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Investigation of Qualitatively Phytoplankton in the Turkish Coasts of the Black Sea and a Species List

Karadeniz'in Türkiye Kıyılarında Fitoplanktonun Kalitatif Olarak İncelenmesi ve Tür Listesi

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Abstract

In this study, in respect of "The Black Sea Pollution Monitoring Project", the distribution of the qualitatively phytoplankton in the samplings during the periods of September 2004, April 2005 and October 2005 along the Turkish coasts of the Black Sea has been investigated and also has been presented a species list. The acquired list of the species will contribute so much to the phytoplankton control list of Turkish Coasts of the Black Sea. A total of 129 taxa belonging to 7 classes were identified in qualitative and quantitative samples. Diatoms represented the majority of the community (52.7 %), followed by dinoflagellates (36.4 %). Especially in the water samples of river inputs belonging to 4 classes were determined totally 12 fresh water algae species.

Key words: Phytoplankton, species list, Black Sea, Turkish coasts.

Introduction

In the literature on the Turkish coasts of Black Sea the phytoplankton studies were limited. There are some studies about this subject done

by Feyizoğlu and Tuncer (1994),Uysal and Sur (1995) and Türkoğlu and Koray (2002). This study will contribute with the previous studies so much to the formation of the phytoplankton check list of Turkish coasts of Black Sea. The study presents the species list and the regional qualitatively distribution of the phytoplankton in the samples of water and plankton net taken in one spring and two fall seasons.

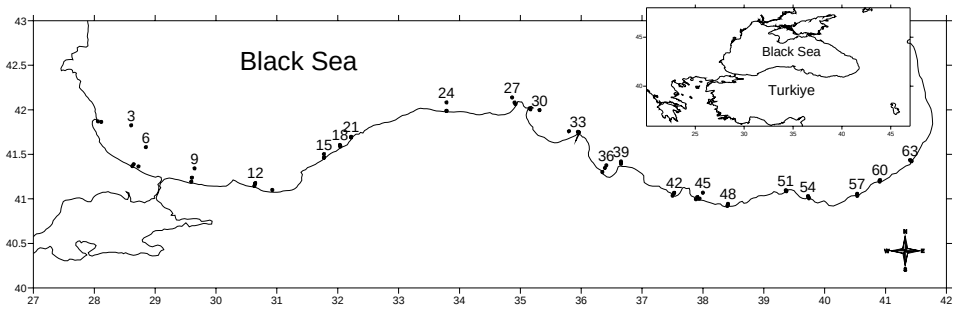

Figure 1. The sampling stations.

Material and Method

The study area included all the Turkish coasts of the Black Sea (41°87' 03 and 41°26'10 N latitude-28°05'86 and 41°24'17 E longitude), a coast line of 1400 km (Fig.1). The phytoplankton water samples were collected at 30 stations (21 stations are on 50 m depth line and others are on 20 m depth line). In addition net samplings were carried out at 10 stations vertically at 50 m depth representing all the study area. The samplings were carried out in September 2004, April 2005 and October 2005.

For the quantitative analyses the phytoplankton water samples collected from standard depths (0.5, 5, 10, 20 m) by Niskin bottles were transferred into 1 liter PVC containers. The water samples were immediately fixed with 40 % formalin buffered with borax in the

proportion of 1:100 and were allowed to settle in the laboratory for a week and concentrated up to 100 ml (Sukhanova, 1978). The concentrated water samples were stored in dark coloured glass bottles with 2 ml 40 % formalin added to preserve during storage (Throndsen, 1978).

The phytoplankton net samples were taken vertically by a standard Nansen plankton net, diameter 57 cm, pore size 55 µm. Then these samples were transferred into plastic vessel (330 cc) and fixed with 40 % formalin buffered with borax to a final concentration of 4 % (Throndsen, 1978).

For species identifications one or two drop net samples were placed on to the glass and covered with a cover glass and then species were identified under a light microscope with 100x and 400x magnifications. The following references used for species identification; Cupp (1943), Delgado and Fortuna (1991), Dodge (1985),Gerhard (1974), Hasle *et al.* (1997), Hendey (1964), Jensen and Moestrup (1998), Fitter and Manuel (1986).

Results

A total of 73 taxa belonging to 3 classes have been identified in plankton net and water samples for whole study area in September 2004. 30 species were dinoflagellates (Dinophyceae), 42 species were diatoms (Bacillariophyceae) and one species was chrysophyte (Chrysophyceae). The most frequent phytoplankton species were the dinoflagellates *Ceratium* spp., *Prorocentrum* spp. and *Protoperidinium* spp., and the diatom *Chaetoceros* spp., *Pseudo-nitzschia* spp. and *Rhizosolenia* spp. Qualitative sampling showed that species number were higher in west part of Black Sea than the east

part in September 2004. 32 species determined at station 11 and 18 species determined at station 50.

A total of 57 taxa belonging to 4 classes have been identified in plankton net and water samples for whole study area in April 2005. 28 species were dinoflagellates, 27 species were diatoms, one species was euglenophyte (Euglenophyceae) and one other species was silicoflagellate (Dictyochophyceae). The most frequent phytoplankton species were the dinoflagellates *Ceratium* spp.*, Noctiluca scintillans* (Macartney) Kofoid and *Protoperidinium* spp., and the diatoms *Chaetoceros* spp., and *Rhizosolenia hebetata* var. *semispina* (Hensen) Gran. Qualitative results showed that species number were higher in the middle part of Black Sea than the east and west part in April 2005. The highest species number (20 species) determined at stations 26 and 32.

A total of 68 taxa belonging to 2 classes have been determined only in plankton net samples in October 2005. Dinophycea is represented by 24 species while Bacillariophycea is represented by 44 species. The most frequent phytoplankton species were the dinoflagellates *Ceratium* spp. and *Protoperidinium* spp., and the diatoms *Chaetoceros* spp., *Guinardia striata* Stolterfoth Hasle com. Now. and *Thalassionema nitzschioides* (Grunow). 85 phytoplankton species have been identified in both plankton net and water samples in this sampling period. 36 species from these were dinoflagellates, 48 species were diatoms and one species was euglenophyte. The results showed that species numbers were higher in October 2005 period than the previous sampling periods.

A total of 129 taxa belonging to 7 classes, 22 at the generic level, were identified as the result for whole sampling periods (Table 1).

Cyanophyceae is represented by 4 species, Dinophyceae by 47 species, Crysophyceae by one species, Dictyochophyceae by one species, Bacillariophycea by 68 species, Euglenophyceae by 3 species and Chlorophyceae by 5 species. Moreover especially in the water samples that they taked from in the mouths of rivers belonging to 4 classes were determined totally 12 fresh water algae species. Diatoms represented the majority of the community (52.7 %), followed by dinoflagellates (36.4 %). The most frequent phytoplankton genera were the diatom *Chaetoceros* and dinoflagellate *Protoperidinium* in terms of diversity.

Table 1 List of identified phytoplankton species in all the study area.

PROCARYOTA
Cyanophyta
Cyanophyceae
Aphanizomenon sp. (fresh water algae)
Anabaena sp. (fresh water algae)
Chroococcus sp. (fresh water algae)
Microcystis sp. (fresh water algae)
EUCARYOTA
Chromophyta
Dinophyceae
Ceratium arietinum Cleve
Ceratium candelabrum (Ehrenberg) Stein
Ceratium furca (Ehrenberg) Claparedé & Lachmann
Ceratium fusus (Ehrenberg) Dujardin
Ceratium hirundinella (O.F. Müller) Bergh
Ceratium pentagonum Gourret
Ceratium tripos (O.F. Müller) Nitzsch
Dinophysis acuta Ehrenberg
Dinophysis caudata Saville-Kent
Dinophysis sp.
Diplopsalis lenticula Bergh
Gonyaulax sp.
Gonyaulax grindleyi Rein
Gonyaulax spinifera (Claparedé & Lachmann) Diesing

Gymnodinium sanguienum Hirasaka
Gymnodinium sp.
Gyrodinium sp.
Heterocapsa triquetra (Ehrenberg) Stein
Lingulodinium polyedrum (Stein) Dodge
Noctiluca scintillans (Macartney) Kofoid
Phalacroma rotundatum (Claparedé & Lachmann) Kofoid Michener
Prorocentrum compressum (Bailey) Abé
Prorocentrum gracile Schütt
Prorocentrum micans Ehrenberg
Prorocentrum minimum Schiller
Prorocentrum scutellum Schiller
Prorocentrum triestinum Schiller
Protoceratium cf. *spinulosum* (Murray & Whitting) Schiller
Protoperidinium bipes (Paulsen) Balech
Protoperidinium brevipes (Paulsen) Balech
Protoperidinium brochi (Kofoid & Swezy) Balech
Protoperidinium claudicans (Paulsen) Balech
Protoperidinium conicum (Gran) Balech
Protoperidinium crassipes (Kofoid) Balech
Protoperidinium depressum (Bailey) Balech
Protoperidinium diabolus (Cleve) Balech
Protoperidinium divergens (Ehrenberg) Balech
Protoperidinium oceanicum (Vanhöffen) Balech
Protoperidinium pallidum (Ostenfeld) Balech
Protoperidinium pellucidum (Berg) Balech
Protoperidinium pentagonum (Gran) Balech
Protoperidinium punctulatum (Paulsen) Balech
Protoperidinium pyriforme (Paulsen) Balech
Protoperidinium sp.
Protoperidinium steinii (Jörgensen) Balech
Pyrophacus horologium Stein
Scrippsiella trochoidea (Stein) Loeblich III
Chrysophyceae
Dinobryon sp.
Dictyochophyceae
Dictyocha speculum Ehrenberg
Bacillariophyceae
Asterionellopsis glacialis (Castracane) F. E. Round
Bacteriastrum elongatum Cleve
Chaetoceros affinis Lauder
Chaetoceros affinis var. *willei* (Gran) Hustedt

Chaetoceros anastomosans Grunow in Van Heurck
Chaetoceros brevis Schütt
Chaetoceros compressus Lauder
Chaetoceros constrictus Gran
Chaetoceros costatus Pavillard
Chaetoceros curvisetus Cleve
Chaetoceros danicus Cleve
Chaetoceros decipiens Cleve
Chaetoceros diadema (Ehrenberg) Gran
Chaetoceros holsaticus Schütt
Chaetoceros laciniosus Schütt
Chaetoceros lorenzianus Grunow
Chaetoceros messanensis Castracane
Chaetoceros cf. *pendulus* Karsten
Chaetoceros peruvianus Brightwell
Chaetoceros similis Cleve
Chaetoceros simplex Ostenfeld
Chaetoceros sp.
Chaetoceros teres Cleve
Chaetoceros tetrastichon Cleve
Chaetoceros wighami Brightwell
Climacosphenia moniligera Ehrenberg
*Coscinodiscus radiatus*Ehrenberg
Coscinodiscus sp.
Dactyliosolen fragilissimus (Bergon) Hasle comb. nov.
Detonula confervacea (Cleve) Gran
Detonula pumila (Castracane) Gran
Ditylum brightwelli (T. West) Grunow *in* Van Heurck
Grammatophora marina(Lyngbye) Kützing
Guinardia delicatula Cleve
Guinardia striata Stolterfoth Hasle com. Now.
Gyrosigma sp.
Hemialus hauckii Grunow in Van Heurck
Lauderia annulata Cleve
Leptocylindrus danicus Cleve
Leptocylindrus minimus Gran
Licmophora abbreviata Agardh
Melosira sp. (fresh water algae)
Navicula sp.
Nitzschia longissima (Brébisson in Kützing) Ralfs *in* Pritchard
Nitzschia rectilonga Takano
Nitzschia sigma (Kützing) W. Smith

Nitzschia sp.
Pleurosigma normani Ralfs in Pritchard
Proboscia alata f. alata (Brightwell) Sundström
Proboscia alata f. *gracillima* (Cleve) Gran
Proboscia alata f. *indica* (H. Peragallo) Gran
Psedosolenia calcar-avis (Schultze) Sundström
Pseudo-nitzschia delicatissima (Cleve) Heiden in Heiden & Kolbe
Pseudo-nitzschia fraudulenta (Cleve) Hasle
Pseudo-nitzschia pungens (Grunow *ex*. P. T. Cleve) Hasle
Rhizosolenia hebetata var. *semispina* (Hensen) Gran
Rhizosolenia imbricata var. *shrubsolei* (Cleve) Schröder
Rhizosolenia styliformis Brightwell
Skeletonema costatum (Greville) Cleve
Striatella unipunctata (Lyngbye) Agardh
Synedra undulata (Bailey) Gregory
Thalassionema nitzschioides (Grunow) Mereschkowsky
Thalassiosira allenii Takano
Thalassiosira eccentrica (Ehrenberg) Cleve
Thalassiosira sp.
Thalassiothrix frauenfeldii Grunow
Thalassiothrix longissima Cleve & Grunow
Thalassiothrix mediterranea Pavillard

Chlorophyta
Euglenophyceae
Euglena viridis Ehrenberg (fresh water algae)
Eutreptiella sp.
Phacus sp. (fresh water algae)
Chlorophyceae
Pediastrum sp. (fresh water algae)
Staurastrum sp. (fresh water algae)
Scenedesmus quadricauda (Turpin) Brébisson (fresh water algae)
Scenedesmus sp. (fresh water algae)
Micrasterias sp. (fresh water algae)

Discussion

A total of 129 taxa belonging to 7 taxonomic classes (Cyanophyceae, Dinophyceae, Crysophyceae, Dictyochophyceae, Bacillariophycea, Euglenophyceae, Chlorophyceae) were determined during this

research period. The two major phytoplankton groups , diatoms and dinoflagellates, were more abundant in terms of number of species (about 90 %) than the other taxonomic groups. The diatom species were generally more frequent than dinoflagellates in the months September and October. However, diatoms and dinoflagellates were almost equal diversity (47.3 % and 49.1 %, respectively) in terms of species number in April.

Feyizoğlu and Tuncer (1994) reported that diatoms were abundant than dinoflagllates in terms of number of species (60.8 % and 37.1 %, respectively). According to Uysal and Sur (1995), the majority (about 60 %) of total 120 species were comprised diatoms. Dinoflagellates formed the second major group (about 34 %) and the remainder belonged to other taxonomic groups (Uysal and Sur, 1995). Acording to Türkoğlu and Koray (2002), the two most important groups, diatoms (49.2 %) and diinoflagellates (46.4 %), were more abundant in terms of number of species than the other taxonomic groups.

It is obvious that the results of qualitative analyses of phytoplankton in this study showed an expressive similarity with the previous studies. The results of this research will be a great contribution at the next studies.

Özet

Bu çalışmada Karadeniz Kirlilik İzleme Projesi kapsamında Eylül 2004, Nisan 2005 ve Ekim 2005 dönemlerinde Karadeniz'in Türkiye kıyılarında yapılan örneklemelerde fitoplanktonun kalitatif dağılımları incelenmekte ve ayrıca bir tür listesi oluşturulmaktadır. Elde edilen tür listesi Karadeniz ve Türkiye Denizleri fitoplankton kontrol listesine katkı sağlayacaktır. Bu çalışmada kalitatif ve kantitatif örneklerde 7 sınıfta toplam 129 takson belirlenmiştir. Diyatomlar kommunitenin en büyük grubunu (% 52.7) temsil

etmekte ve bunu dinoflagellatlar (% 36.4) takip etmektedir. Özellikle nehir ağzı örneklerinde üzere 4 sınıfa ait toplam 12 tatlı su alg türü beirlenmiştir.

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