NATURA MONTENEGRINA, Podgorica, 2011, 10(3): 215-225

PHYTOPLANKTON ABUNDANCE AND COMPOSITION IN THE VILUNI LAGOON (ALBANIAN NORTHERN COAST)

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Key words:
Chaetoceros, *Cylindrotheca closterium*, phytoplankton, blooms, Viluni lagoon.

SYNOPSIS

The present study was carried out in order to investigate the lagoon's phytoplankton abundance and species composition. Diatoms and dinoflagellates were the two main groups of phytoplankton present in water samples taken from the Viluni lagoon during 2007, representing 97% of the total phytoplankton cells counted. A bloom formed by *Chaetoceros* spp. and *Cylindrotheca closterium* was observed in the mid area of the lagoon during the summer, reaching 10000 cells/ml in July. Diatom densities were relatively higher than those of dinoflagellates. The southern part of the lagoon maintained the highest density of dinoflagellates, constituting 64% of the total phytoplankton cells counted. A high abundance of dinoflagellates was also observed in April near the channel connecting the lagoon with the sea, constituting 97% of the total phytoplankton cells counted. Phytoplankton abundance increased with rising water temperature during summer. The abundance of dinoflagellates and other diatom species dropped clearly during the blooming of *Chaetoceros* spp. and *Cylindrotheca closterium*.

INTRODUCTION

The Viluni wetland system together with its marshes covers a total area of 16.3 km^2. Viluni is situated about 2 km in the east of Velipoja beach, about 7 km from the Buna estuary and 12 km in northern part of Shengjini. The coastal lagoon of Viluni is the largest body, with a surface of 3.9 km^2 (3 km long and 0.9 km wide). It represents the remnant part of the drainage of the former wetland complex Pentari – Domni – Murtemza - Velipoja. Viluni is the most important transitional habitat sensu stricto in the whole Velipoja complex, a typical coastal lagoon, separated from the sea by two long shore barriers. The lagoon is characterized by shallow waters, 0.8

to 1 m of depth, in few parts up to 2-3 m. It is connected with the sea through a channel about 300 m long, 30 – 40 m wide and 2 m deep, which is never blocked; its brackish waters exchanges with the seawaters with tide periodicity of 6 hours, which is a rule in Mediterranean lagoons. The mean temperatures of the water oscillate 20 - 22˚C in July and 5 – 7˚C in February. There are also large swamps flooded periodically (3 km^2) and natural dunes at the seaside; therefore, its surface varies largely. There are also four small islands in the lagoon (Miho et al., 2008).

The natural zoning of vegetation in the northern part begins with floodplain forests, followed by tamarisks, *Carex-Juncus* associations and halophylous plants, mainly with *Salicornia* sp.; a reed belt grows only along the littoral parts. A dam prolongs to the western part, and then behind a swampy area with psamo-halophytes.

Miho & Witkowski (2005) made a review of diatoms of the Albanian coastal wetlands, focusing on the taxonomy and ecology; a checklist of 430 taxa was reported belonging to different coastal habitats. Among these species only 27 were recorded at the Viluni lagoon.

The lagoon is the natural nesting site of the Kentish plover (*Charadrius alexandrinus*), and the only natural breading ground of Common Redshank (*Tringa totanus*) in the delta; it is also an important feeding ground for pygmy cormorant and sandwich tern (*Sterna sandwvicensis*), as well as a significant locality for waterfowl, especially during winter.(Miho et al., 2008).

Twenty one mollusk species have been recorded at Viluni lagoon, 12 are gastropods and 9 bivalves; the most common and abundant are the gastropods *Ventrosia ventrosia*, *Rissoa labiosa,* and the bivalves *Cerastoderma glaucum* and *Scrobicularia cottardi* (Miho et al., 2008).

MATERIAL AND METHODS

The investigation started in January 2007 and extended to December 2007 with sampling carried out at monthly intervals. In order to give a better representation of the habitats in the lagoon, seven stations were selected (Fig. 1): V1 and V2 in the northern part; fresh water channels flow in this area; V3 and V4 in the middle; V5 and V6 in the southern part of the lagoon, influenced by currents entering through the channel of communication with the sea; V7 in the western part of the lagoon, close to the channel of communication with the sea.

For the phytoplankton analysis, four series of about 1000 ml of water were collected from subsurface and near the bottom in the selected stations of Viluni Lagoon. The water samples were immediately stored in plastic bottles with Lugol Iodine solution. The species composition and counting of phytoplankton cells were done using inverted microscope Carl Zeiss, Axiovert 40C at high magnification 40x and 100x (objectives) according to Utermöhl (1958), described also in Guillard (1973) in EU Standard prEN 1524 (2005), Lund et al., (1958). The references used for identification of phytoplankton organisms were based on Rampi & Bernhard (1978; 1980), Ricard (1987), Sournia (1978), Hasle & Syvertsen (1996), Witkowski et al. (2000).

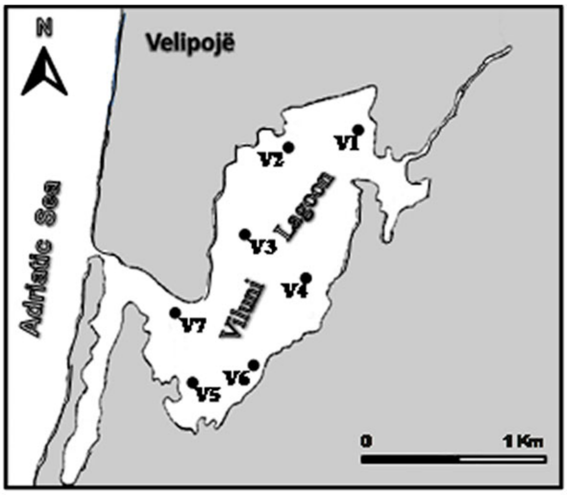

Figure 1:
Map of sampling stations in Viluni Lagoon.

RESULTS

Total phytoplankton cell abundance in 2007 varied significantly from one station to the other. On a monthly average basis, there was a major peak of 2500 cells/ml in July. Lowest abundance was recorded in May (1.34 cells/ml). The annual average value amounted to 293 cells/ml (Tab. 1). The phytoplankton species identified belonged to the following divisions: Cyanophyta (Class Cyanophyceae), Heterokontophyta (Class Bacillariophyceae and Dictyochophyceae), Haptophyta (Class Haptophyceae), Cryptophyta (Class Cryptophyceae), Dinophyta (Class Dinophyceae), Euglenophyta (Class Euglenophyceae) and Chlorophyta (Class Prasinophyceae and Chlorophyceae). Bacillariophyceae (diatoms) and Dinophyceae (dinoflagellates) were the two main classes of phytoplankton in the Viluni Lagoon. They represented 97% of the total phytoplankton cells counted, where diatoms contributed 64.1% and dinoflagellates 32.4% of the total. Diatoms were the most dominant group, with the exception of April, when dinoflagellates dominated the community. Species belonging to other taxonomic groups were relatively rare during the course of the research. During the summer, the outburst of diatoms was observed when *Chaetoceros* spp. and *Cylindrotheca closterium* bloomed (Tab. 2). These species contributed more than 99% of the total phytoplankton cells during June and July at stations V3 and V4 at the middle part of the lagoon (Tab. 3). Dinoflagellates were the second most abundant group during this investigation, except in April (station V6 and V7), May (V7), July (V1, V6, V7), August (V7), September (V3) and particularly at station V5 where dinoflagellates dominated (Tab. 5). The average density of dinoflagellates was higher during the summer and autumn than in spring, showing a wide variation between a maximum of 10.6 cells/ml in June and the minimum of 0.7 cells/ml in May, with an annual average of 4.7 cells/ml (Tab. 4).

Table 1: Total density of phytoplankton (cells/ml).

	Station							
Month	V1	V2	V3	V4	V5	V6	V7	Average
January	7.2	4.0	22.8	10.4	7.2	5.6	14.5	10.2
February	4.5	14.0	17.0	12.5	12.5	5.0	2.6	9.7
March	22.0	4.4	2.8	2.8	10.4	1.2	5.2	7.0
April	2.6	3.6	2.8	2.4	5.0	1.0	7.2	3.5
May	0.8	1.6	0.7	2.2	1.6	0.5	2.0	1.3
June	54.8	33.6	3000	2000	37.2	11.8	4.8	734.6
July	6.5	71.5	10000	8000	44.4	11.8	4.8	2591.3
August	84.4	48.4	16.8	18.8	24.8	9.2	11.6	30.6
September	50.4	11.6	25.2	22.8	32.8	18.8	24.0	26.5
October	10.0	30.8	19.2	9.2	16.4	124.8	73.2	40.5
November	16.4	31.2	13.4	11.8	15.0	65.0	91.0	34.8
December	24.0	34.4	10.4	14.4	14.4	6.8	109.2	30.5
Average	23.6	24.1	1094.3	842.3	18.5	21.8	29.2	293.4

A total of 138 phytoplanktonic taxa were identified (Tab. 6). The diatoms were the predominant group with 87 taxa recorded, or 63% of the total. The most abundant are the following genera: *Asterionellopsis, Chaetoceros, Cylindrotheca, Dactyliosolen, Leptocylindrus, Skeletonema, Striatella, Synedra* and *Thalassionema*. The most important species of these genera were: *Asterionellopsis glacialis, Chaetoceros affinis, Ch. decipiens, Ch. curvisetus, Cylindrotheca closterium, Dactyliosolen fragilissimus, Leptocylindrus danicus, Skeletonema costatum, Striatella unipuctata, Synedra tabulata* and *Thalassionema nitzschoides*.

Table 2: Population density of diatoms (cells/ml).

Month	Station							
	V1	V2	V3	V4	V5	V6	V7	Average
January	3.0	3.0	20.0	7.0	1.0	3.0	13.0	7.1
February	3.0	10.0	16.0	11.0	0.0	2.0	1.0	6.1
March	21.0	4.0	1.0	2.0	3.0	1.0	4.0	5.1
April	1.0	3.0	2.0	2.0	2.0	0.0	0.0	1.4
May	1.0	1.0	1.0	1.0	1.0	0.0	1.0	0.9
June	50.0	20.0	3000	2000	2.0	215.0	75.0	766.0
July	2.0	65.0	10000	8000	41.0	5.0	1.0	2587.7
August	72.0	29.0	10.0	9.0	7.0	7.0	4.0	19.7
September	49.0	9.0	8.0	12.0	12.0	11.0	19.0	17.1
October	7.0	20.0	12.0	7.0	7.0	113.0	71.0	33.9
November	14.0	26.0	10.0	8.0	5.0	58.0	88.0	29.9
December	22.0	32.0	9.0	10.0	3.0	4.0	106.0	26.6
Average	20.4	18.5	1090.8	839.1	7.0	34.9	31.9	291.8

Table 3: Percentage abundance of diatoms.

Month	Station							
	V1	V2	V3	V4	V5	V6	V7	Average
January	38.90	70.00	89.50	65.40	9.70	58.90	86.20	59.80
February	66.70	71.40	94.10	84.00	2.40	46.00	50.00	59.23
March	93.20	90.90	42.90	71.40	30.70	66.70	76.90	67.53
April	53.80	83.30	57.10	66.70	36.00	20.00	2.80	45.67
May	62.50	56.30	71.40	54.50	37.50	60.00	25.00	52.46
June	91.20	58.30	99.40	99.80	5.40	98.00	94.00	78.01
July	36.90	91.30	100	100	91.90	40.70	10.40	67.31
August	85.80	60.30	57.10	48.90	29.00	73.90	37.90	56.13
September	96.80	79.30	31.70	52.60	35.40	59.60	78.30	61.96
October	68.00	66.20	62.50	78.30	41.50	90.40	97.30	72.03
November	86.60	84.60	77.60	71.20	33.30	89.20	96.70	77.03
December	90.00	94.20	84.60	66.70	22.20	52.90	96.70	72.47
Average	72.53	75.51	72.33	71.63	31.25	63.03	62.68	64.14

Table 4: Population density of dinoflagellates (cells/ml).

Month	Station							
	V1	V2	V3	V4	V5	V6	V7	Average
January	3.6	0.4	2.4	3.6	6.3	2.0	1.3	2.8
February	1.0	4.0	1.0	1.5	10.2	2.0	0.6	2.9
March	0.5	0.0	1.2	0.8	5.6	0.4	1.2	1.4
April	1.2	0.6	1.2	0.8	3.2	0.8	7.0	2.1
May	0.3	0.7	0.2	1.0	1.0	0.2	1.5	0.7
June	4.8	14.0	10.4	5.2	30.8	4.4	4.8	10.6
July	4.1	6.2	1.0	2.9	3.6	7.0	4.3	4.2
August	12.0	8.8	3.2	9.6	16.8	2.0	6.8	8.5
September	1.6	2.0	17.2	6.8	20.0	7.6	5.2	8.6
October	2.0	7.6	4.4	2.0	9.6	12.0	2.0	5.7
November	2.2	4.8	3.0	3.4	10.0	7.0	3.0	4.8
December	2.4	2.0	1.6	4.8	11.2	3.2	3.6	4.1
Average	3.0	4.3	3.9	3.5	10.7	4.1	3.4	4.7

Table 5: Percentage abundance of dinoflagellates.

Month	Station							
	V1	V2	V3	V4	V5	V6	V7	Average
January	50.00	10.00	10.50	34.60	86.00	35.70	8.90	33.67
February	22.20	28.50	5.90	12.00	81.60	40.00	23.00	30.46
March	2.70	0.00	42.80	28.50	53.80	33.30	23.00	26.30
April	46.20	16.70	42.90	33.30	64.00	80.00	97.20	54.33
May	37.50	43.80	28.60	45.50	62.50	40.00	75.00	47.56
June	8.80	41.70	0.50	0.20	82.80	2.00	5.50	20.21
July	63.10	8.70	0.00	0.00	8.10	59.30	89.60	32.69
August	14.20	18.20	19.00	51.00	67.70	21.70	58.60	35.77
September	3.20	17.20	68.30	29.80	61.00	40.40	21.70	34.51
October	20.00	24.70	22.90	21.70	58.50	9.60	2.70	22.87
November	13.40	15.40	22.40	28.80	66.70	10.80	3.30	22.97
December	10.00	5.80	15.40	33.30	77.80	47.10	3.30	27.53
Average	24.28	19.23	23.27	26.56	64.21	34.99	34.32	32.41

A total of 35 taxa of dinoflagellates were identified. The most abundant species belonged to the following genera: *Dinophysis, Gonyaulax, Heterocapsa, Prorocentrum, Protoperidinium* and *Scripssiella*. The most important species of these genera were: *Dinophysis caudata, D. fortii, D. sacculus, Gonyaulax monocantha, G. spinifera, Heterocapsa triquetra, Prorocentrum micans, P. minimum, P. scutellum, Protoperidinium bipes, P. depressum, P. diabolum* and *Scrippsiella trochoidea*. Microscopic observations revealed that *Dinophysis* spp., *Protoperidinium* spp. and *Gonyaulax* spp. were widely distributed in the southern part of the lagoon while *Prorocentrum micans* and *P. minimum* were found at the most sampling stations, their number relatively high in the northern and central part.

The blue-green algae were represented by six species: *Anabaena cylindrica*, *Chroococcus minutus*, *Oscillatoria limosa*, *O. curviceps*, *Spirulina major* and *S. subsalsa*, occupying 4% of the total number of taxa identified. They were recorded mostly in the second half of the year. The highest density of *Anabaena cylindrica* was found in June at station V5 constituting 9.5 % of the station’s total. High density of *Oscillatoria* spp. was observed at station V3 during June, forming 24% of the total of this month.

Cryptophyceae were represented by two species namely *Cryptomonas marina* and *Teleaulax amphioxeia* found in the northern part. These species together formed 21.5% of the total abundance at station V2 in August.

Dictyochophyceae were also represented by two species namely *Dictyocha fibula* and *D. speculum* recorded in February at station V7 forming 22% of the total of this month.

Euglenophyceae were represented by two species of genus *Eutreptiella* and *Anisonema*, observed at station V1 and V4 in May.

The green algae were represented by three species: *Pyramimonas* sp., *Planctonema lauterbornii* and *Dunaliella salina*. The first one was recorded at stations V1 and V2 in November while *P. lauterbornii* and *D. salina* were observed only in March at station V7.

DISCUSSION

Phytoplankton peak abundance in the Viluni Lagoon in July 2007 was mainly due to *Chaetoceros* spp. and *Cylindrotheca closterium* bloom at stations V3 and V4 in the central part of the lagoon. The summer water temperature may be suitable for sustaining growth of phytoplankton communities in the lagoon. Low population density of nearly all species in winter and spring confirmed this view. High abundance of *Chaetoceros* spp. and *C. closterium* in stations V3 and V4 in June and July, and not in other stations, may be due to the suitable concentrations of limiting nutrients that induce its thriving in the hot season. According to Raymont (1980) the huge summer blooms are usually attributed to outburst of one or two species of diatoms. The following diatoms were found in almost all sampling stations: *Asterionellopsis glacialis, Chaetoceros affinis, Ch. decipiens, Ch. curvisetus, Cocconeis scutellum, Cyclotella meneghiniana, Cylindrotheca closterium, Dactyliosolen fragilissimus, Leptocylindrus danicus, Melosira moniliformis, Navicula gregaria, Skeletonema costatum, Striatella unipuctata, Synedra tabulata, Thalassionema nitzschoides* and *Toxarium undulatum*. In general, planktonic species are unusually not found due to shallowness of the lagoon, while benthic or epiphytic species are common in the water column, with pennate diatoms dominating over the centric species.

Dinoflagellates occupied the second predominance position with few exceptions at the southern part of the lagoon. The percentage of abundance of this group indicated that they constituted more than 95 % and 85% of the total phytoplankton, respectively in April and July at station V7, close to the channel that connects the lagoon with the sea. The most abundant species recorded on both months were: *Dinophysis caudata, Gonyaulax monocantha, Heterocapsa triquetra, Prorocentrum micans, P. minimum, Protoperidinium depressum and Scrippsiella trochoidea*. The highest density of dinoflagellates was recorded in the southern part, constituting 64% of the total phytoplankton cells counted.

A distinct decline of other phytoplankton species was observed during the blooming of *Chaetoceros* spp. and *Cylindrotheca closterium* July. It is worthy of note that, besides consuming a high concentration of nutrients during the period of thriving, the outburst of some algal species significantly reduces light penetration and consequently restrict the photosynthetic activity of the other species.

CONCLUSIONS

Seventeen species of diatoms are common to those reported by Miho & Witkowski (2005). 60 species of diatoms recorded in the present study can be considered new species due to scarce studies on this lagoon. Preceding data on other groups of phytoplankton were completely lacking, therefore all the other phytoplankton species belonging to different classes are being reported for the first time for the lagoon (Tab. 6).

Table 6: List of phytoplankton species recorded in Viluni lagoon in 2007.

Bacillariophyceae (Heterokontophyta)	*Licmophora gracilis (Ehr.) Grunow var. gracilis*
Achnanthes brevipes C.A. Agardh*	*Licmophora paradoxa (Lyngbye) Agardh*
Ardissonia fulgens (Greville) Grunow*	*Mastogloia angulata Lewis**
Amphora coffaeiformis (C.A. Agardh) Kützing	*Mastogloia braunii Grunow*
Amphora ostrearia Brébisson	*Mastogloia smithii Thwaites*
Amphora ovalis Kützing	*Melosira moniliformis (O.F.Müller) Agardh**
Amphora holsatica Hustedt*	*Navicula ammophila Grunow*
Amphora kolbei Aleem	*Navicula cancellata Donkin*
Asterionella formosa Hassall	*Navicula cryptocephala Kützing*
Asterionellopsis glacialis (Castracane) Round	*Navicula directa (W.Smith) Ralfs*
Bacillaria paradoxa Gmelin	*Navicula gregaria Donkin**
Bacteriastrum delicatulum Cleve	*Navicula palpebralis Brébisson ex W. Smith*
Campylodiscus hibernicus Ehrenberg	*Navicula salinarum Grunow*
Chaetoceros affinis Lauder	*Nitzschia acicularis (Kützing) W. Smith*
Chaetoceros brevis Schütt	*Nitzschia amphibia Grunow*
Chaetoceros curvisetus Cleve	*Nitzschia angularis W. Smith*
Chaetoceros decipiens Cleve	*Nitzschia constricta (Kützing) Ralfs**
Chaetoceros didymus Ehrenberg	*Nitzschia fonticola Grunow*
Cocconeis placentula Ehrenberg*	*Nitzschia frustulum (Kützing) Grunow*
Cocconeis scutellum Ehrenberg*	*Nitzschia hungarica Grunow*
Cocconeis scutellum var. *parva* Grunow	*Nitzschia longissima (Brébisson ex Kützing) Ralfs**
Coscinodiscus granii Gough	*Nitzschia lorenziana Grunow*
Coscinodiscus radiatus Ehrenberg	*Nitzschia sigma (Kützing) W. Smith**
Cyclotella meneghiniana Kützing	*Nitzschia subtilis (Kützing) Grunow*
Cyclotella ocellata Pantocsek	*Paralia sulcata (Ehrenberg) Cleve*
Cylindrotheca closterium (Ehr.) Reiman & Lewin	*Petrodyction gemma (Ehrenberg) D.G.Mann*
Dactyliosolen fragilissimus (Bergon) Hasle	*Pleurosigma angulatum (Queckett) W. Smith**
Diatoma vulgaris Bory	*Rhabdonema adriaticum Kützing*
Diploneis elliptica (Kützing) Cleve	*Rhizosolenia alata Brightwell*
Diploneis interrupta (Kützing) Cleve	*Rhizosolenia delicatula Cleve*
Diploneis ovalis (Hilse) Cleve	*Rhizosolenia robusta Norman*
Epithemia sorex Kützing	*Rhopalodia gibba (Ehrenberg) Müller*
Fragilaria crotonensis Kitton	*Skeletonema costatum (Greville) Cleve*
Fragilaria ulna (Nitzsch) Lange-Bertalot	*Stauroneis anceps Ehrenberg*
Gomphonema parvulum (Kützing) Kützing	*Stauroneis dubitabilis Hustedt*
Grammatophora oceanica (Ehrenberg) Grunow*	*Striatella unipuctata (Lyngbye) Agardh**
Gyrosigma acuminatum (Kützing) Rabenhorst*	*Surirella fastuosa (Ehrenberg) Kützing**
Gyrosigma balticum (Kützing) Rabenhorst*	*Surirella striatula Turpin*
Gyrosigma eximium (Thwaites) Boyer	*Synedra tabulata (C.A. Agardh) Kützing*
Gyrosigma scalproides (Rabenhorst) Cleve	*Thalassiosira eccentrica (Ehrenberg) Cleve*
Gyrosigma spencerii (W.Smith) Griffith & Henfrey	*Thalassionema nitzschioides (Grun.)Mereschkowsky*
Hantzschia amphioxys (Ehrenberg) Grunow	*Thalassiosira sp.*
Hemiaulus hauckii Grunow	*Toxarium undulatum Bailey*
Leptocylindrus danicus Cleve	
Licmophora flabellata (Carmichael) Agardh	

Dinophyceae (Dinophyta) *Amphidinium lanceolatum* Schröder *Amphisolenia bidentata* Schroder *Ceratium furca* (Ehrenberg) Claparede & Lachman *Ceratium fusus* (Ehrenberg) Dujardin *Ceratium minutum* Jörgensen *Ceratium tripos* (O. F. Müller) Nitzsch *Dinophysis caudata* Saville-Kent *Dinophysis fortii* Pavillard *Dinophysis rotundata* Claparede & Lachman *Dinophysis sacculus* Stein *Dinophysis tripos* Gourret *Gonyaulax diegensis* Kofoid *Gonyaulax monocantha* Pavillard *Gonyaulax spinifera* (Claparede & Lachman) Diesing *Gymnodinium cucumis* Schütt *Gymnodinium gibberum* Schilling *Gymnodinium rotundatum* Klebs *Gymnodinium* sp. *Gyrodinium spirale* (Bergh) Kofoid & Swezy *Heterocapsa triquetra* (Ehrenberg) Stein *Karenia brevis* (Davis) G. Hansen et Moestrup *Noctiluca scintillans* (Macartney) Kofoid & Swezy *Oxytoxum longiceps* Schiller *Protoperidinium bipes* (Paulsen) Balech *Protoperidinium conicum (Gran) Balech* *Protoperidinium depressum (Baley) Balech* *Protoperidinium diabolum (Cleve) Balech* *Protoperidinium divergens (Ehrenberg) Balech* *Protoperidinium globulus (Stein) Balech* *Prorocentrum dentatum Stein* *Prorocentrum lima (Ehrenberg) Dodge* *Prorocentrum micans Ehrenberg* *Prorocentrum minimum (Pavillard) Schiller* *Prorocentrum scutellum Schroed* *Scrippsiella trochoidea (Stein) Loeblich*	**Cyanophyceae (Cyanophyta)** *Anabaena cylindrica* Lemmermann *Chroococcus minutus* (Kützing) Nägeli *Oscillatoria limosa* C.A. Agardh *Oscillatoria curviceps* C.A. Agardh *Spirulina major* Kützing *Spirulina subsalsa* Ørsted **Haptophyceae (Haptophyta)** *Chrysochromulina adriatica* Leadbeater **Cryptophyceae (Cryptophyta)** *Cryptomonas marina* Dangeard *Teleaulax amphioxeia* (Conrad) Hill **Dictyochophyceae (Heterokontophyta)** *Dictyocha fibula* Ehrenberg *Dictyocha speculum* Ehrenberg **Euglenophyceae (Euglenophyta)** *Eutreptiella* sp. *Anisonema prosgeobium* Skuja **Chlorophyceae (Chlorophyta)** *Planctonema lauterbornii* Schmidle *Dunaliella salina* Teodoresco **Prasinophyceae (Chlorophyta)** *Pyramimonas* sp.

* Also reported by Miho & Witkowski (2005).

REFERENCES:

GUILLARD, R.L.R. 1973: Division rates. In: Stein J.R. (Eds), Handbook of Phycological Methods. - *Cambridge University Press*, *Cambridge,* pp: 289-312.

HASLE, G.R. & SYVERTSEN, E.E. 1996: Identifying marine diatoms. Vol. 2. - *Academic Press, San Diego*, New York, 361 pp.

LUND, J.W.G., KIPLING, C., & LECREN, E.D. 1958: The Inverted Microscope Method of Estimating Algal Numbers and the Statistical Basis of Estimations by Counting. – *Hydrobiologia,* 11: 143-170.

MIHO, A. & WITKOWSKI, A. 2005: Diatom (Bacillariophyta) Flora of Albania Coastal Wetlands Taxonomy and Ecology: A Review. - *Proceedings of the California Academy of Sciences*. 56(12): 129-145.

MIHO, A., KASHTA, L. & BEQIRAJ, S. 2008: Between the Land and the Sea - Ecoguide to discover the transitional waters of Albania. - *Salento University Publishing*, 250 pp.

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

RAMPI, L. & BERNHARD, M. 1978: Key for the determination of Mediterranean Diatoms. - *Comitato Nazionale Energia Nucleare* RT/BIO (78-1), Roma, 71pp.

RAMPI, L. & BERNHARD, M. 1980: Chiave per la determinazione delle Peridinee Pelagiche Medterranee. – *Comitato Nazionale Energia Nucleare* RT/BIO (80)8, Roma, 193 pp.

RAYMONT, J.E.G. 1980: Plankton and productivity in the oceans. Phytoplankton, Vol. 1, second edition. - *Pergamon Press*, Oxford, 489 pp.

RICARD, M. 1987: Atlas du phytoplancton marin. Diatomophycées, Volume 2. – Edition du *C.N.R.S.*, Paris, 297 pp.

SOURNIA, A. 1978: Phytoplankton Manual. - *UNESCO Monographs on Oceanographic Methodology*, 6, Paris, 337 pp.

UTERMÖHL, H. 1958: Zur Vervollkommung der quantitaiven Phytopankton-Methodik. Mitteilungen Internatonale Vereinigung Theoretische und Angewandte. - *Limnologie* 9: 1-38.

WITKOWSKI, A., LANGE-BERTALOT, H. & METZELTIN, D. 2000: Diatom flora of Marine Coasts 1. In: Lange-Bertalot, H. (Eds), Iconographia. Diatomologica. Annotated Diatom Micrographs, Vol.7. Diversity-Taxonomy-Identification. Konigstein, Germany. - *A. R. G. Gantner Verlag K. G. Koeltz Scientific Books*, 219 plates, 925 pp.

Received: 04 Aprile 2010.