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# PRELIMINARY WATER QUALITY REPORT FOR SOME ALBANIAN RIVERS

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## Abstract

A characterization of important properties of the water in the four most important Albanian rivers: Semani, Shkumbini, Ishmi, and Mati started yr. 2002. The study includes physic-chemical properties, the concentration of heavy metals and the biodiversity of microscopic benthic algae. In two field trips (May and November 2002), high levels of nitrites, nitrates, ammonium and phosphates in Ishmi and Semani were observed, indicating a heavy pollution originating from the input of untreated urban waste-waters from the towns of Tirana, Berati, Kuçova and Fieri. The rivers Semani, Ishmi and Shkumbini were found in a critical state concerning suspended solids, which are a direct consequence of intense erosion. Although wastes from mining and metallurgy were dumped, the concentrations of heavy metals in the water were generally low, as well as their concentration in biomass, e.g. in *Graminae* at the river border or in the benthic alga *Cladophora.* The toxic metals cadmium and lead as well as copper and zinc had low levels, close to the background values. However, a slight increase in the stations near the urban centers was observed.

Macroscopic algae grew only scarcely in the rivers studied. *Cladophora glomerata* was found in seven sites in May but only in two in November. This may be due to the different season, the variation in turbidity and in some cases, i.e. in Lana, Ishmi, Osumi and Gjanica even to very high pollution. More than 170 species of microscopic algae were determined. Among the diatoms *Diatoma moniliformis, Gomphonema olivaceum, G. tergestinum, Achnanthes minutissima* and *Cocconeis pediculus* dominated in places of low level of organic and inorganic pollution (oligosaprobiç, β-mesosaprobic, mesotrophic), like in Mati (all stations), Brari (upstream Tirana), Labinotfushe (upstream Shkumbini) and Berati (upstream Osumi). But most of the tributaries are in a α-mesosaprobic (mesotrophic) to polysaprobic (eutrophic) state, e.g. Lana and Ishmi, the downstream part of Shkumbini, and Gjanica. This is confirmed also by the high contents of the nutrients nitrogen and phosphor. Diatoms found at these sites were mainly *Nitzschia palea, N. dissipata, N. incospicua, Gomphonema parvulum, Navicula veneta, N. suchlandtii, N. saprophila.*

## INTRODUCTION

Albania is a country with both large mountain areas and long sea-coasts, with a high quantity of available water. More than 150 creeks and small rivers form finally 8 large streams, running southeast to northwest towards the Adriatic coast. About 65 % of their total watershed area extends within Albania (Kabo, 1990-91). These water resources are important for urban and tourism activities, agriculture (irrigation), livestock and fishing, hydro-energetic, thermo-energetic and industry. Drini and Mati cascades are essential to the economy for the production of electricity. Since 1998, drinking water for Tirana town, with a growing population of more than 700'000 inhabitants, is taken from the Buvilla reservoir, formed by collecting water of Terkuza (tributary of the Semani river), ca. 30 km North of the capital.

Despite the importance of water resources and the growing interest for water use, the water in Albania continues to be seriously endangered. A dramatic situation exists mainly in the western lowlands, where the big urban and industrial centers are located, with intense agriculture and tourism. Up to now, urban wastewater and industrial wastes are fed directly into rivers and transported to the sea. They are not controlled, and monitoring of surface and underground water does not take place regularly. The existing data offer only little reliable insight into the environmental situation, due to sporadic and non-systematic sampling. Moreover, the existing data are not easily available due to the lack of publications and scarce information exchange between institutions.

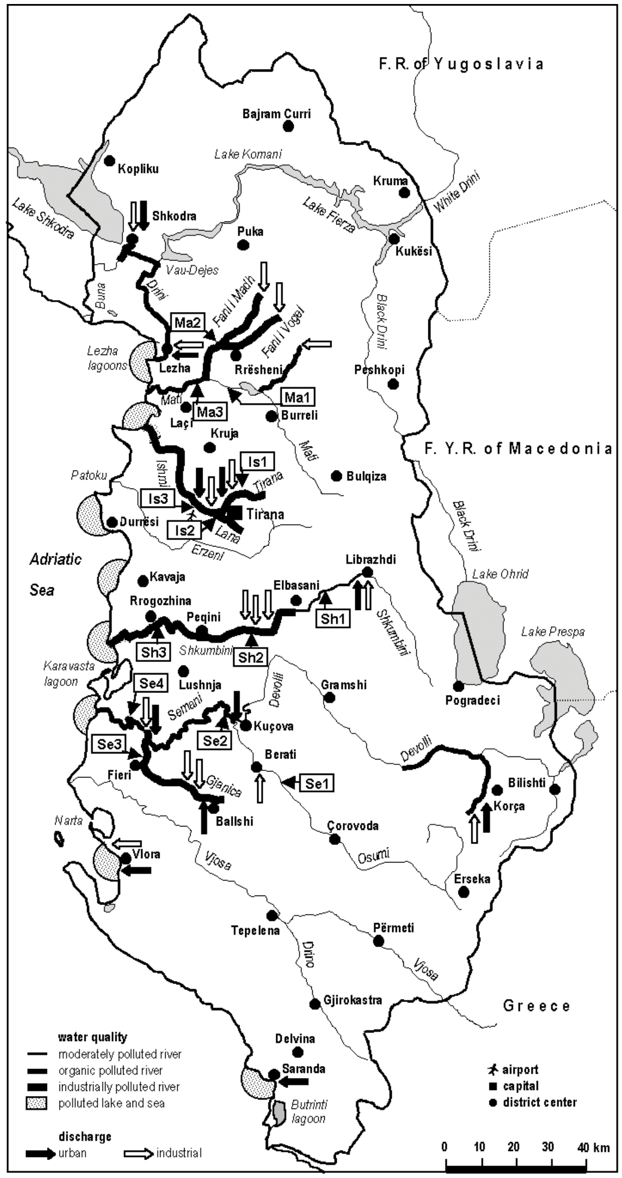


**Figure 1:** Albanian map with main rivers and the sampling stations. Also, there is indicated the water quality of the rivers and sea areas. Arrows denote the discharge of either urban (*solid arrows*) or industrial (*open arrows*) wastewater (schematized after UNEP, 2000)

The present paper represents a preliminary report on the pollution by nutrients and heavy metals in the most impacted rivers: **Semani** with its effluents **Gjanica** and **Osumi**, **Shkumbini**, **Ishmi** with the effluents **Lana** and **Tirana**, **Mati** with the effluent **Fani**. This work started yr. 2002 within the SCOPES joint project; the Swiss National Science Foundation supported it. The project is a cooperation between three institutions in Albania: the departments of Chemistry and Biology at the Tirana University, the department of Agronomy at Tirana Agricultural University, and the University of Zurich (Institute of Plant Biology and its Limnological Station, and the Institute of Environmental Sciences) and the City of Zurich Water Supply.

## MATERIAL AND METHODES

Two campaigns of field trips were carried out in May and November 2002 covering a total of 13 sampling sites: **Ma1** and **Ma3** in Mati, **Ma2** in Fani (Mati tributary); **Is1** in Tirana and **Is2** in Lana (both Ishmi tributaries), **Is3** in Ishmi; **Sh1**, **Sh2**, **Sh3** along Shkumbini; **Se1, Se2** along Osumi and **Se3** in Gjanica (Semani tributaries), **Se4** in Semani (Fig.1). For each river one station has been selected upstream of towns or industrial sites at a site less impacted by human activities; the others are downstream, representing most impacted areas. Macroscopic algae and/or aquatic higher plants were collected at each station: *Cladophora* and/or alternatively an aquatic grass (*Paspalus sp.*). Heavy metals were determined using UV-VIS and atomic absorption spectroscopy (flame and non-flame techniques): Pb, Cu, Zn, Mn, Fe, Cr, Ni, Ca, and Hg, both directly in the water and in collected biomass in the Analytical Chemistry Laboratory of Tirana University. Other physic-chemical parameters, i.e. conductivity, pH, temperature, suspended matter, nitrites, nitrates, ammonium and phosphates, were measured directly in the field or in laboratory.

To evaluate the algal biodiversity and the trophic state, the epiphytic microscopic algae were determined. The trophy state as used in this paper means pollution by organic (oligo- to polysaprobic levels) as well as by inorganic substances (oligo- to eutrophic levels). Cleaning of diatom frustules, preparation of permanent slides and determinations were done after Krammer *et al.* (1986-2001). The trophy index for diatoms was calculated using the formula of Zelinka *et al.* (1961), the respective values for each species and the trophy classes were taken from Rott *et al.* (1999).

## RESULTS AND DISCUSSIONS

Physic-chemical parameters, nutrient concentration and the content in heavy metals in the water are reported in Table 1. A critical situation is found in Semani, Ishmi and Shkumbini with a high content of suspended solids (SS). Except in Mati (Ma1), SS often exceeded several fold than 50 mg/l, the EC Directive 78/659 of the third class limit on the quality of fresh water needing protection or improvement in order to support fish life (BMZ, 1995). This situation was observed not only during the wet season in autumn but also in late spring at low water level (Tab. 1). According to Cake *et al.* (1999), suspended solids along Shkumbini increased to 264 mg/l in Paperi (Sh2), with an extreme value of 8'770 mg/l in February 92 in the waste discharge of the Metallurgic Factory. Moreover, these high values are due to the high rates of **soil erosion** existing throughout Albania. It is a direct consequence of the large deforestations in the respective watershed areas. This leads to massive depositions of solid material in the coastal areas, especially in the coastal lagoons, resulting also in unfavorable conditions for the aquatic life in rivers and the marine coast and for the related economic activities, such as agriculture, fishing and tourism.

High levels of nitrites were in rivers Lana and Ishmi both in May and November, in November nitrites increased also in rivers Mati (Ma3), Tirana (Is1), Shkumbini (Sh2) and Osumi (Se1). In November, nitrates were high, as well, caused probably from heavy rain runoff. High values of ammonium were found in rivers Lana and Ishmi, both in May and November. The high level of ammonium and nitrites indicates reducing conditions in Lana and Ishmi, due to a high organic load. The EC guide and imperative values of high quality fresh water are respectively $<0.01$ mg/l and $<0.03$ mg/l for the nitrites, $<0.04$ and $<1$ mg/l (*Salmonid* waters), $<0.2$ and 1 (4) mg/l (*Cyprinid* waters) for the total ammonia (BMZ, 1995). It is noticed that not only in rivers Lana, Ishmi, and Gjanica, but also in Mati, downstream Shkumbini (Sh2) and Osumi (Se1) the respective values were sometimes several fold higher. Nitrates in Shkumbini (Sh3, November, 2002) exceeded the EC guide values of 25 mg/l given for surface water. In Lana and Ishmi the lowest pH values were found; pH values were generally higher in November as compared to May. In contrast, conductivity values were higher in Lana and Ishmi, and very high in Gjanica, another fact of high stress conditions. During the last decade, nitrates increased also downstream Elbasani in Shkumbini River;

ammonium even reached extreme values of up to 100 mg/l at the nearby metallurgical factory. Liquid wastes with a high content of toxic substances, like cyanides, phenols, ammonium, etc. had been discharged, with severe consequences for fish and other organisms (Cake *et al.*, 1999). The situation has been slightly improved since then, but there still remain strong sources of pollution from Elbasani town and from present and former industrial activities.

**Table 1:** Data of physic-chemical measurements and concentrations of heavy metals in water in May (*above*) and November (*below*) 2002.

| **Name of the main river** | **Mati** | | | **Ishmi** | | | **Shkumbini** | | | **Semani** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of tributari/station**<br>**Physic-chemical parameters and heavy metals** | **Mati** | **Fani/Rubiku** | **Mati/Miloti** | **Tirana/Brari** | **Lana** | **Ishmi** | **Labinotfushe** | **Paperi** | **Rrogozhina** | **Osumi/Berati** | **Uravajgurore** | **Gjanica/Fieri** | **Mbrostari** |
| | **Ma1** | **Ma2** | **Ma3** | **Is1** | **Is2** | **Is3** | **Sh1** | **Sh2** | **Sh3** | **Se1** | **Se2** | **Se3** | **Se4** |
| **Conductivity, µS/cm (20°C):** | 206.0 | 221.0 | 195.0 | 299.0 | 508.0 | 550.0 | 226.0 | 304.0 | 319.0 | 403.0 | 411.0 | 844.0 | 414.0 |
| | 100.0 | 16.4 | 24.6 | 361.0 | 531.0 | 464.0 | 224.0 | 277.0 | 264.0 | 41.9 | 88.0 | 362.0 | 562.0 |
| **pH:** | 8.0 | 7.9 | 7.9 | 7.9 | 7.3 | 7.4 | 8.0 | 7.8 | 8.0 | 8.2 | 8.2 | 7.9 | 7.9 |
| | 8.1 | 8.0 | 8.0 | 8.3 | 7.7 | 7.6 | 8.1 | 8.2 | 8.4 | 8.4 | 8.1 | 7.9 | 8.2 |
| **Temperature, °C:** | 16.1 | 20.0 | 20.5 | 14.6 | 20.8 | 22.3 | 17.1 | 19.7 | - | - | - | - | - |
| | 11.9 | 8.9 | 12.1 | 12.6 | 14.5 | 13.0 | 10.4 | 11.4 | 11.0 | 11.0 | 12.4 | 13.3 | 11.4 |
| **Suspended solids (SS, mg/l):** | - | - | 11.0 | 5.0 | 123.3 | 62.0 | 31.0 | 72.7 | 158.0 | 173.0 | 280.0 | 237.0 | 436.0 |
| | 19.0 | 29.0 | 30.0 | 53.6 | 140.0 | 128.0 | 328.0 | 55.6 | 72.2 | 35.0 | 52.0 | 116.0 | 55.0 |
| **$NO_2$-N, mg/l:** | 0.006 | 0.003 | 0.004 | 0.002 | 0.121 | 0.420 | 0.003 | 0.009 | 0.012 | 0.006 | 0.009 | 0.073 | 0.010 |
| | 0.008 | 0.005 | 0.076 | 0.110 | 0.112 | 0.121 | 0.019 | 0.064 | 0.012 | 0.091 | 0.011 | 0.014 | 0.007 |
| **$NO_3$-N, mg/l:** | 0.70 | 0.88 | 0.49 | 0.50 | 1.85 | 1.57 | 0.78 | 1.02 | 0.71 | 0.65 | 0.87 | 1.41 | 1.01 |
| | 0.16 | 0.56 | 2.00 | 5.93 | 0.95 | 0.72 | 3.57 | 9.80 | 46.2 | 0.70 | 0.20 | 9.33 | 7.03 |
| **$NH_4$-N, mg/l:** | 0.48 | 0.39 | 0.41 | 0.51 | 8.20 | 7.40 | 0.66 | 0.38 | 0.77 | 0.81 | 1.28 | 0.83 | 0.74 |
| | 0.15 | 0.25 | 0.19 | 0.67 | 32.70 | 3.91 | 0.54 | 0.42 | 0.18 | 0.30 | 0.16 | 1.70 | 0.19 |
| **$PO_4$-P, mg/l:** | 0.007 | 0.004 | 0.003 | 0.005 | 0.332 | 0.102 | 0.325 | 0.011 | 0.009 | 0.004 | 0.008 | 0.004 | 0.007 |
| | 0.008 | 0.007 | 0.009 | 0.050 | 0.630 | 0.133 | 0.012 | 0.028 | 0.250 | 0.012 | 0.023 | 0.200 | 0.012 |
| **P-total, mg/l** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 0.013 | 0.012 | 0.012 | 0.060 | - | 0.151 | 0.018 | 0.054 | 0.039 | 0.015 | 0.027 | - | 0.018 |
| **Pb, µg/l:** | 1.5 | 3.6 | 2.0 | 1.6 | 2.9 | 2.9 | 2.0 | 2.0 | 2.4 | 2.9 | 2.4 | 2.9 | 1.0 |
| | 0.4 | 0.1 | 0.5 | 1.0 | 1.3 | 0.9 | 2.1 | 1.5 | 1.2 | 1.1 | 0.5 | 1.1 | 1.9 |
| **Cd, µg/l:** | 0.1 | 0.2 | 0.3 | - | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 1.2 | 0.1 |
| | 0.5 | 1.2 | <0.1 | <0.1 | 0.1 | <0.1 | <0.1 | 0.2 | <0.1 | <0.1 | 0.3 | <0.1 | <0.1 |
| **Cu, µg/l:** | 0.1 | 1.6 | 0.9 | 1.2 | 4.7 | 2.8 | 1.2 | 1.0 | 1.1 | 0.9 | 0.8 | 1.9 | 1.4 |
| | 2.7 | 3.7 | - | 1.52 | 9.76 | 3.55 | 1.81 | 3.25 | 2.52 | 2.73 | 1.14 | 1.84 | 1.67 |
| **Zn, mg/l:** | <0.01 | 0.04 | <0.01 | 0.01 | 0.03 | <0.01 | 0.01 | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 0.02 |
| | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | <0.01 | 0.01 | <0.01 | 0.01 | 0.01 | 0.01 |
| **Mn, mg/l:** | 0.06 | 0.06 | 0.06 | 0.11 | 0.26 | 0.12 | 0.12 | 0.19 | 0.09 | 0.07 | 0.09 | 0.09 | 0.11 |
| | 0.03 | 0.03 | 0.03 | 0.05 | 0.12 | 0.16 | 0.07 | 0.03 | 0.03 | 0.03 | 0.05 | 0.08 | 0.06 |
| **Fe, mg/l:** | 0.02 | 0.03 | 0.01 | 0.02 | 0.07 | 0.02 | 0.02 | 0.01 | 0.03 | 0.03 | 0.03 | 0.02 | 0.12 |
| | 0.04 | 0.09 | <0.03 | 1.05 | 0.04 | 0.04 | 1.37 | 0.21 | 0.04 | <0.03 | 0.14 | 0.05 | 0.83 |
| **Cr, µg/l** | 0.4 | 0.8 | 1.3 | <0.2 | <0.2 | <0.2 | 0.2 | 1.4 | 2.7 | 2.6 | 0.8 | 0.3 | 10.0 |
| | 1.8 | 0.4 | 1.7 | 3.6 | 5.2 | 1.2 | 7.6 | 2.7 | 2.5 | 0.6 | 2.2 | 0.3 | 7.6 |
| **Ni, µg/l** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 3.5 | 1.9 | 1.8 | 7.9 | 2.1 | 3.3 | 13.1 | 6.4 | 3.2 | 2.3 | 4.0 | 6.3 | 16.8 |
| **Hg, µg/l** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 0.10 | 1.13 | 2.28 | <0.10 | <0.10 | 0.10 | 1.74 | 0.34 | <0.10 | 0.70 | 2.04 | 0.21 | <0.10 |

Nitrogen and phosphorus may strongly influence the growth of photosynthetic organisms in the rivers (cyanobacteria and algae). The concentrations of phosphates found at all stations of

Ishmi, Shkumbini (Sh2 and Sh3) and Gjanica confirm the eutrophic to polytrophic state according to Rott *et al.* (1999). This is imaged in the structure of the diatom population and the trophy index. The main sources leading to the high nutrient concentrations are the discharges of **untreated urban liquid wastes** from Tirana town into the rivers Tirana, Lana and Ishmi, from Berati, Kuçova and Fieri towns into rivers Osumi, Gjanica and Semani. Combined with the high level of suspended solids, this creates significant additive or synergistic effects not only for the fishes, but also for the whole aquatic food net. Only the waters upstream river Mati can be considered as not polluted and suitable for supporting high valuable fish species.

The concentrations of heavy metals were generally low. However, some minor pollution is observed, according to the EC environmental standards (BMZ, 1995). Cadmium exceeds slightly these standards in Fani (1.2 µg/l, Nov. 2002) and Gjanica (1.3 µg/l, May 2002). The EC environmental standard values for the mercury in surface waters (0.5-1 µg/l) were exceeded in Fani (Ma2), downstream Mati (Ma3), upstream Shkumbini (Sh1) and Osumi (Se2). Toxic metals of chromium, nickel, lead and cadmium do not exceed the maximum EC permissible concentration or guide values (BMZ, 1995).

Accumulation of heavy metals in aquatic biota is a suitable tool for monitoring the average load. However, macroscopic algae were only scarcely found along the rivers in the coastal lowland. We only observed *Cladophora glomerata* in 7 places in May 2002 and two in November. This may be due to the different season (high biomasses of *Cladophora* occur usually from May to July), the increased turbidity due to a high content in solid matter and in some cases even the high pollution, i.e. in rivers Ishmi, Lana, Gjanica and Osumi. Therefore, it seems that macroscopic algae can hardly be used to measure the annual fluctuations in heavy metals in western lowland region. Instead, grasses from the genus *Paspalus* were collected from the riverbanks (*Paspalus* can be found in more or less constant biomasses). The results are reported in Table 2. However, it is difficult to find any relation between the heavy metal content in the water and in the biota possibly due to the fact that in algae and higher water plants some species are able to accumulate heavy metals in their tissue and others do not.

**Table 2:** Data on heavy metals (mg/kg dry weight) in biota (*Graminae*) in May (above) and November 02 (below)

| Heavy metals | Mati | | | Ishmi | | | Shkumbini | | | Semani | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ma1 | Ma2 | Ma3 | Is1 | Is2 | Is3 | Sh1 | Sh2 | Sh3 | Se1 | Se2 | Se3 | Se4 |
| Pb, µg/l: | 1.17 | - | 0.13 | 0.00 | 1.87 | 1.45 | 2.10 | 1.94 | - | 0.87 | 2.66 | 0.51 | 1.05 |
| | 0.85 | 2.25 | 0.06 | 7.30 | 0.60 | 0.43 | 0.21 | 0.28 | 0.15 | 0.16 | 1.01 | 1.86 | 0.03 |
| Cd, µg/l: | 0.26 | - | 0.06 | 0.37 | 0.22 | 0.09 | 0.18 | 3.10 | - | 0.61 | 0.16 | 0.08 | 0.25 |
| | 0.13 | 0.08 | 0.17 | 0.10 | 0.30 | 0.13 | 0.18 | 0.06 | 0.30 | 0.03 | 0.04 | 0.04 | 0.03 |
| Cu, µg/l: | 10.80 | - | 6.33 | 4.14 | 6.78 | 16.06 | 13.09 | 14.52 | - | 9.87 | 39.22 | 5.30 | 12.33 |
| | 11.88 | 21.84 | 17.93 | 13.91 | 18.53 | 13.46 | 10.39 | 7.57 | 13.22 | 7.83 | 11.79 | 20.57 | 40.23 |
| Zn, mg/l: | 22.79 | - | 1.22 | 19.21 | 67.69 | 53.17 | 40.61 | 63.79 | - | 21.76 | 40.82 | 22.03 | 33.89 |
| | 20.89 | 39.63 | 27.63 | 29.34 | 18.87 | 7.64 | 9.08 | 7..94 | 10.21 | 11.34 | 4.62 | 19.95 | 16.36 |
| Mn, mg/l: | 167.3 | - | 12.5 | 88.9 | 160.8 | 757.3 | 167.9 | 315.0 | - | 14.6 | 300.7 | 170.1 | 93.3 |
| | 93.51 | 103.27 | 256.26 | 50.18 | 104.71 | 80.93 | 90.72 | 80.18 | 101.25 | 66.38 | 90.80 | 128.53 | 109.32 |
| Fe, mg/l: | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 228.43 | 174.54 | 1142.0 | 247.23 | 293.37 | 345.24 | 210.30 | 164.71 | 255.9 | 302.19 | 418.93 | 952.03 | 487.92 |
| Cr, µg/l: | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 3.06 | 12.34 | 14.18 | 11.46 | 8.75 | 3.83 | 8.35 | 12.85 | 3.84 | 8.23 | 5.71 | 31.26 | 9.81 |
| Ni, µg/l: | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 13.32 | 29.05 | 22.33 | 4.9 | 4.73 | 3.25 | 11.84 | 8.95 | 14.73 | 19.68 | 5.78 | 10.3 | 12.97 |
| Hg, µg/l: | 0.25 | - | 0.17 | 0.18 | 0.28 | 0.15 | 0.11 | 0.29 | - | 0.21 | 0.26 | 0.10 | 0.17 |
| | 0.1 | 0.05 | 0.03 | 0.03 | 0.05 | 0.08 | 0.04 | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 | 0.06 |

In contrast to the scarce presence of macroscopic algae, a characteristic diversity of microscopic algae, mainly diatoms, was found within the periphyton communities. More than 170 species of diatoms were determined. *Diatoma moniliformis, Gomphonema olivaceum, G. tergestinum, Achnanthes minutissima* and *Cocconeis pediculus* dominated at sites with a low state (mesotrophic to meso-eutrophic), e.g. in Mati (all stations), upstream Tirana (Is1), upstream Shumbini (Sh1) and upstream Osumi (Se1). At these river stations, high species diversity was found, as well. Most of other sampling sites were in eutrophic to polytrophic conditions with a high content of nutrients, nitrogen and phosphorus. There the diatom structure was dominated mainly by eutraphentic species, like *Nitzschia palea, N. dissipata, N. incospicua, Gomphonema parvulum, Navicula veneta, N. suchlandtii,* and *N. saprophila.*

**Table 3:** Total number of species found (N), and calculated trophy indices of diatoms (TIdia) and diversity (H') in May (*upper*) and November 02 (*below*)

| *Algal structure* | Ma1' | Ma1 | Ma2 | Ma3 | Is1 | Is2 | Is3 | Sh1 | Sh2 | Sh3 | Se1 | Se2 | Se3 | Se4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Number of species, N:* | *27* | *45* | *48* | *42* | *32* | *17* | *33* | *12* | *39* | *39* | *42* | *36* | *42* | *50* |
| *Shannon index of diersity, H':* | *1.73* | *3.16* | *3.70* | *2.50* | *2.75* | *1.09* | *2.13* | *1.25* | *2.93* | *3.25* | *3.24* | *3.67* | *3.66* | *4.53* |
| Diatom Trophic Index = | 1.4 | 1.9 | 2.7 | 1.6 | 2.1 | 3.4 | 3.3 | 2.5 | 2.2 | 2.8 | 2.5 | 2.3 | 2.9 | 1.6 |
| **Relative trophic class:** | Oligo-Mezotroph | Meso-Eutroph | Eutroph | Mesotroph | Meso-Eutroph | Polytroph | Polytroph | Eutroph | Meso-Eutroph | Eu-polytroph | Eutroph | Eutroph | Eu-Polytroph | Mesotroph |

| *Algal structure* | Ma1 | Ma2 | Ma3 | Is1 | Is2 | Is3 | Sh1 | Sh2 | Sh3 | Se1 | Se2 | Se3 | Se4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Number of species, N:* | *64* | *33* | *31* | *36* | *19* | *24* | *29* | *39* | *38* | *37* | *55* | *31* | *27* |
| *Shannon index of diersity, H':* | *2.66* | *2.78* | *3.12* | *3.35* | *2.15* | *3.32* | *2.88* | *2.62* | *3.00* | *1.92* | *0.97* | *1.48* | *0.99* |
| Diatom Trophic Index = | 2.1 | 2.4 | 2.1 | 2.7 | 3.3 | 3.3 | 2.5 | 3.1 | 3.0 | 1.9 | 2.2 | 3.0 | 2.2 |
| **Relative trophic class:** | Meso-Eutroph | Eutroph | Meso-Eutroph | Eu-polytroph | Polytroph | Polytroph | Eutroph | Eu-polytroph | Eu-polytroph | Meso-Eutroph | Meso-Eutroph | Eu-Polytroph | Meso-Eutroph |

The diatom index can be considered as a good indicator of the saprobic value, as recently discussed by Kelly *et al.* (1996) and Rott *et al.* (1999). It is linked mainly with the preference to phosphor, and depends on the relative number of the dominant *taxa* in the sample. As it is shown in table 3, it varied from 1.4 (*oligo-mesotrophic,* Bushkashi, Ma1) to 3.4 (*polytrophic,* Lana). High values were observed for Lana and Ishmi, the part of Shkumbini in Rrogozhina (Sh3) and Gjanica (Se3). These sites are strongly polluted and correspond to the quality level 3 according to the classification of Dell'Uomo (1996). In a previous study high trophy values (2.1 to 3.4) were observed downstream Shkumbini at Paperi and Peqini (Sh2), demonstrating that the urban and industrial pollution continues at the same rate as during the last decade (Cake *et al.,* 1999). In contrast the water quality in Bushkashi and Mati (Ma3), Tirana (Ma1) and Semani (Se4) can be considered fairly good to slightly polluted (level 2), while in the other river parts the water quality changed to strongly polluted (level 2 to 3).

From the data obtained during yr. 2002, we wish to make public the critical situation concerning the surface waters of the most important and impacted rivers of Albania. The effect of heavy metals on the water quality seems to be negligible; however, the amount of data is small and therefore final conclusions are impossible. A more important influence on the aquatic life might have the high content of suspended matter and of nutrients of urban origin. The waters of rivers Lana, Tirana, Ishmi, downstream Shkumbini and Gjanica are highly polluted by nutrients such as nitrogen and phosphorus. As a consequence the diatom population shows a typical composition. Eutrophication (inorganic and organic pollution) of the rivers could strongly influence their deltas, the closely located lagoons and the seacoast.

Considering the increasing demand of water and the strong human impact in the western lowland, systematic environmental studies and more information are needed. The existing data offer only little reliable insight into the environmental situation, due to sporadic and non-systematic sampling. A systematic monitoring approach is necessary to understand the present environmental state, to define the main polluting sources and to form the basis for political guidelines to improve the ecological situation. Cooperation between existing institutions would be a helpful support to establish an effective monitoring network.

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