

5. Transitional waters of Albania, overview on their state and protection

The most important transitional habitats, coastal wetlands and lagoons extend along the coastline of the Adriatic Lowlands. The sea has a strong impact on the coast as sea water may penetrate into the territory up to several kilometers mainly through the fluvial estuaries and rivers. Drainage channels and remains of former brackish marshes or coastal lagoons become flooded. Saline wetlands with salt concentrations from 2 to 10‰ are formed, often with a high incidence of halophyte microscopic algae. Most of these sites are also populated by migratory sea fish or water-birds. These ecological and biodiversity variations are important in these transitional habitats. Most important transitional sites along the Albanian coast, listed from North to South, are given in table 5-1, and also shown on the map in figure 5-1. They will be discussed in detail in the following chapters with their physico-geographical, hydrological and biological features.

5.1. General information about transitional values of the coastal zone

As discussed in previous chapters, only the Adriatic coast is generally of low altitude, with many fluvial deltas and lagoons, with dunes and beaches; the estuaries of the biggest Albanian rivers are here, such as of Buna, Drini, Mati, Ishmi, Erzeni, Shkumbini, Semani and Vjosa. The Adriatic Lowlands is the biggest plain of Albania (about $\frac{1}{4}$ of Albanian territory), but also in the whole Eastern Adriatic, and one of the biggest plains in Balkan. Therefore the Adriatic coast is distinguished for its very strong dynamics, expressed from the accumulation processes that push the coastal line towards the sea in some parts, and strong erosion at some beaches with the sea advancing towards the land in some sectors.

Table 5-1: Important coastal wetlands and related sites along the Albanian coast, listed from North to South (Mima <i>et al.</i> , 2006; updated; Tab. 5-4).		
Habitats (Districts)	Fluvial watershed	Surface, km²
Shkodra wetlands		
Viluni Lagoon	Buna / Bojana and Drini / Drim of Shkodra	230 km ²
Velipoja Reserve, including Buna delta		
Freshwater marshes of Buna, with Murteme, Kakarriqi, Domni and Pentari		
Buna / Bojana River		
Shkodra / Skadar Lake		265 km ²
Lezha wetlands		
Merxhani, Knalla and Kulari lagoons, and Kune in the northern part of Drini delta	Drini of Lezha	44 km ²
Knalla wetlands in the northern part of Drini delta		
Ceka and Zaje lagoons, and Vaini forest in the Southern part of Drini delta		
Tale -Old river bed of Mati	Mati	
Kurbini wetlands		
Patogu Lagoon with the deltas of Mati and Ishmi	Mati	50 km ²
Durresi-Kavaja wetlands		
Lalzi wetlands (Bishtaraka marsh and Erzeni delta)	Erzeni	17.8 km ²
Aquaculture farm of Karpeni (Kavaja)	Kavaja	4.6 km ²
Lushnja wetlands		
Karavasta -Divjaka wetland complex	Shkumbini	222 km ²
Fieri wetlands		
Semani Delta	Semani	48.5 km
Old riverbed of Semani		0.8 km ²
Roskoveci marsh		1.3 km ²
Vlora wetlands		
Vjosa-Narta: Narta lagoon, Dajlani cape marsh, Saline and Kallenga lagoons; Vjosa estuary	Vjosa	197 km ²
Orikumi lagoon	Dukati	8 km ²
Saranda wetlands		
Butrinti-Çuka-Stillo: Butrinti lake, Bufi or Rreza lake, and estuaries of Bistrice and Pavlla	Bistrice	135 km ²



Figure 5-1: Hydrographic map of Albania with the most important transitional wetlands labelled as red squares (modified after UNEP, 2000).

These processes produce rapid changes and in a large extent along the coastal line. Kabo (1990) estimated that the accumulation processes doubled the erosion loss at the Adriatic beaches (see chapter 4.1).

The coastal lowlands, both at the Adriatic and the Ionian coast, have been formed by the depositing activity of the rivers since the end of the Pliocene and during the whole Quaternary. In the middle of the 20th century up to 45% of the plains were wetlands, marshy, swampy and muddy, and often flooded by the rivers. After 1950, a large part of the lowlands were drained and transformed into agricultural land. More than 400 km² of new agricultural land was gained and more than 1000 km² improved in soil quality. Rivers were modified by dams and some even redirected, like the Drini in Lezha or the Gjadri, Ishmi, Droja and Bistrica. Important drainage channels and pumping stations have been installed to prevent the plains from flooding, i.e. in Hoxhara, Terbufi, Divjaka, Durresi, Mata, Kakarriqi, Velipoja or Butrinti.

Presently the coastal lowlands of Shkodra, Lezha and Durresi often become flooded as a result of increased rainfall and storms. Deforestation in the hilly and mountain part of the watersheds is a primary cause for the excessive erosion by the rivers and a higher level of the groundwater table in the lowlands.

It is obvious that the transitional sites are found along the Adriatic coast. They are important not only for Albania but for the whole Adriatic coastal belt. The Ionian coast is generally mountainous and rocky, with a single plain part in the South with the Butrinti Lake and its transitional values. Data about the different coastal wetland types are summarized in table 5-1 and illustrated in figures 5-1 and 5-2. All the information given in this chapter is based mainly on the inventory of Albanian wetlands, published by Mima *et al.* (2006), and updated with the data on the Protected Areas from MoEFWA (2012) .

5.2. The principal biological values of the transitional wetlands

Only a brief summary on the main biological values are given here. Details are discussed and illustrated in the following chapters for each transitional zone separately.

Flora and vegetation: Reed beds cover large areas around the coastal lagoons, in channels, ponds or freshwater marshes composed mainly of Common reed (*Phragmites australis*), Bulrush (*Typha latifolia*) and *Scirpus* spp. *diverse*. Other tall monocots adapted growing in wet conditions, such as species of *Carex*, *Scirpus*, *Juncus*, Yellow iris (*Iris pseudacorus*) and related genera prosper together with dicots such as common Water-plantain (*Alisma plantago-aquatica*), glasswort (*Arthrocnemum glaucum*), Water mint (*Mentha aquatica*), Brooklime (*Veronica beccabunga*), Chaste tree (*Vitex agnus-castus*) and tamarisks (*Tamarix* spp. *diverse*).

Primary production of brackish waters is powered by more than 800 taxa of microscopic algae, mostly diatoms, followed by dinoflagellates. The bottom of the lagoons is often inhabited by the submersed species, dominated by *Zostera noltii*, *Ruppia cirrhosa* and *R. maritima*, mixed also with macrophyte algae (*Chaetomorpha linum*, *Ulva intestinalis*, *Cladophora* spp., *Gracillaria* spp., *Ulva* spp., *Valonia aegagropila*, etc.). *Z. noltii* is the most widespread in all the lagoons, covering about 40-50% of the muddy bottom, forming often submersed prairies; *Ruppia cirrhosa* grows in the most protected habitats with calm and shallow waters, accompanied often by green algae, i.e. *Chaetomorpha*. In calm and fresh water, floating duckweeds often develop mainly *Lemna minor* or *L. Gibba*, occasionally mixed with *Spirodela polyrhiza*. In the littoral parts with less salinity, various *Potamogeton* species sprout.

In the coastal wetlands and dunes we find halophytes, psamophytes and other brackish and freshwater associations, represented by *Ammophila arenaria*, *Arthrocnemum* spp., *Artemisia caerulea*, *Cakile maritima*, *Ephedra distachya*, *Inula crithmoides*, *Juncus maritimus*, *Limonium vulgare*, *Schoenus nigricans*, *Salicornia europaea*, *Sporobolus pungens* or *Xanthium italicum*.

Woodlands are relevant in coastal lowlands close to freshwater habitats, we come across alluvial forests, mixed forest, coastal pine forest and freshwater wood. The dominant species are White poplar (*Populus alba*), tamarisks (*Tamarix parviflora* and *T. hampeana*), willows (*Salix fragilis* and *S. alba*), Common alder (*Alnus glutinosa*), Narrow-leaved ash (*Fraxinus angustifolia*), Chaste tree (*Vitex agnus-castus*), Field elm (*Ulmus minor*), *Rosa sempervirens*, etc. Coastal pine forest is composed by Stone pine (*Pinus pinea*) and Aleppo pine (*Pinus halepensis*). In river beds grow up the Oriental plane (*Platanus orientalis*), the Small-flowered tamarisk (*Tamarix parviflora*) and willows.

Fauna: Transitional habitats are important shelters for many animal species; about 60% of vertebrates find shelter in the wetlands, especially fish, water birds, amphibians and reptiles (Tab. 5-2); about 60-65% of these are rare or endangered species.

Table 5-2: Species number within different animal groups known in the coastal wetlands and their percentage of the total Albanian number of species
 (NEA/AKM, 1999; Mima *et al.*, 2006 *updated*; Kashta *et al.*, 2010).

Classes	Species in coastal habitats (% in Albania)	Total species in Albania	Total species in Europe
Echinoderms	48 (100%)	48	94
Decapods	115 (100%)	115	150 (only Adriatic Sea)
Mollusks	250 (38.5%)	649	Unknown
Fish	320 (89%)	360	618 (only Mediterranean Sea)
Amphibians	13 (87%)	16	62
Reptiles	27 (75%)	36	123
Birds	290 (89%)	326	514
Mammals	42 (56%)	75	200

Mollusks, crustaceans and chironomids show the highest density; the most representative species belong to the oligochaetes, Haplotaxidae and Tubificidae, amphipods (*Gammarus* spp.), polychaetes (*Nereida* spp. or *Hydroides elegans*), cirripede crustaceans (e.g. *Balanus balanus*). The most frequent are bivalves, such as *Cerastoderma glaucum* and *Scrobicularia cottardi*, and gastropods, such as *Ventrosia ventrosa*, *Cyclope neritea* and *Pirenella conica*. The Mediterranean mussel (*Mytilus galloprovincialis*) grows in dense patches in coastal lagoons and other coastal habitats. The littoral crab *Carcinus aestuarii* is also common in all Albanian lagoons.

Coastal lagoons and estuaries are important areas for wintering of migratory water birds; about 70 species of water-birds have been recorded. Water birds over-winter and breed in coastal lagoons and wetlands in great numbers, but their populations are known to have decreased as the result of the drainage of wetlands during the former regime and virtually uncontrolled hunting in the post-communist period. The Directorate General of Forests and Pastures (MoEFWA) leases large tracts of coastal land to private firms that run them as water bird hunting concessions, but without applying a strict control to the hunters. The most common fishes in marine or transitional waters are the mullets (*Mugil cephalus* and *M. labrosus*), European eel (*Anguilla anguilla*), and other species, like *Sparus auratus*, *Dicentrarchus labrax*, *Lithognathus mormyrus*, *Solea* spp., *Aphanius fasciatus*, *Lichia amia*, *Pagrus pagrus*, *Arnaglossus laterna*, etc. Çobani (2011) reports that the annual capture from lagoons was about 290 tons for the fish, respectively Karavasta 110 t, Vaini 64, Patogu, 40, Kune, 30, Narta, 20, Viluni 10, Orikumi 8 and Butrinti 8. The mussel production was about 150 tons only in Butrinti.

5.3. The protection status of the transitional wetlands

The total surface area of protected sites in Albania has reached more than 4340 km² until 2012 (see Tab. 2-15), equal to more than 15% of the whole territory. More than 1450 km² (or 30%) belong to the coastal areas with about 950 km² of transitional areas and 396 km² of the transitional areas are wetlands, deltas and lagoons (Tabs. 5-3 and 5-4, and Fig. 5-2) (Mima *et al.*, 2006).

Figure 5-2: Surface area (km²) of different coastal wetland types in % (modified after Mima *et al.*, 2006).

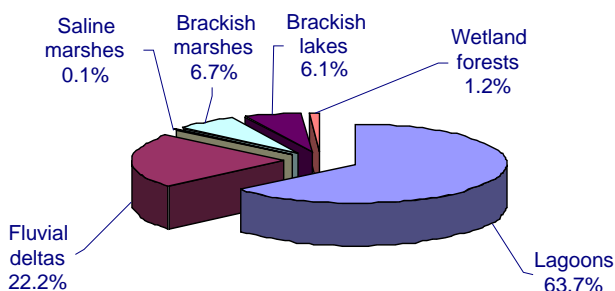


Table 5-3: Different coastal wetland types, their number and surface area (updated from Mima *et al.*, 2006).

Wetland types	Number	Surface, km ²
Lagoons	9	252.4
Fluvial deltas	7	88
Saline marshes	1	0.3
Brackish marshes	3	26.4
Brackish lakes	2	24.2
Wetland forests	1	4.8
Total coastal wetlands (% of Albania)	23 (3.4%)	396.1 (51.2%)
Total natural wetlands in Albania	617	773.5

Three wetlands in Albania are of International Importance (Ramsar Convention) covering about 776 km²: Karavasta-Divjaka (Lushnja), Butrinti-Çuka-Stillo (Saranda) and Shkodra Lake-Buna River-Velipoja (Shkodra) (Tab. 5-4). Four of 15 National Parks (II category IUCN) extend into the coastal zone, two of them, Karavasta-Divjaka and Butrinti, comprise strictly transitory habitats. In addition, five sites are declared as Managed Nature Reserves / Natural Parks (IV) and two as Protected Landscapes / Seascapes (V). Near the coast about 70 sites have been declared as Natural Monuments (III). Transitional wetlands of Albania with an international protection status are shown in table 5-5.

Table 5-4: Transitional wetlands and other related coastal areas in Albania with a national protection status in 2012 (IUCN Category) (http://www.moe.gov.al/upload/zona%20te%20mbrojtura/RRJETI%20I%20ZONAVE%20TE%20OMBROJTURA%20NE%20SHQIPERI-QERSHOR%20-12.pdf).			
National Designations and IUCN category	Name and district	Number and date of the legal act	Surface, km²
National Parks (II)	Divjaka-Karavasta (Lushnja)	VKM nr.687 19.10.2007	222
	Llogara (Vlora)	VKM nr. 96. 21.11.1966	10
	Butrinti (Saranda)	VKM nr. 693 10.11.2005	86
	Karaburuni-Sazani (Vlora) Marine National Park	VKM nr.289 28.04.2010	124
Managed Nature Reserves / Natural Parks (IV)	Shkodra lake (Shkodra)	VKM nr. 684 02.11.2005	265
	Kune-Vaini-Tale (Lezha)	VKM nr.432 28.04.2010	44
	Pishe Poro (Fieri)	Ur. MB, 1958 Rr. MB,1977	15
	Reza-Karaburuni Peninsula (Vlora)	Rr. MBu 27.7.1977	200
	Patogu-Fushe Kuqe-Ishmi (Kurbini)	VKM nr.995 03.11.2010	50
	Rrushkulli (Durrresi)	Ur. MB, 1995	6.5
Protected Landscapes / Seascapes (V)	Buna – Velipoja (Shko dra)	VKM nr.682 02.11.2005	230
	Vjosa-Narta (Vlora)	VKM nr.680 22.10.2004	197
Total protected areas (33.4% of the total protected areas):			1450
Wetland of International Importance Ramsar Convention	Karavasta-Divjaka (Lushnja)	VKM nr. 413 22.08.1994	145
	Butrinti-Çuka-Stilllo (Saranda)	VKM nr. 531 31.10.2002	135
	Shkodra Lake-Buna River-Velipoja (Shkodra)	VKM nr. 683 02.11.2005	496
Total Ramsar areas (about 18% of the total protected areas):			776
VKM, Decision of the Council of Ministers; Ur. MB, Order of the Ministry of Internal Affairs; Rr. MB, Regulation of the Ministry of Internal Affairs; Rr. Mbu, Regulation of the Ministry of Agriculture.			

Table 5 - 5: Transitional wetlands of Albania with an international protection status.

Wetlands	World Inheritance Convention (UNESCO sites)	RAMSAR Sites	Special Protected Areas - Barcelona Convention	Important Bird Areas (IBAs)
Shkodra		+		+
Buna				
Velipoja			+	+
Kune - Vaini			+	+
Patogu			+	+
Lalzi			+	+
Karavasta		+	+	+
Narta			+	+
Orikumi			+	+
Butrinti	+	+	+	+
Total wetlands (% in Albania)	1 (50%)	3 (100%)	8 (100%)	9 (75%)

Table 5-6: Important Plant Areas (IPAs) along the Albanian coast (Xhulaj and Shuka, 2007).

	Surface, km ²
Estuary of Buna - Velipoja (Shkodra)	46.7
Lake of Shkodra (Shkodra)	154.9
Estuary of Drini - Ceka-Vaini (Lezha)	88
Rodoni cape – Ishmi forest (Durrresi)	64.7
Divjaka – Karavasta complex (Lushnja)	152.5
Roskoveci marsh (Fieri)	1.3
Pishe-Poro – Vjosa estuary (Vlora)	49.2
Karaburuni – Çika Mountain (Vlora)	343.2
Gjipe Canyon (Himara)	12
Porto Palermo (Himara)	6
Borshi - Lukov a (Saranda)	55.3
Butrinti Lake (Saranda)	40
Stillo cape (Saranda)	5.3
Total IPAs along the coast (% in Albania)	1020 (26.5%)
Total IPAs in Albania	3850

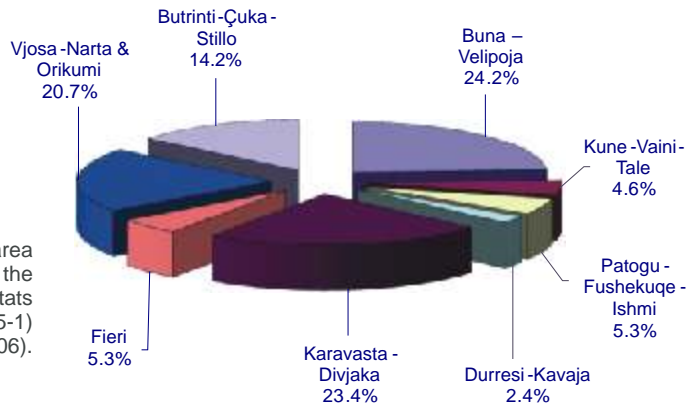


Figure 5-3: Surface area in km² and in % of the main transitional habitats (data after table 5-1) (Mima *et al.*, 2006).

Thirteen sites along the coastal zone have recently been identified as Important Plant Areas (IPAs) (Tab. 5-6), i.e. sites of threatened wild plants and habitats, with 45 IPAs in the whole Albanian territory (or about 30%). Their area amounts for more than ¼ of the total surface of the country. These IPA sites harbor rich plant diversity and shelter many rare, endangered or endemic species.

5.4. Administration authority and related legislation

After the political change in 1991, several modern laws were approved by the Albanian Parliament, furthermore the Council of Ministers and other regulatory institutions agreed on some important decisions, all aiming the protection of the natural resources of the country including the transitional waters. Principal environmental laws and other legal acts that have impact on the protection and administration of the transitional waters are listed in tables 5-7 and 5-8. Responsible bodies for the management of transitional waters are summarized on table 5-9. Data about Albanian State body or NGOs are given in chapter 2.7, completed with more information about Albanian Environmental issues and about protected areas and transitional coastal areas.

Table 5-7: Principal environmental laws that have an impact on the protection and administration of the transitional waters.		
Laws	Number	Date
Law on Areas of Tourism Priority	7665	21/01/1993
Law on City Planning	7693	1993
Law on Forests and the Forest Service	7623/9385	13/10/1992 04/05/2005
Law on Protection of Medical and Tanniferous Plants	7722	15/06/1993
Law on Land and its Distribution	7763	25/10/1993
Law on Construction, Administration, Maintenance, and operation of Water and Drainage Systems	7846	1994
Law on Protection of the Wild Fauna and Hunting	7875	23/11/1994
Law on Fishing and Aquaculture	7908/8870	05/04/1995 2002
Law on Pastures and Meadows	7917	13/04/1995
Law on Water Resources	8093	21/03/1996
Law on Discharge of Public Waste	8094	21/03/1996
Law on Regulatory Framework of Water Supply and Discharge and Treatment of Waste Waters	8102	28/03/1996
Law on Leasing the Agricultural Land, Forest Land Meadows and Pastures, which are State Property	8318	01/04/1998
Law on Environmental Protection	10 431	09/06/2011
Law on Establishment of Albanian Coastal Guard	8875	04/04/2002
Law on Protection of Marine Environment from Pollution	8905	06/06/2002
Law on Protected Areas	8906/9868	06/06/2002 04/02/2008
Law on Environmental Impact Assessment	10440	07/07/2011
Law on adhering Albania to the Convention on International Trade in Endangered Species of Wild Fauna and Flora	9021	06/03/2003
Law on Protection of Transboundary Lakes	9103	10/07/2003
Law on Environmental Treatment of Polluted Water	9115	24/07/2003
Law on Veterinary Service and Inspectorate	9308	04/11/2004
Law on Energy Efficiency	9379	27/04/2005
Law on Proclaiming the Shkodra lake areas as a Managed Natural Reserve	684	02/11/2005
Law on Biodiversity Protection	9587	20/07/2006
Law on Integrated Management of Waste	10463	22/09/2011

Table 5-8: Decisions of Council of Ministers (DCM) that have an impact on the protection and administration of the transitional waters.		
Decisions	Number	Date
DCM: Approval of zones of priority for the tourism development	88	01/03/1993
DCM: On Environmental Monitoring in the Republic of Albania	103	31/03/2002
DCM: Approval of the Management Plan of Coastal Zone	364	18/07/2002
DCM: On proclamation of Butrinti wetland complex and its surrounding area as specially protected area	531	31/10/2002
DCM: Approval of the new list of the Natural Monuments in Albania	676	20/12/2002
DCM: On protected areas administration	266	24.4.2003
DCM: On procedures for the proposal and declaration of protected and buffer zones	267	24/04/2003
DCM: About the Albanian plant species threatened with extinction	204	04/12/2003
DCM: On proclamation of wetland system Vjosa-Narta as protected landscape	680	22/10/2004
DCM: On establishment of protected areas management committees	86	11/02/2005
DCM: Permitted norms for liquid discharges and criteria for environmental zoning of rivers or sea waters	177	31/03/2005
DCM: On proclamation of Buna River and its wetland surrounding areas as Water/Land Protected Landscape	682	02/11/2005
DCM: On proclamation of Shkodra Lake wetland complex and natural area of Buna River as special protected areas	683	02/11/2005
DCM: On proclamation of Albanian part of Shkodra Lake as Managed Natural Reserve	684	02/11/2005
DCM: On proclamation of Butrinti wetland complex as National Park	693/716	10/11/2005 23/06/2009
MoEFAW: Order for the approval of the Red List of Albanian Flora and Fauna	146	08/05/2007
DCM: On proclaiming Natural Park the natural maritime ecosystem at the Sazani island and the Karaburuni peninsula	289/444	28/04/2010
DCM: On approving the enlargement of the Natural Reserve of Kune-Vaini-Tale	432	28/04/2010
DCM: On the rules of administration for the regional natural parks	519	30/06/2010
DCM: On proclaiming Managed Natural Reserve the Natural Wetland Ecosystem of Patogu -Fushekuqe -Ishmi	995	03/11/2010
DCM: On approving the rules for the proclamation of the special protected areas	897	21/12/2011

Sectors and/or activities	Bodies
Preparation and elaboration of environmental policies and legislation	Ministry of Environment, Forests and Administration of Waters
Coastal Forests and Protected Areas	General Directorate of Forestry Service Ministry of Environment, Forests and Administration of Waters Departments of Forestry Service in related districts
Fishing and Aquaculture	General Directorate of Fishery, Ministry of Environment, Forests and Administration of Waters Fishing inspectorates in six districts
Hunting	General Directorate of Fishery, Ministry of Environment, Forests and Administration of Waters
Tourism and Water Strategy	Ministry of Tourism and Territory Planning
Territory Planning	Council of Territory Planning
Management of Water Resources	National Council of Waters Technical Secretariat of the National Water Council. River Basin Councils River Basin Agencies
Archaeology and Protection of Monuments	Ministry of Culture, Youth and Sports Institute of Archaeology Institute of Cultural Monuments
Agriculture	Ministry of Agriculture, Food, and Local Government
Application of the environmental legislation and environmental protection in local level	Environmental Regional Agencies
Education and public awareness	Ministry of Education and Research Directorates and the education system in respective districts Environmental NGOs

The management authorities and the responsibility for the transitional waters in Albania are divided among various bodies, which consider the task more as a political and administrative one rather than from an ecological and functional point of view. Often the interpretation of the law is not fully clear, nor is it properly applied. Different bodies are involved in the control of the various activities such as fishing, hunting, territory planning and tourism, but there is a severe lack of an integrated and cooperative management approach.

5.5. Overview of the human impact along the Albanian coastal zone

At the International Conference on Marine and Coastal Ecosystems (<http://www.marcoastecos2012.al/>) we discuss the values, problems and the future of the Albanian transitional wetlands (Miho *et al.*, 2013a). The most important aspects of the human impact would be: 1) Intense urbanization and tourism, especially in some coastal areas of the Adriatic, where the most inhabited and industrial centers are situated, i.e. Tirana capital, Durrësi, Vlora, Elbasani, Berati, Fieri, but also in Saranda and along the Ionian Riviera. Increasing energetic and harbor activities can be also added to this. 2) Coastal pollution due to the scarce waste management along the coast and in all river watersheds. The urban wastewater and other industrial wastes are collected directly in rivers and transported without any treatment to the sea. 3) Poor land use practices in watershed areas deforestation, overgrazing, firing, gravel mining in river beds, etc. enhance the strong erosion that cause adverse effects into the coastal and marine habitats. 4) Overfishing and often not controlled hunting. Law 7908, dt. 05/04/1995 on fishing and aquaculture is not strictly applied. 5) The limited authority of governmental bodies, combined with low education and low public awareness and education on environmental and nature protection towards the new development in Albania. Separate aspects will be discussed also in detail in each separate part of the transitory habitats and also in the final reflections at the Chapter 14.

Miho *et al.* (2005) reported data on the water quality of the most important and most impacted rivers of Western Coastal Lowland of Albania, Mati and Fani, Ishmi, Lana and Tirana, Shkumbini, Semani, Osumi and Gjanica. This study was the first in Albania for its complexity, taking into consideration the physical-chemical and biodiversity values, trophic state and pollution level in the rivers during the period from May 2002 – to March 2004. The most striking aspect was the high content of nutrients (nitrogen and phosphorous) and total suspended solids, leading also to massive depositions in the coastal areas, especially in the rivers deltas and coastal lagoons (Tab. 5-10; Fig. 5-4; see also Fig. 8-8).

On the other side, Miho *et al.* (2005) reported that the quantity of heavy metals in water, sediments or in biota in all the rivers was unexpectedly low; therefore, the effect of heavy metals on the water quality seems to be negligible today, as a consequence of a low impact from the abandoned mining industry.

In table 5-10 and histograms of the figure 5-4 the coastal contribution to the Adriatic Sea for TSS and nutrients (nitrogen and phosphorous) of four Albanian rivers (Mati, Ishmi Shkumbini and Semani) is shown, based on data measured on 7 field trips during May 02 to March 04 at stations near the coastal zone (Miho *et al.*, 2005), calculated for the perennial mean flow given in table 3-3.

Table 5-10: Average annual amount (t yr⁻¹) of the nutrients nitrogen (NO₃⁻, NO₂⁻, NH₄⁺) and phosphorous (PO₄⁻³), and total suspended solids (TSS) transported into the Adriatic Sea, at coastal stations of some Albanian rivers between May 2002 and March 2004 (data from Miho *et al.*, 2005).

River-Station	Flow (m ³ s ⁻¹)	TSS (t yr ⁻¹)	NO ₃ ⁻ (t yr ⁻¹)	NO ₂ ⁻ (t yr ⁻¹)	NH ₄ ⁺ (t yr ⁻¹)	PO ₄ ⁻³ (t yr ⁻¹)
Mati - Miloti	103	172'100	2'330	65	450	20
Ishmi - Gjola	21	56'000	560	210	3'700	220
Shkumbini -	62	277'500	1'570	110	500	30
Semani- Fieri	96	863'700	4'800	80	580	30
Total Albanian Rivers	1'308	4'686'500	45'000	4'550	76'000	5'000

We believe that the situation is not really improved since that period, but in certain aspects it might be even worsened (Miho *et al.*, 2010).

Not only in rivers Lana, Ishmi (Tirana region) and Gjanica (Fieri), but also in Mati, downstream Shkumbini (Elbasani, Rrogozhina) and Osumi (Berati), nutrients were higher than the EC guide values for Cyprinid waters, fixed in the EC Fish Directive 44 (2006) of quality fresh waters; i.e. the nitrite and ammonium values reached up to 4.0 mg NO₂l⁻¹ in Lana (November 03), up to 42.1 mg NH₄l⁻¹ in Lana (November 02).

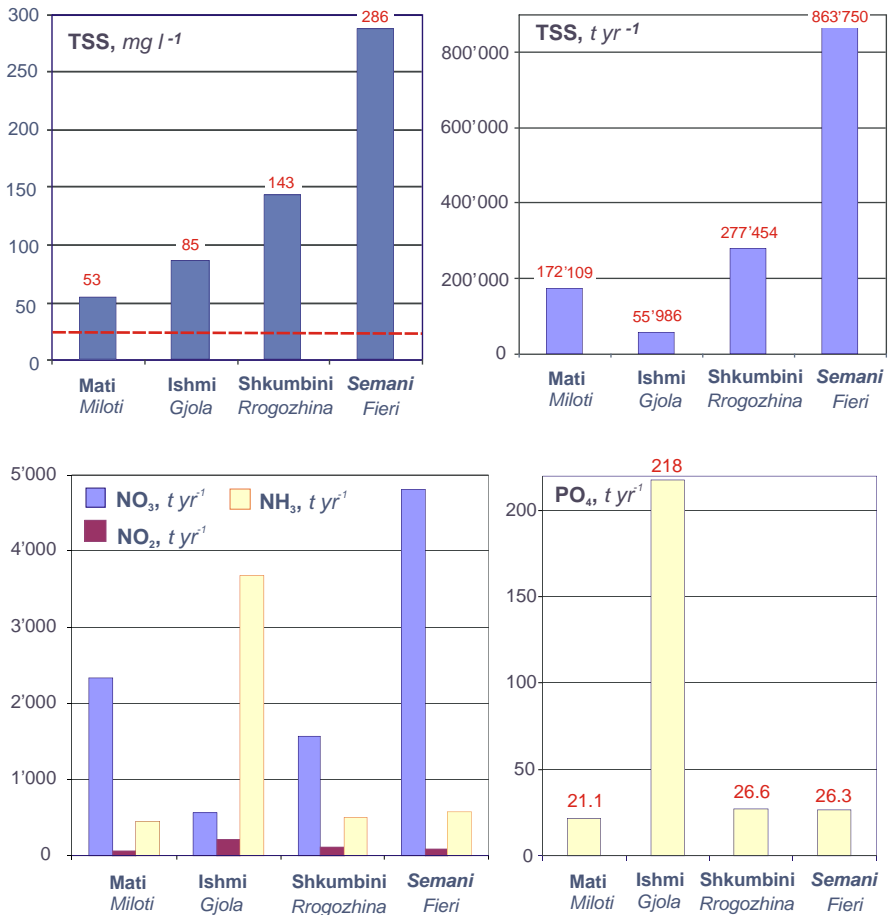


Figure 5-4: Average annual transport (t yr⁻¹) of Total Suspended Solids (TSS) (*above*) and nutrients (nitrogen and phosphorous, *below*) to the Adriatic Sea by four Albanian rivers (Mati, Ishmi Shkumbini and Semani), based on data between May 02 and March 04 at stations near the coast (Miho *et al.*, 2005), calculated as the pluriannual mean flow from table 3-3. The red dashed line indicates the 25 mg l⁻¹ limit which is the EC Fish Directive 44 (2006) of the third class limit concerning the quality of fresh water needing protection or improvement in order to support fish life.

The high level of ammonium and nitrites indicates reducing conditions in Lana and Ishmi due to a high organic load. It is a direct consequence of untreated liquid wastes from Tirana (see Fig. 8-7), Elbasani, Rrogozhina, Berati, Kucova, and Fieri towns. Furthermore the concentrations of O_2 in Lana and Ishmi were below the BE limits. In these rivers an unpleasant smell from the water was present, indicating a high content of decaying organic compounds or chemicals such as phenols. The bacterial content was also very high. Lastly, solid waste deposited along the riverbanks, beside its harmful effects, changed the scenery of the fluvial landscape, decreasing its attractiveness (Miho et al., 2005; 2010).

High contents of total suspended solids (TSS) were found in Semani, Ishmi and Shkumbini (Tab. 5-8 and Fig. 8-8). Except for Mati, TSS often exceeded by several fold the value of 25 mg l^{-1} , the EC Fish Directive 44 (2006) of the third class limit on the quality of fresh water needing protection or improvement in order to support fish life. This situation was observed not only during the wet season in autumn, but also in late spring at low water level. It shows the high rates of soil erosion, which were a direct consequence of the large deforestations in the respective watershed areas (Fig. 5-5). This also results in unfavorable conditions for the aquatic life in rivers and at the marine coast, as well as for the related activities, such as agriculture, fishing and tourism. In addition, besides the heavy urban and industrial impact on water quality, poor land use practices are widespread with illegal deforestation or gravel mining in the Ishmi tributaries. It affects the geomorphology of the coastal zone and disturbs its biodiversity (ABCNews, 2013).

Nuro & Marku (2011) give a review of organochlorine pesticides residues for some Albanian aquatic ecosystems, i.e. Adriatic Sea (Vlora Bay, Porto-Romano and Velipoja), Buna River, Shkodra Lake, Butrinti Lake and Ohrid Lake, measured in water, sediments and biota (mussels and fish) samples, collected during 2005-2010. In graphs of figure 5-6 can be evidenced that the pollution from pesticide is far to be negligible. Even in mussels from Butrinti, the values were higher than 0.01 mg kg^{-1} , the general EU limit for pesticide residues permitted in products of animal and plant origin that are intended for human or animal

92 consumption.

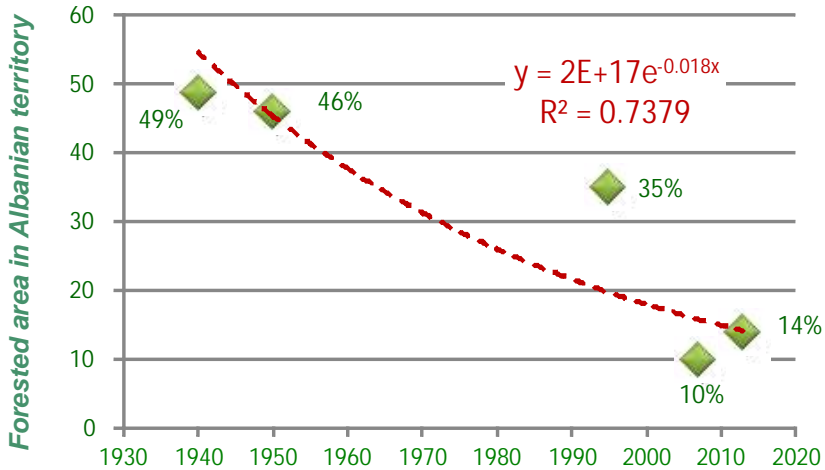


Figure 5-5: Forested area (%) in Albanian territory during last century (Miho, 2011).

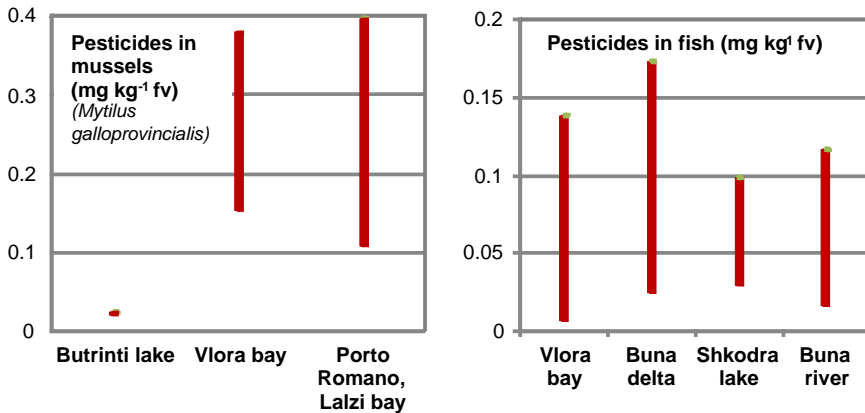


Figure 5-6: Review of organochlorine pesticides residues for some aquatic ecosystems in Albania, in Adriatic Sea (Vlora Bay, Porto-Romano and Velipoja), Buna River, Shkodra Lake, Butrinti Lake and Ohrid Lake, measured in mussels and fish during 2005-10 (elaborated from Nuro & Marku, 2011). It is worth to mention that the general EU limit for pesticide residues is **0.01 mg kg⁻¹**. ([Http://miepo.md/public/files/cbi/eulegislation.food/2012_EU_legislation_Maximum_Residue Levels_MRLs_of_pesticides_in_food.pdf](http://miepo.md/public/files/cbi/eulegislation.food/2012_EU_legislation_Maximum_Residue Levels_MRLs_of_pesticides_in_food.pdf))