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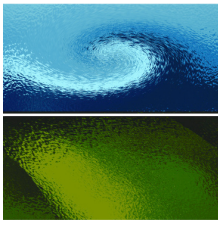

RESEARCH ARTICLE

Data on phytoplankton of the Albanian coastal lagoons (Patoku, Karavasta, Narta)

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Abstract

1 - Data on phytoplankton groups of three lagoons of the Albanian coast (Patoku, Karavasta and Narta) have been reported in this paper.

2 - The phytoplankton growth was relatively low in Patoku and Karavasta. Intense growth was observed in Narta lagoon, with blooming state in April. *Bacillariophyceae*, *Dinophyceae* and *Cryptophyceae* represented the most abundant part of the phytoplankton of these three lagoons. Filamentous *Cyanophyceae* were present only occasionally, especially in Narta.

3 - About 18 species present in phytoplankton were potentially toxic, but not relevant in lagoons; nevertheless, *Prorocentrum minimum* was found relatively abundant in spring 2006, in Narta.

4 - Continuous assessment of microscopic algae would inform better about the knowledge of Albanian coastal wetlands; moreover, it would help on the fulfillment of required standards derived from the application of the EU Water Framework Directive (WFD).

Keywords: Albanian lagoons, Phytoplankton, Water Framework Directive.

Introduction

Despite the reclamation for agricultural purposes during the past decades, Albania still has more than 390 km^2 of coastal wetlands or lagoons, most of them extended along the coastline of Adriatic Lowland (Mima *et al*., 2003). Starting from the northern part, Viluni, Merxhani, Ceka, Patoku, Karavasta, Narta and Orikumi are situated along Adriatic coast, respectively under the activity of rivers Buna, Drini, Mati, Erzeni, Shkumbini, Semani and Vjosa. Only Butrinti lagoon is situated in the Southern part, in Ionian Sea. The main hydrological characteristics of Albanian territory including the coastal wetlands and lagoons were given by Kabo (1990–91).

Albanian lagoons, wetlands and dunes are distinguished about the richness of breeding and refuge habitats for flora and fauna, especially for fishes and wintering of migratory of globally threatened birds. After World Database on Protected Areas (http://sea.unep-wcmc.org/wdpa/index.htm), along the Albanian coast there extend three Wetlands of International Importance (Ramsar): Butrinti (13'500 ha), Karavasta Lagoon (20'000 ha) and Lake Shkodra and River Buna (49'562 ha); there are also 7 sites of Managed Nature Reserve (ca. 30'000 ha) (Karaburuni / Vlora, Kulari, Kune - Vaini, Patoku - Fushkuqe, Pishe Poro / Fieri, Pishe Poro / Vlora, Rrushkulli, Velipoja). Ancient town in Butrinti belongs to World Heritage Convention, and two sites, Divjaka and Kune belong to Barcelona Convention. Beside the biodiversity and tourist values, the wetlands and lagoons are important habitats for fishing and aquaculture.

Human interest and pressure towards coastal zones and especially wetlands increased continuously after the economical changes in Albania, like urbanization and tourism, water pollution, non sustainable land use in watershed areas, gravel mining in riverbeds, aquaculture and fishing, etc. (Cullaj *et al*., 2005). Microscopic algae of Albanian coastal wetlands are not well known. Knowledge of their food webs and primary production would evidence better the natural state, the values of habitats and biodiversity, the endangerment level, the potential values in fishing and aquaculture, etc. In the present paper, recent data on the phytoplankton of the most representative lagoons of Adriatic coast (Narta, Karavasta and Patoku) is reported, aiming to increase the interest of relevant institutions about their values and continues efforts to protect them.

Material and methods

The study on phytoplankton of three coastal Adriatic lagoons: Narta, Karavasta and Patoku, was carried out during yrs. 2004-07, with a sampling frequency two times per year (April and November). Four stations were selected in Narta, two in Karavasta, and two in Patoku. Sampling mode was done after Utermöhl method (1958), following also EU Standard, prEN 15204 (2005), using an inverted microscope XDS-1R and sedimentation chambers of 25 ml. Additionally, floristic examinations were carried on in phytoplankton and other interesting habitats; cleaning of diatom frustules was performed using the acid method, as described by Krammer & Lange-Bertalot (1991), and also EU standards EN 13946 (2003) and EN 14407 (2004), using a normal optical microscope Leica DML.

Results

Miho (1994) had first studied the phytoplankton of Butrinti lagoon, during yrs. 1987-91; sporadic assessment was carried on in Lezha lagoons (Ceka, Merxhani, Kenalla) (Miho & Mitrushi, 1999), and in other Albanian wetlands, i.e., Saranda, Karavasta, Narta, Patoku, Viluni and Durresi (Lalzi) (Dedej, 2005). Miho & Witkowski (2005) make a review of diatoms of Albanian coastal wetlands, focused on taxonomy and ecology; a checklist of about 430 taxa was reported belonging to different coastal habitats (Butrinti, Karavasta, Lezha, etc.).

In the three lagoons a total of 162 species have been identified (Annex 1). As shown in Annex 1, the species found belong mainly to diatoms (*Bacillariophyceae*) and dinoflagellates (*Dinophyceae*) with respectively 107 and 44 species. The number of species for each lagoon varies from 88 in Patoku, 94 in Karavasta to 102 in Narta. . The highest number of species, more than 50, was found in spring 2006. Taking into account the general composition of phytoplankton for the three lagoons in total, 66% of the species belong to *Bacillariophyceae*, 27% to *Dinophyceae* and 7% to *Cyanophyceae*, *Haptophyceae*, *Dictyochophyceae*, *Prasinophyceae* and *Euglenophyceae* all together. In Patoku lagoon there is an evident difference between species number among diatoms and dinoflagellates, respectively 80% and 20% of species composition. In Karavasta lagoon there is also a difference between these two groups but lower than in Patoku, diatoms with 64% and dinoflagellates with 36%. In Narta lagoon, the situation looks similar to that in Karavasta, diatoms with 69% and dinoflagellates with 31%. It's worth mentioning that pennate diatoms were dominant in all lagoons.

The most common species were *Chaetoceros* sp. *diverse*, *Cylindrotheca closterium*, *Navicula* sp. (*Bacillariophyceae*), and *Prorocentrum micans* and *P. minimum* (Dinophyceae). The most abundant (cell/ml) were diatoms: *Chaetoceros* sp. (spring 2006), *Thalassiosira* sp. and *Cylindrotheca closterium* (spring 2006

and 2007), *Pleurosigma* sp. (spring 2007); from the dinoflagellates most abundant were *Prorocentrum micans* (spring 2006 and 2007) and *P. minimum* (fall 2004, 2006, and spring 2006); *Oscillatoria* sp. (blue-green algae) was found also abundant in spring 2006 (station close to Narta village).

Discussions

Preliminary data on phytoplankton of Narta, Karavasta and Patoku lagoons that belong to the present study were also reported previously by Xhulaj (2006; 2007), Xhulaj & Miho (2007); an overview of the whole study is presented here. The average values of phytoplankton groups (cells/ml) are given in Table 1. Relatively low values of phytoplankton were observed mainly in Patoku and Karavasta. It was only a slight difference between these two lagoons, which was not significantly approved. Narta lagoon was the most productive, especially in spring period (up to 3674 cells/ml in April 2005, and 4761 cells/ml in April 2006). *Bacillariophyceae*, *Dinophyceae* and *Cryptophyceae* represented the most abundant part. Filamentous *Cyanophyceae* (*Anabaena* sp., *Oscillatoria* sp. or *Spirulina* sp.) were present only occasionally, especially in Narta (up to 966 cells/ml in April 06).

The values of phytoplankton were higher in April than in November, as it can be foreseen from the other lagoons (i.e. Butrinti; Miho, 1994). It is worth to mention the presence in high quantity of species from genus *Prorocentrum* (*Dinophyceae*) in Narta, especially *P. micans* and *P. minimum* (up to 407 cells/ml). About 18 species in the phytoplankton belong to toxic or potentially toxic algae given by Moestrup (2004), where the most common were the dinoflagellates, i.e. *Prorocentrum minimum*, *P. lima*, *Gymnodinum* sp., *Amphidinum* sp., *Protoperidinium* sp., etc., and the pennatae diatoms, *Pseudonitzschia seriata*, *Amphora* cf. *coffeaeformis*, etc. *Nevertheless*, they were not relevant in Karavasta and Patoku during all the seasons; they were found relatively abundant in Narta in spring 2006, represented mainly by *P. minimum*; after Moestrup (2004), ingested cells of *P. minimum* may cause detrimental effects in mollusks.

Tab. 1. Seasonal composition of the phytoplankton groups (average values cells/ml) in three Adriatic lagoons (Patoku, Karavasta and Narta) during years 2004-07

Groups	Autumn 2004			Spring 2005			Autumn 2005		
	Patoku	Karavasta	Narta	Patoku	Karavasta	Narta	Patoku	Karavasta	Narta
Diatoms-Centricae	3	23	33	6	10	760	14	72	30
Diatoms-Pennatae	108	81	391	244	73	204	251	171	143
Dinophyceae	1	123	280	26	39	305	21	116	148
Cryptophyceae	54	62	185	323	260	1516	135	95	218
Phytoflagellatae	25	16	35	19	49	30	0	0	0
Chrysophyceae	0	0	0	0	0	0	0	0	0
Haptophyceae	0	1	0	0	0	4	0	0	1
Cyanophyceae	0	0	6	0	0	13	35	0	2
Euglenophyceae	0	0	0	0	0	0	0	0	1
Prasinophyceae	0	0	1	13	0	2	0	0	0
Other Algae	0	0	12	0	0	100	27	0	15
Total (cells/ml):	**190**	**306**	**941**	**632**	**430**	**2934**	**484**	**454**	**557**
Groups	**Spring 2006**			**Autumn 2006**			**Spring 2007**		
	Patoku	Karavasta	Narta	Patoku	Karavasta	Narta	Patoku	Karavasta	Narta
Diatoms-Centricae	234	165	1042	80	66	127	175	64	214
Diatoms-Pennatae	263	225	770	179	147	226	434	410	828
Dinophyceae	121	145	734	295	113	263	105	228	425
Cryptophyceae	97	112	182	29	90	90	176	261	172
Phytoflagellatae	0	0	0	0	0	0	35	159	28
Chrysophyceae	0	0	0	0	0	0	0	0	0
Haptophyceae	0	0	5	0	0	0	0	0	0
Cyanophyceae	0	0	403	0	0	38	0	0	38
Euglenophyceae	0	0	0	0	0	0	0	0	0
Prasinophyceae	5	0	7	3	0	1	0	0	0
Other Algae	13	6	7	3	0	2	0	0	1
Total (cells/ml):	**733**	**652**	**3151**	**587**	**416**	**747**	**924**	**1122**	**1706**

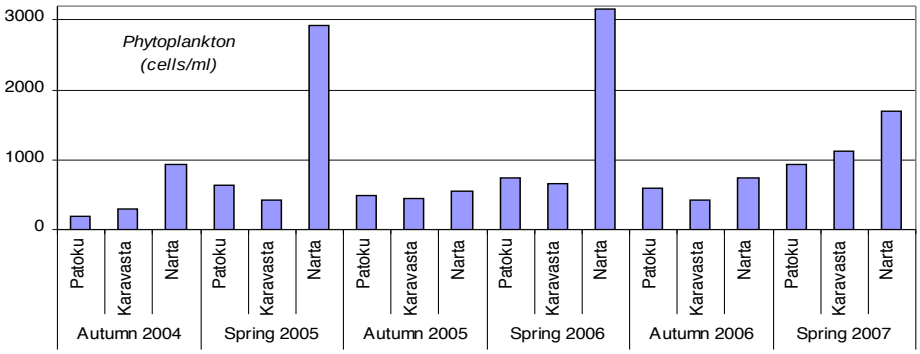

Fig. 1. Seasonal average values of phytoplankton (cells/ml) in Patoku, Karavasta and Narta lagoons during years 2004-07

The scarce communication with the sea and eventual high content of nutrients from the surrounding villages and cultivated fields were probably the consequence of the high presence of dinoflagellates and cyanobacteria in Narta.

According to Guelorget & Perthuisot (1984), Narta waters belong mainly to zone V considering the high content of phytoplankton, which are suitable to an extensive fishing (i.e. mullets) or shrimps (*Peneidae*). Karavasta and Patoku waters may belong mainly to the zones IV and V, as was also confirmed by Guelorget & Lefebvre (1993) in their assessment made in April 1993. According to Dutrieux and Guelorget (1988) the zones IV and V in Karavasta, Narta and Patoku are also characterized by relatively scarce exchange/renewal of the waters and limited communication with the sea.

The studied lagoons are under direct influence of rivers: Ishmi, Tirana, Lana, Gjanica, etc., heavily loaded with urban and industrial sewage waters. Mediterranean dune forests along the coast are under pressure of tourist development (urbanization), too. Also, the high rate of erosion caused by excessive woodcutting, overgrazing or firing in relative shallow water basins, further increases the amount of suspended matter transported to the sea by the rivers. As already mentioned here, most of the lagoons continues suffering from the obstruction of the channels that link with the sea, causing scarce exchange/ renewal of the waters, as well.

Conclusions

The studied Adriatic lagoons show a normal phytoplankton growth, without evident stressing conditions or algal blooms, except in the area of Narta lagoon close to the village. Moreover, several habitats show high species richness (diatoms). A continuous assessment of phytoplankton would inform better about their productivity and stress conditions; the information about toxic algae would prevent the risks in aquatic livings and humans. It would help Albanian institutions to fulfill the required standards derived from the application of the EU Water Framework Directive (WFD).

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Annex 1

List of species found in the three lagoons. With "+" is noted the presence of the species.

P - Patoku; K - Karavasta; N – Narta.

Species	Classification	P	K	N
Achnanthes brevipes	Bacillariophyceae: Pennatae	+	+	+
Achnanthes longipes	Bacillariophyceae: Pennatae		+	+
Achnanthes sp.	Bacillariophyceae: Pennatae	+		+
Alexandrium sp.	Dinophyceae		+	+
Alexandrium tamarense	Dinophyceae	+		
Amphidinium sp.	Dinophyceae	+	+	+
Amphisolenia sp.	Dinophyceae	+		
Amphora ostrearia	Bacillariophyceae: Pennatae		+	+
Amphora pediculus	Bacillariophyceae: Pennatae		+	
Amphora sp.	Bacillariophyceae: Pennatae		+	+
Anabaena sp.	Cyanophyceae			+
Ardissonia fulgens	Bacillariophyceae: Pennatae	+	+	+
Asterionella formosa	Bacillariophyceae: Pennatae			+
Asterionellopsis glacialis	Bacillariophyceae: Pennatae			+
Aulacoseira sp.	Bacillariophyceae: Centricae	+	+	
Bacillaria paradoxa	Bacillariophyceae: Pennatae	+		
Bacteriastrum sp.	Bacillariophyceae: Centricae			+
Ceratium furca	Dinophyceae	+		
Ceratium sp.	Dinophyceae		+	
Ceratium tripos	Dinophyceae		+	
Ceratulina pelagica	Bacillariophyceae: Centricae			+
Chaetoceros affinis	Bacillariophyceae: Centricae	+		
Chaetoceros dadayi	Bacillariophyceae:		+	

	Centricae			
Chaetoceros danicus	Bacillariophyceae: Centricae	+		
Chaetoceros decipiens	Bacillariophyceae: Centricae		+	+
Chaetoceros rostratus	Bacillariophyceae: Centricae			+
Chaetoceros simplex	Bacillariophyceae: Centricae			+
Chaetoceros socialis	Bacillariophyceae: Centricae	+		
Chaetoceros sp.	Bacillariophyceae: Centricae	+	+	+
Chaetoceros tenuissimus	Bacillariophyceae: Centricae			+
Chaetoceros wighamii	Bacillariophyceae: Centricae	+		
Chrysocromulina sp.	Haptophyceae		+	
Coccolithus wallichii	Haptophyceae			+
Cocconeis placentula	Bacillariophyceae: Pennatae		+	
Cocconeis scutellum	Bacillariophyceae: Pennatae	+	+	+
Cocconeis sp.	Bacillariophyceae: Pennatae	+	+	+
Coscinodiscus sp.	Bacillariophyceae: Centricae		+	
Cyclotella ocellata	Bacillariophyceae: Centricae		+	+
Cyclotella radiosa	Bacillariophyceae: Centricae			+
Cyclotella sp.	Bacillariophyceae: Centricae	+	+	+
Cylindrotheca closterium	Bacillariophyceae: Pennatae	+	+	+
Cymbella sp.	Bacillariophyceae: Pennatae	+		+
Dactyliosolen fragilissimus	Bacillariophyceae: Centricae			+
Dictyocha fibula	Dictyochophyceae	+		
Dictyocha speculum	Dictyochophyceae			+
Dinophysis caudata	Dinophyceae		+	+
Dinophysis fortii	Dinophyceae		+	
Dinophysis rotundatum	Dinophyceae		+	+
Dinophysis sacculus	Dinophyceae		+	+
Dinophysis sp.	Dinophyceae		+	+
Diploneis bombus	Bacillariophyceae: Pennatae	+		

Diploneis didyma	Bacillariophyceae: Pennatae	+		
Diploneis sp.	Bacillariophyceae: Pennatae	+	+	+
Ditylum brightwellii	Bacillariophyceae: Pennatae	+		
Entomoneis sp.	Bacillariophyceae: Pennatae	+	+	+
Euglena sp.	Euglenophyceae	+		+
Fragilaria capucina	Bacillariophyceae: Pennatae	+	+	+
Fragilaria crotonensis	Bacillariophyceae: Pennatae		+	
Fragilaria sp.	Bacillariophyceae: Pennatae		+	+
Gonyaulax diegensis	Dinophyceae			+
Gonyaulax sp.	Dinophyceae	+	+	+
Gonyaulax spinifera	Dinophyceae	+		
Grammatophora oceanica	Bacillariophyceae: Pennatae	+	+	
Grammatophora sp.	Bacillariophyceae: Pennatae	+	+	
Gymnodinium sanguineum	Dinophyceae		+	+
Gymnodinium sp.	Dinophyceae	+	+	+
Gyrodinium sp.	Dinophyceae	+		+
Gyrosigma balticum	Bacillariophyceae: Pennatae	+	+	
Gyrosigma eximium	Bacillariophyceae: Pennatae	+		
Gyrosigma scalproides	Bacillariophyceae: Pennatae		+	+
Gyrosigma sp.	Bacillariophyceae: Pennatae	+		+
Hantzschia sp.	Bacillariophyceae: Pennatae		+	
Haslea spicula	Bacillariophyceae: Pennatae			+
Hemiaulus hauckii	Bacillariophyceae: Centricae			+
Heterocapsa triquetra	Dinophyceae			+
Heterodinium sp.	Dinophyceae			+
Hippodonta capitata	Bacillariophyceae: Pennatae			+
Hyalosira delicatula	Bacillariophyceae: Pennatae			
Leptocylindrus danicus	Bacillariophyceae: Centricae	+		+

Leptocylindrus mediterraneus	Bacillariophyceae: Centricae	+		+
Leptocylindrus sp.	Bacillariophyceae: Centricae	+		+
Licmophora flabellata	Bacillariophyceae: Pennatae	+	+	+
Licmophora paradoxa	Bacillariophyceae: Pennatae	+		+
Licmophora remulus	Bacillariophyceae: Pennatae	+		
Licmophora sp.	Bacillariophyceae: Pennatae	+	+	+
Mastogloia angulata	Bacillariophyceae: Pennatae		+	+
Mastogloia sp.	Bacillariophyceae: Pennatae	+	+	+
Melosira moniliformis	Bacillariophyceae: Centricae			+
Melosira nummuloides	Bacillariophyceae: Centricae	+	+	+
Melosira varians	Bacillariophyceae: Centricae	+	+	+
Mesoporos perforatus	Dinophyceae	+		
Mesoporos sp.	Dinophyceae		+	
Navicula digitoradiata	Bacillariophyceae: Pennatae		+	
Navicula gregaria	Bacillariophyceae: Pennatae	+		
Navicula palpebralis	Bacillariophyceae: Pennatae		+	
Navicula phyllepta	Bacillariophyceae: Pennatae	+	+	
Navicula sp.	Bacillariophyceae: Pennatae	+	+	+
Navicula transitans	Bacillariophyceae: Pennatae	+	+	+
Navicula trivialis	Bacillariophyceae: Pennatae			+
Neosynedra provincialis	Bacillariophyceae: Pennatae		+	
Nitzschia coarctata	Bacillariophyceae: Pennatae		+	
Nitzschia compresa	Bacillariophyceae: Pennatae	+		
Nitzschia constricta	Bacillariophyceae: Pennatae	+	+	
Nitzschia frustulum	Bacillariophyceae: Pennatae	+	+	

Nitzschia lanceolata	Bacillariophyceae: Pennatae	+	+	
Nitzschia longissima	Bacillariophyceae: Pennatae	+	+	+
Nitzschia lorenziana	Bacillariophyceae: Pennatae	+		
Nitzschia pellucida	Bacillariophyceae: Pennatae		+	
Nitzschia prolongata	Bacillariophyceae: Pennatae	+		
Nitzschia reversa	Bacillariophyceae: Pennatae	+	+	+
Nitzschia scalpelliformis	Bacillariophyceae: Pennatae			+
Nitzschia sicula	Bacillariophyceae: Pennatae	+		
Nitzschia sp.	Bacillariophyceae: Pennatae	+	+	+
Noctiluca scintillans	Dinophyceae	+	+	+
Odontella aurita	Bacillariophyceae: Centricae	+	+	
Ornithocercus magnificus	Dinophyceae		+	
Oscillatoria sp.	Cyanophyceae	+		+
Oxyphysis sp.	Dinophyceae		+	
Oxyrrhis marina	Dinophyceae			+
Oxytoxum sp.	Dinophyceae	+	+	+
Paralia sp.	Bacillariophyceae: Centricae			+
Peridinium breve	Dinophyceae		+	
Peridinium sp.	Dinophyceae	+	+	+
Pleurosigma angulatum	Bacillariophyceae: Pennatae	+	+	+
Pleurosigma elongatum	Bacillariophyceae: Pennatae	+	+	
Pleurosigma sp.	Bacillariophyceae: Pennatae	+	+	+
Prorocentrum dentatum	Dinophyceae		+	+
Prorocentrum lima	Dinophyceae	+	+	+
Prorocentrum micans	Dinophyceae	+	+	+
Prorocentrum minimum	Dinophyceae	+	+	+
Prorocentrum rotundatum	Dinophyceae		+	
Prorocentrum scutellum	Dinophyceae		+	+
Prorocentrum sp.	Dinophyceae		+	+
Protoperidinium bipes	Dinophyceae		+	+
Protoperidinium breve	Dinophyceae		+	
Protoperidinium depressum	Dinophyceae		+	+

Protoperidinium divergens	Dinophyceae	+		+
Protoperidinium sp.	Dinophyceae	+	+	+
Pseudonitzschia seriata	Bacillariophyceae: Pennatae	+	+	+
Pseudonitzschia sp.	Bacillariophyceae: Pennatae	+		+
Pterosperma sp.	Prasinophyceae			+
Pyramimonas sp.	Prasinophyceae			+
Pyrophacus horologium	Dinophyceae		+	
Pyrophacus sp.	Dinophyceae		+	+
Rhizosolenia alata	Bacillariophyceae: Centricae	+		
Rhopalodia sp.	Bacillariophyceae: Pennatae			+
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Surirella sp.	Bacillariophyceae: Pennatae	+	+	+
Synedra fasciculata	Bacillariophyceae: Pennatae		+	
Syracosphaera pulchra	Haptophyceae	+		+
Thalassionema nitzschioides	Bacillariophyceae: Pennatae	+	+	+
Thalassionema sp.	Bacillariophyceae: Pennatae	+		
Thalassiosira sp.	Bacillariophyceae: Centricae	+	+	+
Thalassiosira visurgis	Bacillariophyceae: Centricae			+
Thalassiosira weissflogii	Bacillariophyceae: Centricae		+	+
Thalassiotrix sp.	Bacillariophyceae: Pennatae	+		
Toxarium undulatum	Bacillariophyceae: Pennatae	+	+	+

References

Cullaj A, Hasko A, Miho A, Schanz F, Brandl H, Bachofen R 2005. The quality of Albanian natural waters and the human impact (Review article). Environment International, 31: 133-146 (**www.sciencedirect.com**)

Dutrieux E, Guelorget O 1988. Ecological Planning: A Possible Method for the Choice of Aqua-cultural Sites. Ocean and Shoreline Management 11: 427–447

Guelorget O, Lefebvre A 1993. Résultats de la campagne réalisée an avril 1993 sur trios lagunes Albanais: Butrinti, Karavasta et Patoku. Laboratoire d'Hydrobiologie Marine, Université des Sciences et Techniques du Languedoc, France: 40 pp.

Guelorget O, Perthuisot J-P 1984. Indicateurs biologiques et diagnose écologique dans le domaine paralique. Bulletin Ecologique 15 (1): 67–76.

INSTAT Ed 2004. Population and Housing Census of Albania, 2001. Shqipëria 2001 - Regjistrimi në Harta – Albania 2001 Census Atlas. Seria e Studimeve, Tirana: 11

Kabo M 1990–91. Gjeografia Fizike e Shqipërisë, Vol. I & II. Albanian Academy of Sciences. Geographical Research Centre, Tirana, Albania

Krammer K, Lange-Bertalot H 1986-2001. Suesswasserflora von Mitteleuropa. 2/1: pp. 876; 2/2: pp. 596; 2/3: pp. 576; 2/4: 437; 2/5: Fischer Verlag, Stuttgart.

Miho A 1994. Qualitative and Quantitative Data on Phytoplankton of Butrinti Lake (Saranda). Ph.D. Dissertation. Tirana University, Tirana, Albania. 145 pp. (In Albanian)

Miho A, Cullaj A, Hasko A, Lazo P, Kupe L, Schanz F, Brandl H, Bachofen R, Baraj B 2005. Gjendja mjedisore e disa lumenjve të Ultësirës Adriatike Shqiptare. SCOPES program (Swiss National Science Foundation - SNSF), Tirana (In albanian with a summary in English): 235 pp. (**www.fshn.edu.al**)

Miho A, Mitrushi R. 1999. Phytoplanktonic data and trophic state of Lezha lagoons. Albanian Journal of Natural and Technical Sciences (AJNTS) (Academy of Sciences, Tirana, Albania) 1/1: 69–76

Miho A, Witkowski A 2005. Diatom (Bacillariophyta) Flora of Albania Coastal Wetlands Taxonomy and Ecology: A Review. Proceedings of the California Academy of Sciences. Vol. 56, No. 12: 129-145

Miho A, Xhulaj S 2005. Të dhëna mbi diatometë e kompleksit ujor Karavasta - Divjakë. Studime Biologjike, 10/2005: 113-123

Mima M, Fitoka N E, Bego F Eds 2003. Inventarizimi i ligatinave shqiptare. ECAT Tirana) dhe EKBY. Thermi, Greece.1-130 + 75 pp. Annexes.

Moestrup Ø 2004. IOC Taxonomic Reference List of Toxic Algae, Intergovernmental Oceanographic Commission of UNESCO; ioc.unesco.org/hab/data.htm,2004.

Peja N, Vaso A, Miho A, Rakaj N, Crivelli J L 1996. Characteristics of Albanian lagoons and their fisheries. Fisheries Research 27: 215-225

EN 13946 2003. Water quality. Guidance standard for the routine sampling and pretreatment of benthic diatoms from rivers.

EN 14407 2004: Water quality. Guidance standard for the identification, enumeration and interpretation of benthic diatom samples from running waters.

prEN 15204 2005. Water quality – Guidance standard on the enumeration of phytoplankton using inverted microscopy (Utermöhl technique).

UNEP Ed 2000. Post-Conflict Environmental Assessment - Albania. United Nations Environment Programme (UNEP), SMI (Distribution Services) Limited, Stevenage, UK. 80 pp.

Utermöhl H 1958. Zur Vervollkommung der quantitaiven Phytopankton-Methodik. Mitt int Ver theor angew Limnol 9: 1-38

Xhulaj S 2006 Të dhëna mbi diatometë e lagunës së Nartës. Buletini Matematika dhe Shkencat e Natyrës - BMSHN (UT), Nr. 3: 43-52

Xhulaj S 2007. Mbi përbërjen llojore të diatomeve të lagunës së Patokut (Laç). Buletini Matematika dhe Shkencat e Natyrës - BMSHN (UT), Nr. 4: 62-71.

