



Cheklst of Phytoplankton species in the southern part of Caspian Sea

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Abstract

In this study, 397 phytoplankton species were recorded in the SCS. Bacillariophyta contributed 190 species, Chlorophyta 80 species, Cyanophyta 55 species, Pyrrophyta 39 species, Euglenophyta 25 species, Chrysophyta 4 species, Xanthophyta 3 species and Cryptophyta 1 species. During the research period, the highest number of phytoplankton species belongs to Bacillariophyta and the highest number of species recorded in the southern part of Caspian Sea.

Materials & methods

Site study, date and sampling strategy:

Samples were collected during more than 40 cruises carried out on board the R/V Guilan from summer 1994 in the SCS at 18 transects (1994-2000) and then at 6 transects along each transect four stations were located at depths of 10, 20, 50 and 100 m (38° 38 N - 49° 54 E), Phytoplankton samples were collected along the Southern coasts of the Caspian Sea using a Van Dorn water bottle sampler from the surface, 2, 5, 10, 20, 50 and 100m of column waters. phytoplankton samples were collected (Vollenweider, 1974), and were held in 0.5 L bottles and preserved using buffered formaldehyde to obtain a final concentration of 4% (Sourina, 1978). Phytoplanktons were identified to the possible taxon using the previous studies (Zabelina *et al.*, 1951; Morosova-Vodanidskaya, 1954; Kiselev, 1956; Prescott, 1962; Piroshkina *et al.*, 1968; Habit and Pankow 1976; Eker *et al.*, 1999; Kasimov, 2000)

Results & Discussion

Phytoplankton species composition and community structure

During in this study, 397 phytoplankton species were recorded belonging to eight divisions in the SCS. Bacillariophyta contributed 190 species, Chlorophyta 80 species, Cyanophyta 55 species, Pyrrophyta 39 species, Euglenophyta 25 species, Chrysophyta 4 species, Xanthophyta 3 species and Cryptophyta 1 species. The main phytoplankton groups in the Caspian Sea consist of Bacillariophyta, Pyrrophyta and Cyanophyta (Salmanov, 1987; Kasymov and Bagirov, 1983;; Ganjian and Hosseini, 1998, Ganjian and Makhlogh, 2003; Ganjian *et al.*, 2004a,b; Ganjian, 2007). There are very few studies available on phytoplankton biodiversity of the Caspian Sea (CEP, 2000; Ganjian *et al.*, 2010; Ganjian, 2011). Data of the years 1992-1993 showed that phytoplankton was represented by 146 species and interspecies pertaining to 5 phyla (Ganjian *et al.*, 1998), and Ganjian *et al.*, 2010 and Ganjian, 2011 reported during (1994-2007) phytoplankton were comprised of 334 species (interspecies) from 8 algal phyla in the SCS. Bacillariophyta, Chlorophyta and Cyanophyta constituted the main species, with relative abundance of 47%, 19% and 16%, respectively. During the research period, the highest number of phytoplankton species belongs to Bacillariophyta and the highest number of species recorded in the southern part of Caspian Sea.



Table 1. Cheklist of Phytoplankton species in the southern part of Caspian Sea

Bacillariophyta: 190	<i>Coscinodiscus sp.</i>	<i>Gyrosigma scalproides</i>
<i>Actinocyclus ehrenbergii</i>	<i>Cyclotella caspia</i>	<i>Gyrosigma spenceri</i>
<i>Actinocyclus paradoxus</i>	<i>Cyclotella kuetzingiana</i>	<i>Gyrosigma strigile</i>
<i>Amphora ovalis</i>	<i>Cyclotella meneghiniana</i>	<i>Gyrosigma variabile</i>
<i>Amphora sp.</i>	<i>Cyclotella quadriuncta</i>	<i>Meiosira varians</i>
<i>Asterionella formosa</i>	<i>Cymatopleura solea</i>	<i>Melosira sp.</i>
<i>Bacillaria paradoxa</i>	<i>Cymbella cistula</i>	<i>Melosira granulata</i>
<i>Calenois sp.</i>	<i>Cymbella cymbiformis</i>	<i>Melosira italica</i>
<i>Caloneis amphisbaena</i>	<i>Cymbella lanceolata</i>	<i>Melosira juergensii</i>
<i>Campylodiscus sp.</i>	<i>Cymbella parva</i>	<i>Melosira moniliformis</i>
<i>Campylodiscus clypeus</i>	<i>Cymbella prostrata</i>	<i>Melosira sp.</i>
<i>Campylodiscus echeneis</i>	<i>Cymbella sp.</i>	<i>Melosira varians</i>
<i>Cerataulina pelagica</i>	<i>Cymbella tumida</i>	<i>Navicula anglica</i>
<i>Chaetoceros convolutus</i>	<i>Cymbella ventricosa</i>	<i>Navicula bombus</i>
<i>Chaetoceros peruvianus</i>	<i>Diatoma bombus</i>	<i>Navicula cryptocephala</i>
<i>Chaetoceros simplex</i>	<i>Diatoma digitale</i>	<i>Navicula cuspidata</i>
<i>Chaetoceros diversicurvatus</i>	<i>Diatoma ochki</i>	<i>Navicula fluens</i>
<i>Chaetoceros mirabilis</i>	<i>Diatoma ochki sp.</i>	<i>Navicula forcipata</i>
<i>Chaetoceros muelleri</i>	<i>Diatoma sp.</i>	<i>Navicula gibbula</i>
<i>Chaetoceros rigidus</i>	<i>Diatoma vulgare</i>	<i>Navicula gracilis</i>
<i>Chaetoceros socialis</i>	<i>Diploneis bombus</i>	<i>Navicula gregaria</i>
<i>Chaetoceros sp.</i>	<i>Diploneis interrupta</i>	<i>Navicula kotschyi</i>
<i>Chaetoceros sp.</i>	<i>Diploneis sp.</i>	<i>Navicula lanceolata var.arenaria</i>
<i>Chaetoceros subtilis</i>	<i>Diploneis subovalis</i>	<i>Navicula laterostrata</i>
<i>Chaetoceros thronscnii</i>	<i>Epithemia sp.</i>	<i>Navicula menisculus</i>
<i>Chaetoceros wghamii</i>	<i>Fragilaria sp.</i>	<i>Navicula pusilla</i>
<i>Chetoserus mueelleri</i>	<i>Fragilaria subsalina</i>	<i>Navicula simplex</i>
<i>Chetoserus rigidus</i>	<i>Fragilaria capucina</i>	<i>Navicula sp.</i>
<i>Cocconeis hustedtii</i>	<i>Gomphonema angustatum</i>	<i>Navicula sp1.</i>
<i>Cocconeis gigas sp1.</i>	<i>Gomphonema bohemicum</i>	<i>Navicula sp2.</i>
<i>Cocconeis placentula</i>	<i>Gomphonema olivaceum</i>	<i>Navicula spicula</i>
<i>Cocconeis scutellum</i>	<i>Gomphonema olivaceum</i>	<i>Navicula subrhombica</i>



	<i>var. calcarea</i>	
<i>Cocconeis skvortzowii</i>	<i>Gomphonema salinarum</i>	<i>Nitzschia thermalis</i>
<i>Cocconeis sp.</i>	<i>Gomphonema sp.</i>	<i>Nitzschia tenuirostris</i>
<i>Coscinodiscus eccentricus</i>	<i>Gomphonema sp1.</i>	<i>Nitzschia acicularis</i>
<i>Coscinodiscus gigas</i>	<i>Gomphonema sp2.</i>	<i>Nitzschia closterium</i>
<i>Coscinodiscus granii</i>	<i>Gomphonema subsalinum</i>	<i>Nitzschia constricta</i>
<i>Coscinodiscus jonesianus</i>	<i>Gyrosigma acuminatum</i>	<i>Nitzschia distans</i>
<i>Coscinodiscus perforatus</i>	<i>Gyrosigma attenuatum</i>	<i>Nitzschia fonticola</i>
<i>Coscinodiscus proximus</i>	<i>Gyrosigma kuetzingii</i>	<i>Nitzschia holsatica</i>
<i>Coscinodiscus radiatus</i>	<i>Gyrosigma peisone</i>	<i>Nitzschia hungarica</i>

Bacillariophyta

<i>Nitzschia sublinearis</i>	<i>Rhopalodia sp.</i>
<i>Nitzschia tryblionella</i>	<i>Skeletonema costatum</i>
<i>Nitzschia acicularis</i>	<i>Skeletonema subsalsum</i>
<i>Nitzschia closterium</i>	<i>Skeletonema costata</i>
<i>Nitzschia reversa</i>	<i>Skeletonema costatum</i>
<i>Nitzschia seriata</i>	<i>Skeletonema subsalsum</i>
<i>Nitzschia sigma</i>	<i>Stephanodiscos hantzschii</i>
<i>Nitzschia sigmoidea</i>	<i>Stephanodiscos sp.</i>
<i>Nitzschia sp.</i>	<i>Stephanodiscus binderana</i>
<i>Nitzschia lanceolata</i>	<i>Stephanodiscus dubius</i>
<i>Nitzschia longgisma</i>	<i>Stephanodiscus hantzschii</i>
<i>Nitzschia lorenziana</i>	<i>Stephanodiscus socialis</i>
<i>Nitzschia parva</i>	<i>Stephonodiscus sp.</i>
<i>Nitzschia reversa</i>	<i>Surirella arcata</i>
<i>Nitzschia sigma</i>	<i>Surirella ovalis</i>
<i>Nitzschia sigmoidea</i>	<i>Surirella robusta</i>
<i>Nitzschia sp</i>	<i>Surirella sp.</i>
<i>Nitzschia sp.1</i>	<i>Synedra acus</i>
<i>Nitzschia sp ۲.</i>	<i>Synedra amphirhynchus</i>
<i>Nitzschia sp3.</i>	<i>Synedra pulchella</i>
<i>Nitzschia sublinearis</i>	<i>Synedra sp.</i>
<i>Nitzschia tennuis</i>	<i>Synedra ulna</i>



<i>Pinnularia interrupta</i>	<i>Tabellaria intermedia</i>
<i>Pinnularia sp.</i>	<i>Thalassionema nitzschoide</i>
<i>Pleurosigma angulatum</i>	<i>Thalassiosira sp.</i>
<i>Pleurosigma delicatulum</i>	<i>Thalassiosira aculeata</i>
<i>Pleurosigma ehrenbergii</i>	<i>Thalassiosira caspica</i>
<i>Pleurosigma elongatum</i>	<i>Thalassiosira hustedtii</i>
<i>Pleurosigma salinarum</i>	<i>Thalassiosira parva</i>
<i>Pleurosigma sp.</i>	<i>Thalassiosira variabilis</i>
<i>Pseudonitzschia seriata</i>	
<i>Pseudonitzschia sp.</i>	
<i>Rhicosphenia curvata</i>	
<i>Rhizosolenia calcar-avis</i>	
<i>Rhizosolenia fragilissima</i>	
<i>Rhoicosphenia curvata</i>	
<i>Rhoicosphenia sp.</i>	
<i>Rhopalodia gibba</i>	

Chlorophyta : 80

<i>Actinastrum hartzachii</i>	<i>Coelastrum microporum</i>	<i>Pandorina charkoriensis</i>
<i>Actinastrum hantzschii</i>	<i>Coelastrum sp.</i>	<i>Pandorina morum</i>
<i>Ankistrodesmus acicularis</i>	<i>Crucigenia crucifera</i>	<i>Pediasreum tetras</i>
<i>Ankistrodesmus arcuatus</i>	<i>Crucigenia lauterbornii</i>	<i>Pediastrum boryanum</i>
<i>Ankistrodesmus convolutus</i>	<i>Crucigenia quadrata</i>	<i>Pediastrum integrum</i>
<i>Ankistrodesmus falcatus</i>	<i>Crucigenia quadrata</i>	<i>Pediastrum simplex</i>
<i>Ankistrodesmus lauterborn</i>	<i>Crucigenia rectangularis</i>	<i>Pediastrum sp.</i>
<i>Ankistrodesmus sp.</i>	<i>Crucigenia sp.</i>	<i>Scenedesmus abundans</i>
<i>Ankistrodesmus sp.</i>	<i>Crucigenia westella</i>	<i>Scenedesmus acuminatus</i>
<i>Binuclearia lauterbornii</i>	<i>Dictyosphaerium ehrenborgianum</i>	<i>Scenedesmus armatus</i>



<i>Binuclearia</i> sp.	<i>Dictyosphaerium pulchellum</i>	<i>Scenedesmus bijuga</i>
<i>Chlamidomonas</i> sp.	<i>Echinosphaerella</i> sp.	<i>Scenedesmus bijugatus</i>
<i>Chlamydomonas floscularia</i>	<i>Eudorina</i> sp.	<i>Scenedesmus denticulatus</i>
<i>Chlamydomonas globosa</i>	<i>Golenkinia Paucispina</i>	<i>Scenedesmus obliquus</i>
<i>Chlamydomonas olifani</i>	<i>Golenkinia</i> sp.	<i>Scenedesmus quadricauda</i>
<i>Chlamydomonas ovalis</i>	<i>Gonium pectorale</i>	<i>Scenedesmus quadricauda</i>
<i>Chlamydomonas</i> sp1	<i>Monoraphidium contractum</i>	<i>Scenedesmus</i> sp.
<i>Chlorella</i> sp.	<i>Mougeotia</i> sp.	<i>Schroderia</i> sp.
<i>Chodatella breviseta</i>	<i>Oedogonium</i> sp.	<i>Schroederia setigera</i>
<i>Chodatella</i> sp.	<i>Oocystis nodulosa</i>	<i>Schroederia</i> sp.
<i>Clamidiomonas ovalis</i>	<i>Oocystis borgei</i>	<i>Selenastrum bibrajanum</i>
<i>Clamidiomonas</i> sp.	<i>Oocystis composita</i>	<i>Selenastrum</i> sp.
<i>Closterium sphaericum</i>	<i>Oocystis parva</i>	<i>Staurastrum tetracerus</i>
<i>Closterium moniliferum</i>	<i>Oocystis socialis</i>	<i>tetraedron</i> sp.
<i>Closterium</i> sp.	<i>Oocystis solitaria</i>	<i>Tetrastelmis</i> sp.
<i>Codotella</i> sp.	<i>Oocystis</i> sp.	<i>tetrastrum</i> sp.
<i>Coelastrum Microporum</i>	<i>Crucigenia westella</i>	

Cyanophyta: 55

<i>Anabaena bergii</i>	<i>Aphanocapsa crassa</i>	<i>Nodularia harveyana</i>
<i>Anabaena aphanizomenides</i>	<i>Aphanotece</i> sp.	<i>Nodularia spumigena</i>
<i>Anabaena kisselevii</i>	<i>Aphanothece elabens</i>	<i>Nodularia harrayana</i>
<i>Anabaena reniformis</i>	<i>Aphanothece</i> sp.	<i>Nostoc linckia</i>
<i>Anabaena</i> sp.	<i>Aphanozonema issatschenkoi</i>	<i>Nostoc</i> sp.



<i>Anabaena sphaerica</i>	<i>Chroococcus pallidus</i>	<i>Oscillatoria bonnemaisonii</i>
<i>Anabaena spiroides</i>	<i>Chroococcus</i> sp.	<i>Oscillatoria agardhii</i>
<i>Anabaena spiroides</i>	<i>Gloeocapsa Limnetica</i>	<i>Oscillatoria chalybea</i>
<i>Anabaena subcylindrica</i>	<i>Gloeocapsa minor</i>	<i>Oscillatoria geminata</i>
<i>Anabaenopsis arnoldii</i>	<i>Gomphosphaeria aponina</i>	<i>Oscillatoria geminata</i>
<i>Anabaenopsis cunningtonii</i>	<i>Lyngbya limnetica</i>	<i>Oscillatoria limosa</i>
<i>Anabaenopsis elenkinii</i>	<i>Lyngbya birgei</i>	<i>Oscillatoria</i> sp.
<i>Anabaenopsis nadsonii</i>	<i>Lyngbya limnetica</i>	<i>Oscillatoria tenuis</i>
<i>Anabaenopsis raciborskii</i>	<i>Lyngbya</i> sp.	<i>Phormidium</i> sp.
<i>Anabaenopsis</i> sp.	<i>Lyngbya</i> sp.	<i>Phormidium tenue</i>
<i>Anabaenopsis</i> sp1.	<i>Lyngbya spiralis</i>	<i>Scytonema hofmanni</i>
<i>Aphanizomenon elabens</i>	<i>Merismopedia minima</i>	<i>Spirulina anabaena</i>
<i>Aphanizomenon flos-aquae</i>	<i>Merismopedia punctata</i>	<i>Spirulina laxissima</i>
<i>Aphanizomenon forti</i>	<i>Microcystis aeruginosa</i>	<i>Spirulina</i> sp.
<i>Aphanizomenon</i> sp.	<i>Microcystis minima</i>	<i>Spirulina subtilissima</i>
<i>Aphanizominon</i> sp.	<i>Microcystis pulvereae</i>	<i>Spirulina tenuis</i>
<i>Aphanizominon ussaczevii</i>	<i>Microcystis</i> sp.	

Pyrrophyta : 39		Euglenophyta:25	
<i>Exuviaella cordata</i>	<i>Peridinium achromaticum</i>		
<i>Exuviaella marina</i>	<i>Peridinium cinctum</i>	<i>Euglena acus</i>	<i>Euglena tuba</i>
<i>Glenodinium behningii</i>	<i>Peridinium digital</i>	<i>Euglena anabaena</i>	<i>Euglena viridis</i>
<i>Glenodinium caspicum</i>	<i>Peridinium grani</i>	<i>Euglena caudata</i>	<i>Euglena wangi</i>
<i>Glenodinium danicum</i>	<i>Peridinium</i>	<i>Euglena</i>	<i>Phacus</i> sp.



	<i>inconspicuum</i>	<i>ehrenbergii</i>	
<i>Glenodinium lenticula</i>	<i>Peridinium latum</i>	<i>Euglena euglena</i>	<i>Trachelomonas planctonica</i>
<i>Glenodinium lenticula f.minor</i>	<i>Peridinium sp.</i>	<i>Euglena gracilis</i>	<i>Trachelomonas sp.</i>
<i>Glenodinium penardii</i>	<i>Peridinium subsalsum</i>	<i>Euglena mutabilis</i>	<i>Trachelomonas sp1</i>
<i>Glenodinium sp.</i>	<i>Peridinium thricoidum</i>	<i>Euglena proxima</i>	<i>Trachelomonas sp2</i>
<i>Glenudinium danicum</i>	<i>Prorocentrum micans</i>	<i>Euglena sp.</i>	<i>Trachelomonas spiculifera</i>
<i>Goniaulax digitale</i>	<i>Prorocentrum obtusum</i>	<i>Euglena sp1.</i>	<i>Trachelomonas tambowica</i>
<i>Goniaulax minima</i>	<i>Prorocentrum praximum</i>	<i>Euglena sp2.</i>	<i>Trachelomonas verrucosa</i>
<i>Goniaulax monacantha</i>	<i>Prorocentrum proximum</i>	<i>Euglena sp3.</i>	<i>Tracholemonas similis</i>
<i>Goniaulax polyedra</i>	<i>Prorocentrum scutllum</i>	<i>Trachelomonas sp3.</i>	
<i>Goniaulax sp.</i>			
<i>Goniaulax spinifera</i>		Chrysophyta:4	Xantophyta: 3
<i>Gymnodinium lacustre</i>		<i>Dinobryon bavaricum</i>	<i>Teribonema sp.</i>
<i>Gymnodinium rhomboides</i>		<i>Dinobryon sertularia</i>	<i>Tribonema volgar</i>
<i>Gymnodinium sp.</i>		<i>Dinobryon sp.</i>	<i>Teribonema sp1</i>
<i>Gymnodinium variable</i>		<i>Mallomonas sp.</i>	Cryptophyta:1
<i>Lyngbya limnetica</i>			<i>Cryptonema marconi</i>
<i>Lyngbya sp.</i>			
<i>Nodularia spumigena</i>			
<i>Oscillatoria agardhii</i>			
<i>Oscillatoria limosa</i>			



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