequence several small lagoons in the southern part have been formed, like the lagoon of Spiaxhio and other small godullas (Figs. 10-2 and 10-15).

Recent shifting northward of the Shkumbini mouth (in Kulari; Fig. 10-11) will in future probably effect the sedimentation rate at the former mouth. These dynamics imply that it is difficult to maintain a direct connection between the Karavasta lagoon and the Adriatic Sea through the northern channel. In the south the second and third channel linking the Karavasta lagoon with the Godulla lagoon are currently not filled as coastal currents are lacking. However, with increasing erosion the Godulla lagoon may disappear and the central channel will become the main link between Karavasta and the sea. The northern and central exchange channels are about 700 m and 1200 m in length (Fig. 10-16), respectively. Because of the scarce tidal flow, they often need dredging to avoid their silting.

Figure 10-15: Spiaxhio lagoon (on the right) and its bordering salt marshes; the Divjaka pine forest forms the bordering belt (Photo: A. Miho).

A sandy path near the first connecting channel (first dajlan) leads the visitor to the littoral cordon of Godulla (Fig. 10-6), a newly formed habitat, also listed as Natural Monument. The Divjaka beach is one of the best preserved natural beaches in Albania, used in summer mainly by the local people from Lushnja and by visitors.

Figure 10-16: The largest connecting channel between the Karavasta and Godulla lagoons (middle channel) (Photo: A. Miho).

In the eastern part of the Divjaka beach, the dunes (Fig. 10-17) of the Divjaka oasis form a sandy belt of 20 km and often 100 m wide. It separates the lagoon from the sea, extending from the Shkumbini to the Semani mouth. It forms a continuum of the natural wetland habitats of Karavasta – Divjaka. As ecological and geomorphologic values they are specified as Natural Monuments.

Figure 10-17: New sandy dunes in the Kulari zone, near the Shkumbini delta (Photo: A. Miho).

Other unique natural habitats in the zone are the natural salt marshes around the lagoons, between the banks of the Shkumbini and Semani rivers. Open areas dominate in the basin with agricultural fields, abandoned land and areas with salt-grasses.

Forests and shrubs cover an area of about 12 km^2. In the northwest of the Karavasta lagoon the Divjaka forest spreads; it is a typical dune forest bordered east and west by brackish or freshwater habitats. In the core zone of the Divjaka NP an old mixed coniferous forest expands. Such climax forests with White poplar on the river banks prosper in the old dunes; they are mixed with shrubs in the Kulari zone and in the southern part of the dunes near the Semani delta. Although perhaps less known and studied by the scientific community, the Kulari is certainly a most fascinating natural zone in the whole complex.


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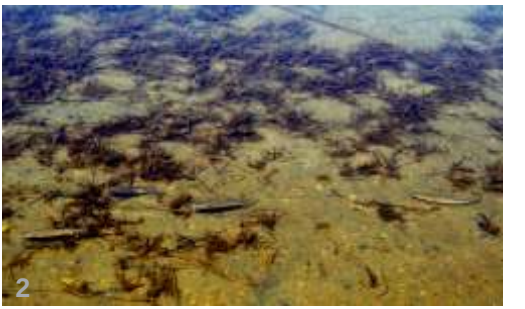
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Grasses or reed are widespread close to the littoral habitats of the lagoons. Some relict dune slacks are typical habitats of the littoral cordon; these shallow depressions run north-south through the forest and more open areas. They bear a characteristically different vegetation compared to the dunes. Usually most of them are wet during winter, but the amount of water varies from site to site as well as over the seasons.

10.5 Biodiversity of the Karavasta-Divjaka wetland

Flora

Submersed vegetation: In the Karavasta lagoon phanerogam grasses dominate. The Spiral tasselweed (*Ruppia cirrhosa*) grows mainly in the shallow mostly littoral zones, it is accompanied by macrophyte algae, like *Chaetomorpha linum, Valonia aegagropila*, *Chondria capillaris, Polysiphonia* spp. and *Ceramium diaphanum. Ulva* spp. has been found abundantly though very localized in the north of the lagoon near a freshwater inflow pipe. The specific composition of the communities of submersed phanerogams and algae in the lagoon might be a consequence of the variable salinity over time, probably the result of massive freshwater inflow during the wet seasons and the slow exchange of water during summer. The massive growth of the nitrophilic macro-algae *Chaetomorpha* and *Ulva* are likely the cause for the growth limitation of *Ruppia* observed in the Karavasta lagoon.

The submersed vegetation in the Godulla lagoon is quite diverse. Typical representatives are *Zostera noltii*, *Ruppia cirrhosa* and *Cymodocea nodosa* together with various algae (Fig. 10-18). They form dense communities up to depths of 1.8 m. The specific composition of seagrasses and algae indicate that the sea has a higher influence than in Karavasta lagoon.

««« Figure 10-18: 1-2: Dwarf eelgrass (*Zostera noltii*) and filamentous algae at the bottom of the lagoon**; 3-4:** thallus balls of the Club bubble algae (*Valonia aegagropila*) (Photos: L. Kashta and A. Miho).

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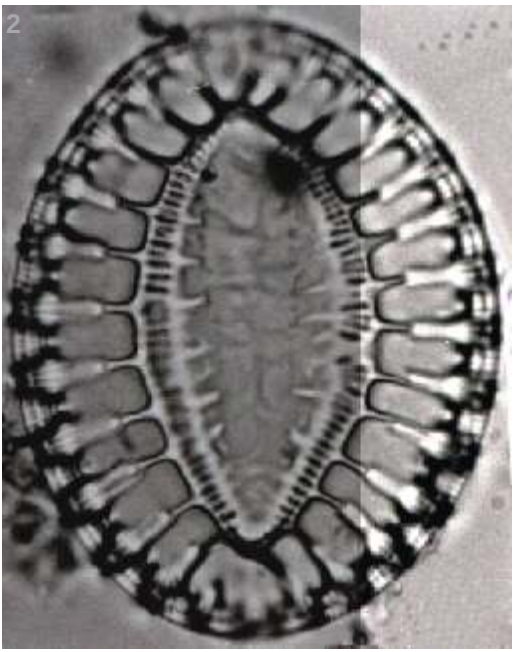
The salinity in Godulla is more stable during the year. The abundance and diversity of submersed angiosperms, as well as the abundance of the genera *Cystoseira, Laurentia* and *Polysiphonia* indicate a rather low organic pollution.

The abundance of nitrogen-loving macrophyte algae indicates significant sources of nutrients entering the Karavasta lagoon through drainage channels from the surrounding land. The trend to eutrophication is also denoted by the high nitrogen content in the sediment. So far no ecological crisis has been observed, probably because of the low level of phosphorus. In the Godulla lagoon no signs of eutrophication are apparent as the exchange with the sea is better and the Karavasta lagoon buffers land-based inflows. In the Karavasta lagoon the risk of eutrophication and turning anoxic exists at summer temperatures near 30°C unless persistent winds re-oxygenate the water body and bring the anoxic sediment back into suspension.

Phytoplankton and periphyton: About 290 microscopic algae were reported for various habitats of Karavasta (periphyton and phytoplankton; Miho *et al*., 2012), of which 260 were diatoms and 30 dinoflagellates. More than 90 algal species were present in the phytoplankton. Diatoms were often the most abundant, but seldomly outnumbered by dinoflagellates or *Cryptophyceae* (Tab. 10-3). Phytoplankton growth was weaker compared to the lagoons of Narta and Patogu (Xhulaj, 2009). The most abundant diatom species are listed in table 10-4. The phytoplankton composition and the species abundance is determined by the inadequate exchange and renewal of water, due to the lack of communication by channels with the sea. More than 200 species of diatoms were found in periphyton samples from the various habitats (Tab. 10-4); some of them are shown also in the figure 10-19.

Figure 10-19: Microscopic siliceous algae (diatoms) from the Karavasta lagoon: **1:** *Lyrella lira*; **2:** *Surirella fastuosa*; **3:** *Grammatophora oceanica* var. *oceanica*; **4:** *Nitzschia compressa* var. *compressa*; **5:** *Cocconeis scutellum* (Photos: A. Miho). **»»»**



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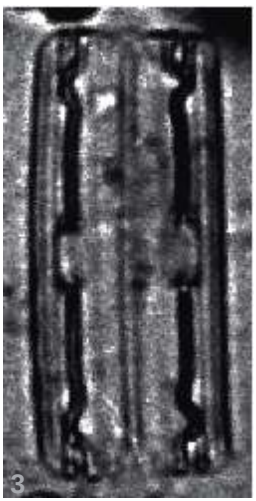

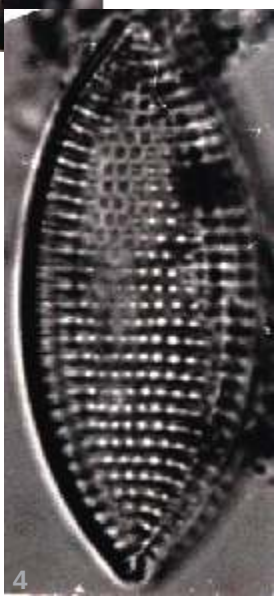

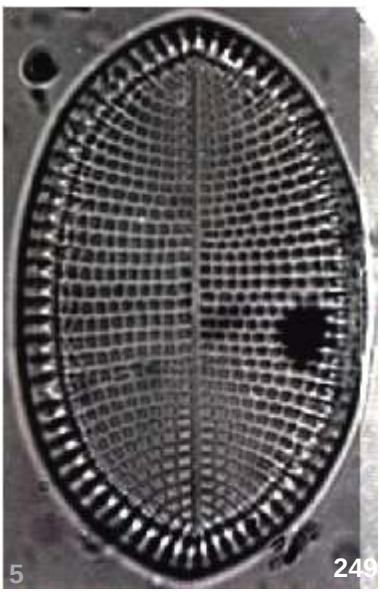

Table 10-3: Phytoplankton groups (average from two stations; cells l^{-1}) in Karavasta from 2004 to 2007 (Xhulaj, 2009).

Groups / Time	Nov-04	Apr-05	Nov-05	Apr-06	Nov-06	Apr-07
Diatoms - *Centrales*	23'100	9'800	71'800	164'900	66'100	64'200
Diatoms - *Pennales*	81'000	73'000	171'000	225'300	146'700	409'800
Dinophyceae	122'700	39'200	116'000	144'500	113'300	228'000
Cryptophyceae	62'200	259'800	96'000	111'700	89'600	260'700
Phytoflagellatae	16'000	48'600	0	0	0	159'400
Chrysophyceae	100	0	0	0	0	0
Haptophyceae	800	0	0	0	0	0
Other algae	0	0	0	5'900	0	0
Total	**305'900**	**430'400**	**454'800**	**646'400**	**415'700**	**1'122'100**

Saltmarsh vegetation: In the old dunes in the western part of the lagoon longitudinal saline pools separated by saltmarsh flats have been formed. These are dominated by glassworts like species of *Salicornia* and *Arthrocnemum* (Fig. 10-20), together with rushes and sedges (*Juncus acutus, J. gerardii, J. maritimus, Carex distans* and *C. extensa*). Towards the middle of the old dune system that separates the lagoon from the sea, the saltmarsh flats become gradually transformed into scrubland with species-rich grassland and then followed by woodland forests.

A transect from the open wetland, passing through grassland and scrubland to woodland and then to the new dunes and the beach documents most conservation key points of the Divjaka – Karavasta region. It covers a broad range of habitats in a small area and shelters an extremely diverse flora and fauna.

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Table 10-4: Most frequent phytoplankton and periphyton species; *X = present.*

Diatoms	**Characteristics**	**Phytoplankton**	**Periphyton**
Chaetoceros spp.	centric	X	
Cocconeis scutellum	pennate	X	
Cyclotella ocellata	centric	X	X
Cylindrotheca closterium	pennate	X	
Fragilaria capucina	pennate	X	X
Gomphonema parvulum	pennate		X
Melosira nummuloides	centric	X	X
Melosira varians	centric	X	
Navicula gregaria	pennate		X
Nitzschia amphibia	pennate		X
Nitzschia frustulum	pennate		X
Nitzschia longissima	pennate	X	
Nitzschia reversa	pennate	X	
Planothidium delicatulum	pennate		X
Planothidium engelbrechtii	pennate		X
Pleurosigma elongatum	pennate	X	
Stephanodiscus spp.	centric	X	
Striatella unipunctata	pennate	X	
Thalassionema nitzschioides	centric	X	
Thalassiosira weissflogii	centric	X	X
Dinoflagellates			
Alexandrium spp.		X	
Amphidinium spp.		X	
Ceratium tripos		X	
Dinophysis caudata		X	
Dinophysis rotundata	toxic, not frequent	X	
Dinophysis sacculus	toxic, not frequent	X	
Gymnodinium spp.		X	
Gymnodinium sanguineum		X	
Oxytoxum spp.		X	
Prorocentrum dentatum		X	
Prorocentrum lima	toxic, not frequent	X	
Prorocentrum micans		X	
Prorocentrum minimum	toxic, not frequent	X	
Prorocentrum scutellum		X	
Protoperidinium depressum		X	
Scrippsiella trochoidea		X	

«««« Figure 10-20: Dune slacks - habitats with halophyte grasses in littoral shallow areas of the Pine Godulla in the Divjaka strictly protected reserve (Photo: L. Kashta).

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Key representatives in the grassland at the edge of the woodland and the scrubs are the Yellow-worth (*Blackstonia perfoliata*), the Greater quaking-grass (*Briza major*), the Long-bracted sedge (*Carex extensa*), the Articulated rush (*Juncus articulatus*), the Sea lavender (*Limonium* sp.), orchids, the Black-beaked sedge (*Schoenus nigricans*) and tamarisks. In dune slacks the scrub vegetation is dominated by rushes and sedges (*Juncus acutus, J. maritimus* and *Carex extensa*), bramble (*Rubus fruticosus* agg.), the Lyme grass (*Leymus arenarius*; = *Elymus arenarius*), the Sea couch (*Elymus pycnanthus*), the Black-beaked sedge, the Purple loosestrife (*Lythrum salicaria*) and glassworts.

Freshwater vegetation: Standing freshwater in small deep ponds is found in the north of the Divjaka and in Kulari. Both are very unusual habitats which house plant species such as Pondweeds (*Potamogeton pectinatus*), the Brackish water-crowfoot (*Ranunculus baudotii*) and the Stonewort (*Chara aspera*). Tamarisks occur throughout the zone, mostly as isolated trees or shrubs and mixed with other plants. In some areas, particularly south of the Shkumbini mouth, tamarisks become the dominant vegetation.

Further north and northwest of the Divjaka (in Kulari zone), agricultural fields are separated by a complex of drainage ditches. These are the only freshwater habitats in the Karavasta – Divjaka basin besides the small ponds mentioned above. They are inhabited by plant species that tolerate a low salinity and a relatively low water quality. Typical plant species are given in the table 10-5. The terrestrial habitats in the Kulari zone are generally also wet in summer and with deep standing water during winter.

Dune grassland: The dune grassland forms a sparse cover with a few salt-tolerant grass species to stabilize the dunes. The density of the grasses increases as the dunes become more stable. Many grass species thrive here, the vegetation is dominated by the Marram grass (*Ammophila arenaria*), together with the Sea couch (*Elymus pycnanthus*) or the Curved sicklegrass (*Parapholis incurva*).

Table 10 5: Freshwater vegetation in Karavasta Divjaka complex.		
Scientific name	**Common name**	**Albanian name**
Alisma lanceolatum	Narrow-leaved water plantain	Kelkoja e ujit
Ceratophyllum submersum	Soft hornwort	Gjethebriri gati i zhytur
Juncus acutiflorus	Sharp-fruited rush	Kulmaku, Zhuka lulemprehte
Lemna gibba	Fat duckweeds	Lemna gungaçe
Lycopus europaeus	Gipsywort	Kembeujku evropian
Lythrum salicaria	Purple loosestrife	Bargjaku shelgor
Polygonum hydropiper	Water pepper	Nejca piper-uji
Potamogeton nodosus	Loddon pondweed	Potamogetoni
Schoenoplectus (Scirpus) lacustris	Common club-rush	Kryekuqi
Typha angustifolia	Lesser reedmace	Shavari, Rogozi gjethengushte
Veronica anagallis-aquatica	Blue water-speedwell	Veronika rruth-ujore

As the dunes get higher, the number of plant species increases. We find the Evening primrose (*Oenothera biennis*), the Sea daffodil (*Pancratium maritimum*), the Coastal medick (*Medicago marina*), the Sea bindweed (*Convolvulus soldanella*), the Sea holly (*Eryngium maritimum*) and the Sea spurge (*Euphorbia paralias*). On the side of the dunes towards the lagoon the vegetation merges from rushes and sedges to saltmarsh vegetation with glassworts or to scrubs. The Lesser dodder (*Cuscuta epythimum*) is also quite common in the dunes. Halophytic species are dominant in open areas, including all the surrounding fields which are dominated by halophyte grasses and agricultural or abandoned land, where Glasswort (*Salicornia fruticosa*), mixed with the Sea lavender (*Limonium vulgare*), the Sea purslane (*Halimione portulacoides*), the Sea rush (*Juncus maritimus*), the Sharp-pointed rush (*J. acutus*), the Seepweeds (*Suaeda maritima*) and the Glaucous glasswort (*Arthrocnemum glaucum*) are prevailing (Figs. 10-20 to 10-22).

Figure 10-21: Dune slacks - habitats with halophyte grasses in littoral shallow areas of the Pine Godulla in the Divjaka strictly protected reserve (Photo: L. Kashta).

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Figure 10-22: Dune slacks close to the main channel (second *dajlan*) (Photo: A. Miho).

Woodlands: Old-growth forest or primary forest of pines represents the vegetation pattern of the Divjaka with its outstanding biodiversity. The pattern of the vegetation of the park is given in table 10-6. The indigenous Aleppo pine (*Pinus halepensis*) and the Umbrella pines (*Pinus pinea*) dominate (Figs. 10-23 and 10-24), the last one planted, although in few areas also naturally spreading.

Woodland develops between the dune slacks, alongside the broad wet depressions or on the edge of the slacks. The forest grows to a dense cover, especially in the parts with a mixed tree composition, with junipers, poplars, willows and tamarisks. The forest is mixed also with deciduous vegetation, with elm (*Ulmus* spp.), ash (*Fraxinus angustifolia*), oak (*Quercus* spp.), alder (*Alnus glutinosa*) and the Judas tree (*Cercis siliquastrum*) (Fig. 10-25). In the eastern part a forest with the white poplar (*Populus alba*) borders cultivated fields, while in Kulari (Fig. 10-24), a mixed forest of elm, narrow leaf ash, oaks and pines covers some hundreds of hectares.

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Table 10-6: Vegetation pattern and endangered species in Divjaka National Park (Ruci *et al.*, in Ricciardi *et al.*, 2000; *Anonymous,* 1997).

Dominant species	Species deserving attention	Species deserving high attention	Local resources
Erica verticillata *Myrtus communis* *Pinus halepensis* *Pinus pinea* *Pistacia lentiscus*	*Ammophila arenaria* *Aster albanicus* ssp. *paparistoi* *Juniperus oxycedrus* ssp. *macrocarpa* *Lepiota procera* *Orchis albanica*	*Adiantum capillus -veneris* *Clathrus ruber* *Dryopteris filix -mas* *Fraxinus angustifolia* *Hydrocotyle vulgaris* *Quercus robur* *Sarcosphaera crassa*	*Morchella conica* *Pancratium maritimum* *Pinus pinea* *Populus alba*

Figure 10-23: Habitats with halophyte grasses in littoral shallow areas of the Pine Godulla in the Divjaka Strictly Protected Reserve (Photos: L. Kashta).

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In some areas, especially in Kulari, old-growth umbrella pines form an open canopy above shrubs and open ground. In some places there are small spots of lower canopy under the pines, dominated often by the Common myrtle (*Myrtus communis*), junipers (*Juniperus* spp.), the Butcher's broom (*Ruscus aculeatus*), brooms (*Cytisus* spp.) and hawthorns (*Crataegus* spp.).

Where the ground is dry in the highest zones of relict dunes, the pine woodland has a heath-like ground flora rich in lichens and mosses (i.e. *Pseudoscleropodium purum*), ericaceous species or shrubs. Other typical plants include the Greater quaking-grass (*Briza maxima*), bents (*Agrostis* spp.), bromes (*Bromus* spp.) and stands of sedges (*Carex arenaria* and *C. binervis*). At a higher grounds orchids, ferns (*Adiantum capillus-veneris, Dryopteris filix-mas, Pteridium aquilinum*), mushrooms (*Clathrus ruber, Lepiota procera, Sarcosphaera crassa, Morchella conica*) are abundant, as well as a second canopy of myrtle.

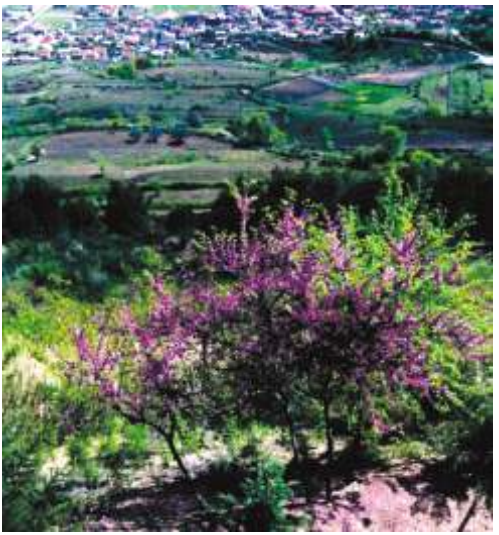

Figure 10-25: The Judas tree (*Cercis siliquastrum*) in the Ardenica hills (Lushnja) (Photo: O. Nika).

On the edge of shaded slacks these communities pass into wetland communities with an intermediate sedge zone. Rare and endemic species grow in such habitats, like *Aster albanicus* ssp. *paparistoi* (chromosome number 2n=18) (Fig. 10-27), *Orchis albanica* (=*Anacamptis morio* ssp. *caucasica*) and *Orchis* x *paparistoi* (*Orchis albanica* x *O. coriophora*).

The woodland scrub community represents the second canopy with a dense cover (>60%) of bushes and shrubs of one to 5 m height. Juniper (*Juniperus oxycedrus* ssp. *macrocarpa*) forms often the link between woodlands and scrubs (Fig. 10-28). Dominant plants of the scrub canopy are mastic (*Pistacia lentiscus*) and heath (*Erica arborea*, *E. manipuliflora*), mixed with roses (*Rosa* spp.), privet (*Ligustrum vulgare*), hawthorn (*Crataegus monogyna*), junipers (*Juniperus* spp.), bramble (*Rubus fruticosus*), dogwood (*Cornus sanguinea*), wild madder (*Rubia peregrina*) and butcher's broom (*Ruscus aculeatus*). Often some deciduous trees, like elm and white poplar, grow within the scrub formations, even a few sporadic apple trees (*Malus* spp.) are found in the Divjaka NP.

«««« Figure 10-24: Old-growth forests from the Divjaka-Karavasta zones: ***above,*** Canopies of Aleppo pines and Umbrella pines in the Divjaka National Park; ***below,*** an old-growth forest with White poplar in the Kulari zone (Photos: A. Miho and L. Kashta).

Table 10 - 7: Plant biodiversity in relict dune slacks.		
Scientific name	**Common name**	**Albanian name**
Alisma lanceolatum	Narrow leaved water plantain	Kelkoja e ujit
Bolboschoenus maritimus	Sea club-rush	Bolboskeni bregdetar
Carex binervis	Sedges	Presja
Carex extensa		Presja e zgjeruar
Carex otrubae		Presja
Cyperus fuscus	Brown galingale	Truska e zeshket
Euphrasia spp.	Eyebrights	Eufrazia
Hydrocotyle vulgaris	Marsh-pennywort	Hidrokotili
Iris pseudoacorus	Yellow flag	Badra e ujit
Juncus maritimus	Sea rush	Kulmaku, Zhuka bregdetare
Limonium spp.	Sea lavender	Fshesa
Lycopus europaeus	Gipsywort	Kembeujku evropian
Lythrum salicaria	Purple loosestrife	Bargjaku shelgor
Rubus spp.	Brambles	Manaferra
Rumex conglomeratus	Clustered dock	Lepjeta lemshuke
Samolus valerandi	Brookweed	Samoli i Valerandit
Schoenoplectus spp. *(=Scirpus* spp.)	Tall club rushes	Kryyekuqi
Smilax aspera	Arkoudovatos	Morenza
Typha angustifolia	Lesser reedmace	Shavari, Rogozi gjethengushte

Figure 10-27: Main plant species from the Divjaka-Karavasta zones: **1-2:** True myrtle (*Myrtus communis*) (Divjaka); **3-4:** *Juniperus oxycedrus* ssp. *macrocarpa* (Photos: L. Kashta).

«««« Figure 10-26: Main plant species from the Divjaka-Karavasta zone: **1-2:** *Aster albanicus* ssp. *paparistoi*; **3:** *Convolvulus soldanella* (Photos: L. Kashta).

The woodland ground flora is marginal and consists of few scattered plants. When the canopy opens up, species-rich dry grassland develops with Carnation sedge (*Carex flacca*), thistles (*Carlina* sp., *Cirsium vulgare*), Wild carrot (*Daucus carota*), Small-headed blue eryngo (*Eryngium creticum*), Cut-leaved geranium (*Geranium dissectum*), plantains (*Plantago lanceolata, P. major*), Creeping cinquefoil (*Potentilla reptans*), Bracken (*Pteridium aquilinum*) and clover (*Trifolium* spp.). Other elements of the scrub layer are the Scattered brooms, Blackthorn (*Prunus spinosa*), Butcher's broom (*Ruscus aculeatus*) with climbers such as Ivy (*Hedera helix*) and Arkoudovatos (*Smilax aspera*). Grasses are often dominant with Wild-wheat (*Aegilops ovata*), Lesser quaking-grass (*Briza minor*), Hairy-brome (*Bromus ramosus*), Bermuda-grass (*Cynodon dactylon*) and Hare's tail grass (*Lagurus ovatus*).

The relict dune slacks are often below the water table and its water varies from deep salty water to shallow largely freshwater. Under a closed canopy sparse vegetation is found with the aquatic flora of the wetlands in open canopy. The dune slacks that cross the Divjaka forest longitudinally in the northern part are usually broader and have either a canopy of broadleaves with oaks and ash, or are open. Some of them are of high biodiversity as illustrated in table 10-7.

Fauna

A rich and particular fauna is sheltered in the mosaic of the diverse habitats of the Karavasta-Divjaka wetlands. The large number of bird species represents possibly the most significant ecological value, with about 228 species recorded in the different habitats. About 29 amphibians and reptiles and 25 mammals complete the rich animal diversity. Many rare or vulnerable animal species are found, on the national, regional but also on a global scale.

Figure 10-28: Reptiles form the Divjaka – Karavasta complex: **1:** Balkan wall lizard (*Podarcis taurica*); **2:** European glass lizard (*Ophisaurus apodus*, =*Pseudopus apodus*); **3:** Hermann's tortoise (*Testudo hermanni*) (Photos: I. Haxhiu and A. Miho).

Figure 10-29: Animals form the Divjaka – Karavasta complex: **1-1':** shells of the mollusk *Abra tenuis;* **2:** shell of the mollusk *Rissoa labiosa;* **3:** a cicada (*Cicadoidea*) (Photos: S. Beqiraj and A. Miho).

About 12 species of mammals, 16 species of reptiles and amphibians and more than 210 species of birds are listed in the Red Book of Albanian Fauna. These species have a national conservation state and are present in the List of Wetlands of International Importance (Ramsar). The list of rare or vulnerable species of animals from the Karavasta – Divjaka complex is given in table 10-8. Animal species form the Divjaka – Karavasta complex are illustrated in figures 10-28, 10-29, 10-31 and 10-32.

Lagoons: The macro-zoobenthos is dominated by mollusks, annelids and crustaceans. The rich invertebrate fauna reflects outstanding ecological conditions and a high degree of protection compared to other Albanian lagoons. In the most important habitats of brackish water, including the lagoons of Karavasta, Godulla and Spiaxho, a total of 120 benthic invertebrate species has been reported, 22 foraminifers, 5 sponges, 1 cnidarian, 2 nemerteans, 5 bryozoans, 36 mollusks (20 gastropods and 16 bivalves), 23 polychaetes, 4 oligochaetes, 20 crustaceans, one chironomid (larvae) and one ascidian.

Concerning mollusks and crustaceans the Karavasta lagoon houses a quite higher number of species than the other lagoons, while the highest number of species of other groups has been found in the Godulla lagoon, probably because Godulla has a more active and regular water exchange with the sea. The lowest diversity was observed in the Spiaxho lagoon, the smallest brackish water body.

Table 10-8: List of rare or vulnerable species of animals from the Karavasta – Divjaka complex (*Anonymous*, 1997); *G, globally endangered; R, regionally endangered.*

Scientific name	Common name	Albanian name	Status
Aquila clanga	Spotted eagle	Shqipja e rosave	G
Circus macrorus	Pallid harrier	Shqipja e stepave	G
Glareola pratincola	Collared pratincole	Dallendyshja e detit	R
Haliaetus albicilla	White-tailed eagle	Shqipja e detit	G
Lutra lutra	European otter	Vidra, Lunderza	G
Oxyura leucocephala	White-headed duck	Rosa kryebardhe	G
Pelecanus crispus	Dalmatian pelican	Pelikani kaçurrel	G
Phalacrocorax pygmaeus	Pygmy cormorant	Karabullaku i vogel	G
Rhinolophus ferrumequinum	Greater horseshoe bat	Lakuriqi hundepatkua	G
Sterna albifrons	Little tern	Dallendyshja e detit ballbardhe	R
Testudo hermanni	Hermann's tortoise	Breshka e zakonshme	G

Table 10-9: Waterfowl in the Karavasta complex.

Scientific name	Common name	Albanian name
Anas acuta	Dabbling duck	Rosa bishtgjele, Bishtagjeli
Anas clypeata	Dabbling duck	Rosa sqepluge
Anas crecca	Dabbling duck	Rosa kerre
Anas penelope	Dabbling duck	Rosa kryekuqe
Anas platyrhynchos	Dabbling duck	Rosa jeshile
Anas querquedula	Dabbling duck	Marsakja, Marsatorja
Anas strepera	Dabbling duck	Rosa e perhime
Aythya ferina	Pochard	Kryekuqja e mjeme
Aythya fuligula	Duck	Rosa laramane me çafke
Bucephala clangula	Golden eye	Rosa me kater sy
Cygnus columbianus	Swan, rare	Mjellma kolumbiane
Cygnus olor	Swan, rare	Mjellma me xhunge
Fulica atra	Coot	Bajza, Bajukla, Bajuka
Mergus serrator	Red-breasted merganser	Zhytesi i mesem me çallme
Oxyura leucocephala	Duck	Rosa kryebardhe
Pelecanus crispus	Dalmatian pelican	Pelikani kaçurrel
Phalacrocorax carbo	Cormorant	Karabullaku i detit
Phalacrocorax pygmaeus	Cormorant	Karabullaku i vogel, Vrançi
Sterna caspia	Tern	Dallendyshja e madhe e detit

Most species of typical brackish water fauna have been found in the Karavasta lagoon; examples are *Ventrosia ventrosa, Pirenella conica, Cerastoderma glaucum, Abra segmentum, Idotea baltica,* or *Corophium orientale,* the last with the highest relative abundance. On hard grounds, e.g. on submerged wood material, marine species typical for areas rich in organic matter were present besides the characteristic ones of brackish water, like *Balanus eburneus, Conopeum seurati, Chthamalus stellatus, Chthamalus montagui, Balanus amphitrite* and *Mytilus galloprovincialis*. Recently, the presence of the invasive Blue crab *Callinectes sapidus* has been recorded at the Erzeni mouth.

Interestingly the non-biting midges *Chironomus salinarius* breed often in huge numbers in the freshwater wetlands of the zone. They are often mistaken for mosquitoes, but are completely harmless to humans. In fact they have a valuable beneficial function for plants by recycling accumulated detritus to nutrients.

During the bird migration period and in the winter the lagoon system attracts a large number of waterfowl that feed on the submerged vegetation, some are given in table 10-9. The most important habitats of the lagoons for birds are the small islands or *sopes* as called by local people. They are formed of glasswort beds. In fact the Dalmatian pelican nests now only on one of these islands in the strictly protected area of the Divjaka NP (Figs. 10-30 and 10-31). Due to an increasing disruption of habitats in other parts, it left both the Kulari zone and the Karavasta lagoon. As these islands are safe from predators and humans many other breeding birds of the lagoons nest here, i.e. the Collared pratincole (*Glareola pratincola*) and the Little tern (*Sterna albifrons*). Perfect habitats for certain birds exist also in shallow water; these are rich in invertebrates, covered by the water tides and visited by herons and waders. In the lagoons of Godulla and Spiaxho, migratory species are often observed (Tab. 10-10).

Figure 10-30: Pine Godulla in the Divjaka Strictly Protected Reserve; the Dalmatian pelican nests on the small island (*sope*) in the middle of the lagoon (Photos: L. Kashta).

Table 10-10: Birds in shallow water of Karavasta complex.			
Scientific name	**Common name**	**Albanian name**	**Occurence**
Ardea cinerea	Heron	Çafka e perhime	
Calidris alpina	Wading bird	Gjeleza gushezeze, Gjelaci barkzi	
Charadrius dubius	Little ringed plover	Vrapuesi i vogel	migratory, Godulla-Spiaxho
Charadrius hiaticula	Plover	Vrapuesi qafezi	migratory, Godulla-Spiaxho
Egretta garzetta	Heron	Çafka e bardhe e vogel	
Limosa lapponica	Godwit	Gjeleza e madhe bishtvijezuar	migratory, Godu lla-Spiaxho
Limosa limosa	Godwit	Gjelëza e madhe bishtzeze, Gjelaci bishtzi	migratory, Godulla-Spiaxho
Numenius arquata	Wading bird	Kojliku i madh, Kthinza	
Numenius phaeopus	Whimbrel	Kojliku mesatar	migratory, Godulla-Spiaxho
Pluvialis apricaria	Plover	Gjelaci pikalosh ngjyre ari, Vrapuesi i arte	
Pluvialis squatarola	Plover	Gjeleza pikaloshe, Vrapuesi i hirte	migratory, Godulla-Spiaxho
Recurvirostra avosetta	Wading bird	Sqepbiza, Sqepshpata kembekalter, Korana	
Tadorna tadorna	Heron	Larosh ja, Shota	

Figure 10-31: A couple of the Dalmatian pelican in the Karavasta lagoon (Photo: F. Bego).

Figure 10-32: The Black-winged Stilt (*Himantopus himantopus*) flying in the Divjaka forest (***above***) and in its habitat there (***below***) (Photo: F. Bego).

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The fish community of the Karavasta and Godulla lagoons is the typical one of Mediterranean lagoons with the two groups of migratory and sedentary fish. *Sparidae, Mugilidae, Moronidae, Soleidae, Anguillidae* and *Belonidae* are the main families of migratory species. *Gobiidae, Cyprinodontidae, Atherinidae* and *Syngnathidae* are important as sedentary forms, although some of them also migrate. Most common and frequent are the species *Sparus aurata*, *Mugil cephalus, Solea vulgaris, Belone belone, Dicentrarchus labrax*, *Gobius bucchichi*, members of the *Cyprinodontidae, Atherina boyeri* and *Syngnathus* spp. The Loggerhead turtle (*Caretta caretta*) is also casually visiting the coastal water.

In the shallower areas of the Karavasta lagoon at depths less than 0.6 m, the toothcarp *Aphanius fasciatus* is the dominant species. It is an indicator of enclosed areas and eutrophic habitats. More species within this habitat are listed in table 10-11. The Godulla lagoon harbours a slightly different community with the Sand smelt (*Atherina hepsetus*) as the most abundant species.

Table 10 -11: Fish community in Karavasta and Godulla lagoon.
K = Karavasta lagoon ; G = Godulla lagoon

Scientific name	Common name	Albanian name	Occurence
Aphanius fasciatus	Toothcarp	Çeliku me rripa	G, K, most dominant
Atherina boyeri	Big-scale sand smelt	Aterina symadhe	K
Atherina hepsetus	Sand smelt	Aterina, Terina, Gavoni	G, most dominant
Belone belone	Garfish	Peshku lejlek	K, rare
Carcinus aestuarii	Crab	Gerthia, Gredhja e barishteve	K
Dicentrarchus labrax	Sea bass	Levreku	G
Gobius bucchichi	Goby	Burdullaku	G, K
Mugil cephalus	Mullet	Qefulli i veres	G, K
Palaemon serratus	Shrimp	Karkalec	G, K, rare
Solea spp.	Flatfish	Gjuheza	G
Syngnathus spp.	Pipefish	Peshku gjelpere	G, K

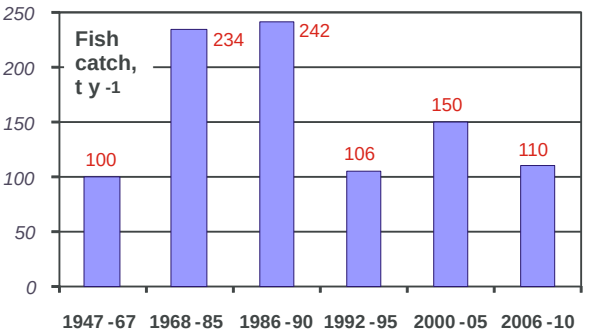

Figure 10-33: ***Left:*** fish yield in the Karavasta lagoon between 1947 and 2010 (Management Plan of Ramsar site of Karavasta, 1996; Flloko, 2004; Çobani (2011)); ***below:*** fish traps (*dajlan*) in the first connecting channel of the Karavasta lagoon (Photo: L. Kashta).

Fish capture in Karavasta decreased compared with the period before 1990 (Fig 10-33). The fish yield is reported to be about 110 t per year. However, it is the highest one for all Albanian lagoons and represents about 40% of the total national fish catch (see Chapter 5).

Cooperatives with up to 90 persons make their living on fishing in the sea along the coast and in the lagoon. They mainly operate with fish weir in the channels and with gill nets and hooks, they also use eel traps. The Karavasta fishery relies quantitatively on mullets and eels, less on sea bass and gilthead bream. Eel contributes the biggest share to the income from fishery, followed by sea bass, gilt-head bream, flatfish and mullets. Fish caught in the traps amounts for about 15% of the income.

Saltmarsh beds: The longitudinal saline pools and dune slacks and the saltmarsh with glassworts provide good feeding habitats for a number of birds, especially for herons (*Egretta garzetta, E. alba, Ardea cinerea, Ardeola ralloides, Nycticorax nycticorax*) and waders (*Himantopus himantopus;* Fig. 10-32), *Tringa erythropus, T. totanus, T. nebularia, T. glareola, T. stagnatilis, Larus genei*). The saltmarsh offers nesting habitats for the Crested lark (*Galerida cristata*) and the Black-headed wagtail (*Motacilla flava* ssp. *feldegg*) and feeding sites for a wide range of migratory species.

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Freshwater: There are only few types of freshwater habitats in the Karavasta-Divjaka complex, some small deep ponds, the drainage channels of the Divjaka, Terbufi and Karavasta plains and the watercourses of the rivers Shkumbini and Semani. Small channels and ponds offer excellent habitats for all kinds of animals. In the freshwater channels of open areas many amphibians or reptiles find their refuge. The amphibians recorded in the area are toads (*Bufo bufo* and *B. viridis*) and frogs (*Hyla arborea, Rana dalmatina, R. balkanica, R. lessonae*). The European pond terrapin (*Emys orbicularis*) and the Grass snake (*Natrix natrix*) are also present. Among the freshwater insects many dragonflies have been listed, like *Anax partenope, Ishnura elegans, Lestes sponsa, L. viridus, Platycnemis pennipes* and *Sympetrum sanguineum*.

Bird species typical for freshwater habitats are the Penduline tit (*Remiz pendulinus*) and the Bee-eater (*Merops apiaster*); the last one is found only in the Kulari zone.

The European otter (*Lutra lutra*) is also regularly met on the riverbanks of the Shkumbini. Many freshwater habitats are as well crucial for supporting life of the terrestrial biota.

Dune grassland: Dune habitats with sparse salt-tolerant vegetation including typical elements of open mudflats or sandy beaches are of low diversity concerning birds, we find wagtails (*Motacilla flava* ssp. *feldegg*, *M. alba, M. cinerea*), the Tawny pipit (*Anthus campestris*), plovers (*Charadrius alexandrinus* and *C. dubius*), the Stone curlew (*Burhinos oedicnemus*), the Collared pratincole (*Glareola pratincola*), the Yellow-legged herring gull (*Larus cachinnans*), terns (*Sterna hirundo, S. albifrons*), the Fan-tailed warbler (*Cisticola juncidis*) and the Oystercatcher (*Haematopus ostralegus*).

Old-growth coniferous woodland: The bird life of the woodland differs significantly from that of the other habitats. Important representatives are listed in table 10-12. In forest habitats reptiles, like the Hermann's tortoise (*Testudo hermanni*), the European glass lizard (*Ophisaurus apodus*), lizards (*Podarcis muralis* and *P. taurica*) (Fig. 10-28), and snakes (*Coluber jugularis, Elaphe longissima* and *E. quatuorlineata*) are well known.

Table 10-12: Bird live in old-growth coniferous woodland.			
Scientific name	**Common name**	**Albanian name**	**Occurence**
Accipiter gentilis	Goshawk	Gjeraqina	
Aegithalos caudatus	Long-tailed tit	Trishtili bishtgjate	
Asio otus	Long-eared owl	Bufi veshgjate, Hutini i vogel	
Buteo buteo	Buzzard	Huta, Orli, Petriti minjngrenes	
Caprimulgus europaeus	Nightjar	Dallendysh e nate	
Carduelis chloris	Greenfinch	Verdulli, Verduni	
Circa etus gallicus	Short-toed eagle	Shqiponja e gjarpinjve	observed in deciduous woodland in the northern part (Kulari zone)
Circus pygargus	Montagu's harrier	Shqipja e baltakeve	migrating
Dendrocopus major	Woodpecker	Qukapiku larosh kurrizbardhe, Q. i madh	
Dendrocopus minor	Woodpecker	Qukapiku i vogel larosh	
Dendrocopus syriacus	Woodpecker	Qukapiku i zakonshem larosh	
Falco subbuteo	Hobby	Skifteri i drureve	
Falco vespertinus	Red-footed falcon	Skifteri kembekuq	migrating
Garrulus glandarius	Jay	Grifsha, Grizhlemza, Çota	
Haliaetus albicilla	White-tailed eagle	Shqiponja e detit, Shqipja e detit	
Hieraaetus pennatus	Booted eagle	Shqiponja e vogel, Shqiponja shkurtabiqe	migrating
Hippolais pallida	Olivaceous warbler	Perqeshesi i vogel i ullinjve	
Lanius senator	Woodc hat shrike	Larashi kokekuq	
Lullula arborea	Wood lark	Drenja	
Luscinia megarhynchos	Nightingale	Bilbili, Bylbyli	
Milvus migrans	Black kite	Qifti zeshkan, Huta e zeze bishtgershere, Kaçubeti zeshkan	
Muscicapa striata	Spotted flycatcher	Mizekapesi i perhimte	
Oriolus oriolus	Golden oriole	Bengu, Ficka, Fikesi	
Pandion haliaetus	Osprey	Shqiponja, Petriti peshkngrenes	migrating
Parus caeruleus	Tit	Trishtili i kaltert, Trinka	
Parus major	Tit	Trishtili i madh	
Pernis apivorus	Honey buzzard	Huta, Petriti grenxangrenes	
Phylloscopus collybita	Chiffchaff	Fishkellyesi i vogel	
Streptopelia turtur	Turtle dove	Turtulli, Turtullesha	
Sylvia atricapilla	Warbler	Bilbilthi kapezi	Scrub habitats
Sylvia cantillans	Warbler	Bilbilthi gushekuq	Scrub habitats
Sylvia communis	Warbler	Bilbilthi i perhimte	Scrub habitats
Sylvia melanocephala	Warbler	Bilbilthi kokezi	Scrub habitats

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Less abundant are the Slow worm (*Anguis fragilis*), the Snake-eyed skink (*Ablepharus kitaibelii*) and the Nose-honed viper (*Vipera ammodytes*).

The forest and scrub habitats provide many protected sites for mammals, like the Red fox (*Vulpes vulpes*), the Golden jackal (*Canis aureus*), the Badger (*Meles meles*), wood mice (*Apodemus sylvaticus* and *A. flavicollis*), the Lesser white-toothed shrew (*Crocidura suaveolens*) which is found also in the dune vegetation, the Greater horseshoe bat (*Rhinolophus ferrumequinum*) and the Weasel (*Mustela nivalis*). The Etruscan shrew (*Suncus etruscus*) lives mainly in the open grassland. Most notably was the presence of Roe deer (*Capreolus capreolus*) and of the domestic Water buffalo (*Bubalus bubalis*; Fig. 10-34) which lived before 1990 hidden in the fenced Divjaka NP. At present, few individuals of this rare and endangered species are only found domesticated in the Divjaka farms.

Agricultural zones: In the eastern part, agricultural land extends between the surrounding hills and the Karavasta lagoon. It is cultivated mainly with vegetables and fruit trees and less with cereals. Approaching the lagoon, the salt content in water and soil increases gradually. Thus many crops are no more able to grow. The bordering zone is used for cattle-grazing.

Figure 10-34: Domestic buffalo, descendant of the water buffalo (*Bubalus bubalis*) (Photo: A. Miho)

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This open grazing land and the agricultural fields remain still valuable breeding and feeding habitats for a number of birds. Birds that like open areas are larks (*Melanocorypha calandra, Galerida cristata, Alauda arvensis, Calandrella brachydactyla*), the Collared pratincole (*Glareola pratincola*) and swallows (*Hirundo rustica*). These habitats provide also a very important breeding habitat for the Common quail (*Coturnix coturnix*) which is becoming rare.

Outside the breeding season the high abundance of cereal crops and the good visibility provide a sound protection from predators. This makes these areas attractive for small seed eating birds, like the sparrows (*Passer domesticus, P. hispaniolensis, P. montanus*), the finches (*Fringilla coelebs, F. montifringilla, Serinus serinus, Carduelis chloris, C. carduelis, C. cannabina*) and the buntings (*Emberiza cirlus, E. schoeniclus, E. citronella, Milaria calandra, Malanocorypha calandra*).

Abandoned fields offer during the wet period appropriate feeding places for waders, like the Ruff (*Philomachus pugnax*) or breeding areas for some rare species like the Stone curlew (*Burhinus oedicnemus*), the Crested lark (*Galerida cristata*), the Skylark (*Alauda arvensis*) and the Short-toed lark (*Calandrella brachydactyla*). During winter these open areas offer feeding places for the Chaffinch (*Fringilla coelebs*), the Brambling (*F. montifrigilla*), the Spanish sparrow (*Passer hispaniolensis*) and others.

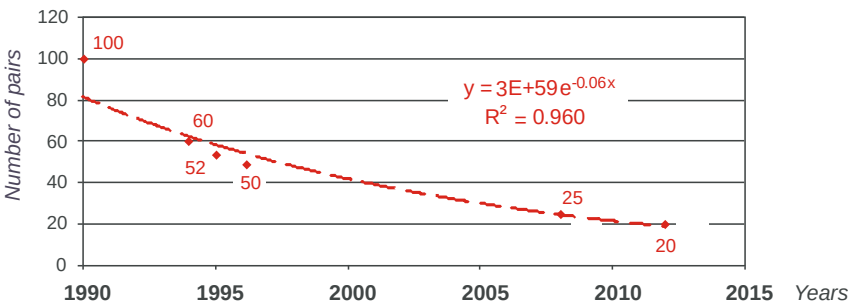

Figure 10-35: Number of couples of the Dalmatian pelican observed in the Karavasta area during the past decades (Gjiknuri, 1994; Hafner, 1996; personal data).

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Human activities like hunting, fishing and swimming are regulated and/or restricted in the different parts of the protected complex. Unfortunately these directives seems neither thoroughly applied nor strictly controlled and punished. The management authorities seems still ineffective, which is easily observed from the chaotic urbanization of the Divjaka beach, the missing awareness of a solid waste management, the misuse of vehicles or hunting. The unsustainable behavior of people in the Karavasta Reserve cannot be better visualized than by the near exponential decrease of the number of the Dalmatian pelican from over 100 couples before 1990 to about 20-25 couples at present (Fis. 10-35).

Figure 10-36: Karavasta wetlandss (Photo: A. Miho).

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