

Plankton Studies in the Arabian Gulf

I - Preliminary List of Phytoplankton Species in Qatari Waters

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ABSTRACT. The species composition of the phytoplankton community in the Arabian Gulf of the Qatar peninsula was studied. The presented data were obtained from the analysis of samples collected seasonally during 1984. A total number of 390 taxa were recorded including 225 diatoms, 152 dinoflagellates, 2 silicoflagellates and 11 blue green algae. The given table represents the first comprehensive list of phytoplankton species occurring in the Qatari waters.

Study of the phytoplankton of any aquatic area is fundamental for clarifying and understanding many phenomena in this habitat. The importance of phytoplankton to the fisheries in the aquatic environment is well known. The specific composition of the phytoplankton community as well as its productivity are prerequisites for any investigation of the marine biology. Their role in the aquatic food chains and webs is so essential that it cannot be neglected.

The phytoplankton in the Arabian Gulf generally and in Qatari waters particularly has received little attention. The available published works depended mainly on samples collected in single trips, which were performed in sporadic times. Hendey (1970) identified 205 species of littoral diatoms on panels immersed in the inshore water of Kuwait. About 50 dinoflagellate species were described by Bohm (1931) in the Gulf of Oman. During December 1968, the Omitaka Maru Training R/V of Tokyo University of Fisheries with collaboration of Kuwait Institute for Scientific Research collected samples from the offshore waters of Kuwait, Qatar and United Arab Emirates. Some of the obtained data were published by Oshite (1974) and Al-Kaisi (1976), where they mentioned few species of phytoplankton in the Qatari waters. The latter author pointed to the occurrence of 275 taxa in the Arabian Gulf. However, no list of phytoplankton species in the

concerned area was published. On the other hand, Ibrahim (1980) studied the primary productivity of the phytoplankton in the coastal water of Qatar without species identification.

In the adjacent waters, the phytoplankton draw more attention than in the Arabian Gulf. A total number of 209 diatom and dinoflagellate species were admitted by Halim (1969) in the Red Sea. Dowidar *et al.* (1978) listed 223 species of the two groups in a local area of the Red Sea Saudi coast. Otherwise, description of 196 diatoms from Mozambique Channel, in the Indian Ocean, was given by Sournia (1968). Moreover, Wood (1963) (in Kimor, 1973) listed 452 dinoflagellate taxa occurred in the Indian Ocean.

From the above stated conditions it becomes necessary to make a list of the phytoplankton species in the Gulf water around the peninsula of Qatar. For this purpose we took the initiative of making this list, which will be a guide for the future investigations of the phytoplankton in the Arabian Gulf. The present work is the first in a series of studies of the phytoplankton in the area under investigation.

The Site

Qatar peninsula lies on the western side of the Arabian Gulf at the northern end of its broad part. The coast line is irregular and extends for about 700 km (Sivasubramnian and Ibrahim 1984). The area extends parallel to the shore line from the top of the peninsula (lat. 25° 00' N) to Umm Said (lat. 26° 51' N). Perpendicular to the beach it extends offshore between longitudes 51° 10' E and 52° 30' E with width of about 76-93 km according to the depth (Fig. 1). The great part of the area is of depths less than 36 m. and mainly with sandy or sand-muddy bottom (Sivasubramnian and Ibrahim 1984).

Offshore, the surface water temperature shows a wide range of seasonal variations. It ranges from 22°C in winter to 33°C in summer. The salinity varies within a limited range (40-42‰), but in some places, where the salt marshes are present on the coast, the salinity may reach up to 60‰.

The average concentration of the oxygen in the surface water in front of Doha City is 4.22 ml/l with a range of 3.82-5.56 ml/l. The range of pH variations lies within 7.67 and 8.35 (Emara *et al.* 1985).

The water in the area of investigation is subjected to mixing processes resulting from the action of the waves and winds. Jackson (1978-1981) stated that NW winds with speed of 20 knots is experienced in the inshore waters 5 days per month, while in the offshore 10-12 days per month. These conditions have a significant impact on the oceanography of the area and contribute to the high turbidity and mixing of the shallow water around Qatar (Sivasubramnian and Ibrahim 1984).

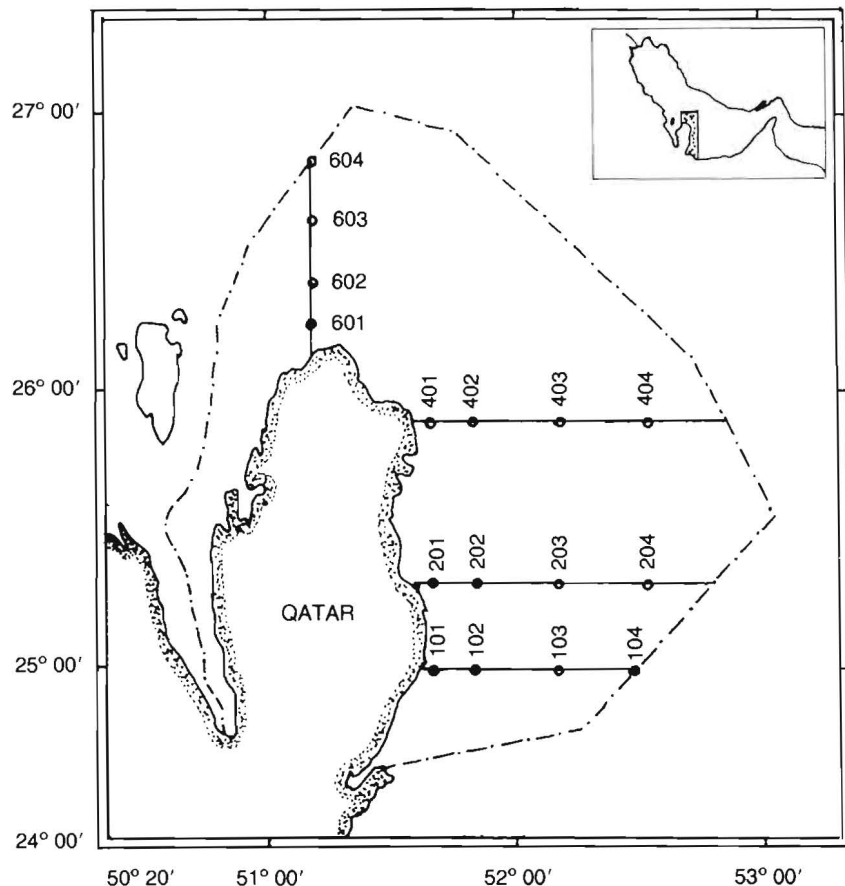


Fig. 1. Distribution of the sampling stations in the water of Qatar.
(The boundaries of Qatari water, after Anonymous, 1977).

Material and Methods

During 1984 samples were collected by the R/V of Qatar University "Mukhtabar Albihar" on a seasonal basis. The samples for qualitative analysis were collected by a fine net (55 μm mesh size). Water samples for the standing crop estimation were collected by one litre plastic bottles at the levels of 0, 5, 10, 15, 20 and/or 30 m. according to the depth of the stations. The samples were preserved by 4% neutralised formaline and concentrated (Uttermohl 1936). All samples were examined under a research microscope. The identification and taxonomic study were based on the following references: Cupp (1943), Dowidar (1983), Hendeby

(1964 and 1970), Hustedt (1930-1966), Kisselev (1950), Lebour (1925), Parke and Dixon (1976), Rampi and Bernard (1980), Sournia (1968), Taylor (1976) and Wood (1968). The sampled stations are shown in figure (1).

Results and Discussion

Table (1) gives a list of phytoplankton species recorded in Qatari water either by the authors of the present work or by the previously mentioned authors. The number of the previously recorded species does not exceed 4% of the total number given in the table. The phytoplankton community of Qatari waters is represented by 390 species including 225 diatoms, 152 dinoflagellates, 2 silicoflagellates and 11 blue green algae.

The majority of diatom species (75%) are holoplanktonic being of either neritic or oceanic origin or both. A significant number of littoral species (25%) with benthic mode of living were observed among the planktonic forms. These species belong to the genera: *Amphora*, *Achnanthes*, *Campylodiscus*, *Diploneis*, *Navicula*, *Licmophora* and others. The occurrence of such species in the plankton may be caused by the mixing processes in the Gulf water.

Chaetoceros, *Rhizosolenia*, *Nitzschia*, *Coscinodiscus*, *Diploneis*, *Navicula*, *Surirella* and *Amphora* were the important genera of diatoms forming about 50% of the total number. Fifteen species were observed as perennial in the phytoplankton all the year round. These are: *Chaetoceros coarctatum*, *Climacodium frauenfeldianum*, *Coscinodiscus radiatus*, *Guinardia flaccida*, *Hemiaulus sinensis*, *H. membranaceus*, *Leptocylindrus danicus*, *Rhizosolenia alata f. indica*, *R. bergonii*, *R. calcar-avis*, *R. clevei*, *R. imbricata*, *R. stolterfothii*, *Skeletonema costatum* and *Thalassionema nitzschioides*. Some of these species dominated the phytoplankton populations in sporadic seasons. The distribution, abundance and seasonal variation of the phytoplankton in the Qatari water will be discussed in a separated work.

It is to be noted that community of the diatoms found around Qatar peninsula indicates that the species diversity in the Arabian Gulf is higher than that observed in the Red Sea by Halim (1969) and Dowidar (1978).

A new form of *Rhizosolenia alata* has been recorded in Qatari water. It was recorded occasionally at three stations in both winter and summer. This form is similar to *R. alata f. indica*. But it is characterized by the presence of two processes at each valvar side parallel and distant from each other. It was observed by Shaban and Muftah (Pers. comm.) and confirmed in this work. It is identified as *R. alata f. bispina* (Shaban & Muftah) Dorgham.

Dinoflagellates comprise oceanic (60%) and neritic forms (40%). The majority of them were recorded in summer but several species were observed permanently throughout the year. Among those are: *Ceratium furca*, *C. fusus*, *C.*

massiliense, *C. tripos*, *C. trichoceros* *Dinophysis caudata* var. *tripos*, *Proto-peridinium depressum*, *P. divergens*, *P. oceanicum*, *P. pendunculatum*, *Prorocentrum micans* and *Pyrophacus horologium*. The most dominant genera were *Ceratium*, *Proto-peridinium* and *Gonyaulax* which together form 68% of the total number of dinoflagellate species.

The species belonging to the genus *Ceratium* recorded in the Qatari water are of great similarity with those found in the Red Sea by Dowidar (1983). However, other dinoflagellates are more diversified in the Gulf. According to the current regime in the Gulf (Emery 1956) the water body of the Arabian Gulf is changed through Hormuz Strait. Consequently, other waters from the Gulf of Oman, Arabian Sea and Indian Ocean enter the Arabian Gulf carried with different planktonic organisms. So, the phytoplankton community of the Gulf includes significant number of allochthonous origin.

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Table 1. Species composition of phytoplankton community in the water of Qatar state.

Species	
a. Diatoms:	
<i>Achnanthes</i>	<i>longipes</i> Agardh
<i>Actinoptychus</i>	<i>undulatus</i> (Bail.) Ralfs
<i>Amphiprora</i>	<i>angustata</i> Hendey
A.	<i>oblonga</i> Grev.
A.	<i>ornata</i> Bail.
A.	<i>surirelloides</i> Hendey
<i>Amphora</i>	<i>graeffi</i> var. <i>minor</i> Per.
A.	<i>hyalina</i> Kütz.
A.	<i>ostrearia</i> var. <i>lineata</i> Cleve
A.	<i>ostrearia</i> var. <i>quadrata</i> de Bréb.
A.	<i>ovalis</i> Kütz.
A.	<i>rostrata</i> Wm.Sm.
A.	<i>spectabilis</i> Greg.
<i>Asterolampra</i>	<i>marylandica</i> Ehrenb.
<i>Asteromphalus</i>	<i>cleveanus</i> Grun. ex Schm.
A.	<i>flabellatus</i> (de Bréb.) Grev.
A.	<i>heptactis</i> (de Bréb.) Ralfs
<i>Auliscus</i>	<i>sculptus</i> (Wm.Sm.) Ralfs in Pritchard
<i>Bacillaria</i>	<i>paxillifer</i> (O.F. Müller) Hendey
<i>Bacteriastrium</i>	<i>delicatulum</i> Cleve
B.	<i>elegans</i> Cleve
B.	<i>hyalinum</i> Lauder
B.	<i>mediterraneum</i> Pavill.
B.	<i>minus</i> Karsten
B.	<i>varians</i> Lauder
<i>Bellerochea</i>	<i>malleus</i> (Bright.) Van Heurck
<i>Biddulphia</i>	<i>alternans</i> (Bail.) Van Heurck
B.	<i>aurita</i> (Lyngbye) de Bréb.
B.	<i>mobiliensis</i> (Bail.) Grunow ex Van Heurck
B.	<i>pulchella</i> Gray
B.	<i>sinensis</i> Grev.
B.	<i>thuomeyi</i> (Bail.) Roper
<i>Campylodiscus</i>	<i>biangulatus</i> Grev.
C.	<i>echeneis</i> Ehrenb.
C.	<i>undulatus</i> Grev.
<i>Cerataulina</i>	<i>pelagica</i> (Cleve) Hendey
<i>Chaetoceros</i>	<i>affine</i> Lauder
Ch.	<i>atlanticum</i> Cleve
Ch.	<i>atlanticum</i> f. <i>audax</i> (Schütt) Gran
Ch.	<i>atlanticum</i> f. <i>neopolitana</i> (Schrod) Hustedt
Ch.	<i>breve</i> Schütt
Ch.	<i>atlanticum</i> f. <i>skeleton</i> (Schütt) Hustedt
Ch.	<i>coarctatum</i> Lauder
Ch.	<i>compressum</i> Lauder
Ch.	<i>convolutum</i> Castr.

Table 1. Continued.

Species	
<i>Ch.</i>	<i>curvisetum</i> Cleve
<i>Ch.</i>	<i>danicum</i> Cleve
<i>Ch.</i>	<i>decipiens</i> Cleve
<i>Ch.</i>	<i>densum</i> Cleve
<i>Ch.</i>	<i>denticulatum</i> Lauder
<i>Ch.</i>	<i>didymum</i> Ehrenb.
<i>Ch.</i>	<i>didymum</i> var. <i>anglica</i> (Grun.) Gran
<i>Ch.</i>	<i>didymum</i> var. <i>protuberans</i> (Lauder) Gran
<i>Ch.</i>	<i>diversum</i> Cleve
<i>Ch.</i>	<i>externum</i> Gran
<i>Ch.</i>	<i>exospermum</i> Meun.
<i>Ch.</i>	<i>fragile</i> Meun
<i>Ch.</i>	<i>lacinosum</i> Schütt
<i>Ch.</i>	<i>laeve</i> Leuduger-Fortmorel
<i>Ch.</i>	<i>lauderi</i> Ralfs
<i>Ch.</i>	<i>lorenzianum</i> Grun.
<i>Ch.</i>	<i>messanense</i> Castr.
<i>Ch.</i>	<i>peruvianum</i> Brightw.
<i>Ch.</i>	<i>peruvianum</i> var. <i>gracilis</i> (Schrod.) Hustedt
<i>Ch.</i>	<i>pseudocurvisetum</i> Mangin
<i>Ch.</i>	<i>simile</i> Cleve
<i>Ch.</i>	<i>teres</i> Cleve
<i>Ch.</i>	<i>tortissimum</i> Gran
<i>Ch.</i>	<i>wighami</i> Brightw.
<i>Ch.</i>	<i>willei</i> Gran
<i>Climacodium</i>	<i>frauenfeldianum</i> Grun.
<i>Climacosphenia</i>	<i>moniligera</i> Ehrenb.
<i>Cocconeis</i>	<i>scutellum</i> Ehrenb. var. <i>scutellum</i>
<i>Corethron</i>	<i>criophylum</i> Castr.
<i>C.</i>	<i>pelagicum</i> Brun.
<i>Coscinodiscus</i>	<i>centralis</i> Ehrenb.
<i>C.</i>	<i>excentricus</i> Ehrenb.
<i>C.</i>	<i>gigas</i> Ehrenb.
<i>C.</i>	<i>gigas</i> var. <i>practexta</i> Janisch ex Hustedt
<i>C.</i>	<i>grani</i> Gough
<i>C.</i>	<i>lineatus</i> Ehrenb.
<i>C.</i>	<i>nitidus</i> Greg.
<i>C.</i>	<i>perforatus</i> Ehrenb.
<i>C.</i>	<i>radiatus</i> Ehrenb.
<i>C.</i>	<i>thorii</i> Pavill.
<i>Coscosira</i>	<i>polychorda</i> (Gran) Gran
<i>Cyclotella</i>	<i>stylorum</i> Brightw.
<i>C.</i>	sp.
<i>Cylindrotheca</i>	<i>gracilis</i> (de Bréb.) Grun. ex Van Heurck
<i>Cymbella</i>	sp.
<i>Dactyliosolen</i>	<i>antarcticus</i> Castr.

Table 1. Continued.

Species	
<i>Diatoma</i>	<i>vulgare</i> Bory
<i>Diploneis</i>	<i>bombus</i> Ehrenb.
<i>D.</i>	<i>chersonensis</i> Grun.
<i>D.</i>	<i>constricta</i> (Grun.) Cleve
<i>D.</i>	<i>crabro</i> Ehrenb.
<i>D.</i>	<i>interrupta</i> (Kütz.) Cleve
<i>D.</i>	<i>lineata</i> (Donkin) Cleve
<i>D.</i>	<i>littoralis</i> (Donkin) Cleve
<i>D.</i>	<i>smithii</i> (de Bréb. ex W.Sm.) Cleve
<i>D.</i>	<i>vetula</i> (Schm.) Cleve
<i>Ditylum</i>	<i>brightwelli</i> (T. West) Grun. ex Van Heurck
<i>D.</i>	<i>sol</i> (Van Heurck) De-Toni
<i>Epithemia</i>	<i>sorex</i> Kütz.
<i>Ethmodiscus</i>	<i>gazellae</i> Janisch
<i>Eucampia</i>	<i>cornutum</i> (Cleve) Grun.
<i>E.</i>	<i>zodiacus</i> Ehrenb.
<i>Fragilaria</i>	<i>crotonensis</i> (Edw.) Kitton
<i>F.</i>	<i>intermedia</i> Grun.
<i>F.</i>	<i>islandica</i> Grun. ex Van Heurck
<i>F.</i>	<i>linearis</i> Antelminelli
<i>Glyphodesmis</i>	<i>eximia</i> Grev.
<i>Gossleriella</i>	<i>tropica</i> Schütt
<i>Grammatophora</i>	<i>marina</i> (Lyngbye) Kütz.
<i>Guinardia</i>	<i>flaccida</i> (Castr.) Perag.
<i>Gyrosigma</i>	<i>balticum</i> (Ehrenb.) Cleve
<i>G.</i>	<i>macrum</i> (W.Sm.) Cleve
<i>Hantzschia</i>	<i>marina</i> (Donkin) Grun. in Cleve & Grun.
<i>Hemiaulus</i>	<i>hauckii</i> Grun.
<i>H.</i>	<i>membranaceous</i> Cleve
<i>H.</i>	<i>sinensis</i> Grev.
<i>Hemidiscus</i>	<i>cuneiformis</i> Wallich
<i>H.</i>	<i>hardmanianus</i> (Grev.) Mann
<i>Hydrosilicon</i>	<i>mitra</i> Brun.
<i>Lauderia</i>	<i>annulata</i> Cleve
<i>Leptocylindrus</i>	<i>danicus</i> Cleve
<i>Licmophora</i>	<i>flabellata</i> (Grev.) Agardh
<i>L.</i>	<i>lyngbyei</i> (Kütz.) Grunow ex Van Heurck
<i>Mastogloia</i>	<i>smithii</i> var. <i>abnormis</i> Grun.
<i>Melosira</i>	<i>granulata</i> Ralfs
<i>Navicula</i>	<i>atlantica</i> Schmidt
<i>N.</i>	<i>clavata</i> Greg.
<i>N.</i>	<i>distans</i> (W.Sm.) Schm.
<i>N.</i>	<i>hennedyii</i> W.Sm.
<i>N.</i>	<i>lyra</i> Ehrenb.
<i>N.</i>	<i>lyroides</i> Hendey

Table 1. Continued.

Species	
<i>N.</i>	<i>marina</i> Ralfs in Pritchard
<i>N.</i>	<i>menaiana</i> Hendey
<i>Nitzschia</i>	<i>angularis</i> W.Sm.
<i>N.</i>	<i>bilobata</i> W.Sm.
<i>N.</i>	<i>closterium</i> (Ehrenb.) W.Sm.
<i>N.</i>	<i>delicatissima</i> Cleve
<i>N.</i>	<i>distans</i> Greg.
<i>N.</i>	<i>longissima</i> (de Bréb. ex Kütz.) Ralfs in Pritchard
<i>N.</i>	<i>longissima</i> var. <i>reversa</i> W.Sm.
<i>N.</i>	<i>pacifica</i> Cupp
<i>N.</i>	<i>panduriformis</i> Greg.
<i>N.</i>	<i>seriata</i> Cleve
<i>N.</i>	<i>sigma</i> (Kütz.) W.Sm.
<i>N.</i>	<i>sigma</i> var. <i>intercedens</i> Grun.
<i>N.</i>	<i>sigmoidea</i> (Ehrenb.) W.Sm.
<i>N.</i>	<i>spathulata</i> de Bréb.
<i>Paralia</i>	<i>sulcata</i> (Ehrenb.) Cleve
<i>Pinnularia</i>	<i>ambigua</i> Cleve
<i>Plagiogramma</i>	<i>vanheurckii</i> Grun.
<i>Planktoniella</i>	<i>sol</i> (Wallich) Schütt
<i>Pleurosigma</i>	<i>angulatum</i> (Queckett) W.Sm.
<i>P.</i>	<i>attenuatum</i> W.Sm.
<i>P.</i>	<i>decorum</i> W.Sm.
<i>P.</i>	<i>intermedium</i> W.Sm.
<i>P.</i>	<i>normanii</i> Ralfs in Pritchard
<i>P.</i>	<i>obscurum</i> W.Sm.
<i>P.</i>	<i>reversum</i> Greg.
<i>P.</i>	<i>rigidum</i> W.Sm.
<i>P.</i>	<i>spencerii</i> (Queckett) W.Sm.
<i>Podocystis</i>	<i>spathulata</i> (Shadbolt) Van Heurck
<i>Podosira</i>	<i>stelliger</i> (Bail.) Mann
<i>Rhabdonema</i>	<i>adriaticum</i> Kütz.
<i>R.</i>	<i>arcuatum</i> (Lyngb.) Kütz.
<i>Raphoneis</i>	<i>amphiceros</i> (Ehrenb.) Ehrenb. var. <i>tetragona</i> (Ehrenb.) Grun.
<i>Rhizosolenia</i>	<i>alata</i> Brightw. f. <i>alata</i>
<i>R.</i>	<i>alata</i> f. <i>gracillima</i> (Cleve) Gran
<i>R.</i>	<i>alata</i> f. <i>indica</i> (Perag.) Gran
<i>R.</i>	<i>alata</i> f. <i>bispina</i> (Shaban et Muftah) Dorgham
<i>R.</i>	<i>bergonii</i> Perag.
<i>R.</i>	<i>calcar-avis</i> Schultze
<i>R.</i>	<i>castracanei</i> Perag.
<i>R.</i>	<i>clevei</i> Ostenfeld
<i>R.</i>	<i>cochlea</i> Brun.
<i>R.</i>	<i>crassipina</i> Schrod.
<i>R.</i>	<i>delicatula</i> Cleve
<i>R.</i>	<i>fragilissima</i> Bergon

Table 1. Continued.

Species	
R.	<i>hebetata</i> Bail. f. <i>hiemalis</i> Gran
R.	<i>hebetata</i> f. <i>semispina</i> (Hensen) Gran
R.	<i>imbricata</i> Brightw.
R.	<i>robusta</i> Norman ex Pritchard
R.	<i>setigera</i> Brightw.
R.	<i>shrubsolei</i> Cleve
R.	<i>stolterfothii</i> Perag.
R.	<i>styliformis</i> Brightw.
R.	<i>styliformis</i> var. <i>latissima</i> Brightw.
R.	<i>styliformis</i> var. <i>longispina</i> Hustedt
<i>Rhoicosigma</i>	<i>compactum</i> (Grev.) Perag.
<i>Schroederella</i>	<i>delicatula</i> (Perag.) Pavill.
<i>Skeletonema</i>	<i>costatum</i> (Grev.) Cleve
<i>Stauroneis</i>	<i>amphioxys</i> Greg. var. <i>amphioxys</i>
S.	<i>membranacea</i> (Cleve) Hustedt
<i>Streptotheca</i>	<i>thamesis</i> Shrubsole
<i>Striatella</i>	<i>delicatula</i> (Kütz.) Grunow ex Van Heurck
S.	<i>unipunctata</i> (Lyngb.) Agardh
<i>Surirella</i>	<i>americana</i> Perag.
S.	<i>fastuosa</i> (Ehrenb.) Kütz.
S.	<i>fastuosa</i> var. <i>recedens</i> (Schm.) Cleve
S.	<i>gemma</i> (Ehrenb.) Kütz.
S.	<i>javanica</i> Schm.
S.	<i>macraeans</i> Grev.
S.	<i>ovalis</i> de Bréb.
S.	<i>striatula</i> Turpin
<i>Synedra</i>	<i>crystallina</i> (Agardh) Kütz.
S.	<i>hennedyana</i> Greg.
S.	<i>undulata</i> (Bail.) Greg.
<i>Thalassionema</i>	<i>nitzschioides</i> Hustedt
<i>Thalassiosira</i>	<i>hyalina</i> (Grun.) Gran.
Th.	<i>subtilis</i> (Ostenf.) Gran
<i>Thalassiothrix</i>	<i>curvata</i> Castr
Th.	<i>frauenfeldii</i> Grun.
Th.	<i>longissima</i> Cleve et Grun.
Th.	<i>mediterranea</i> var. <i>pacifica</i> Cupp
<i>Trachyneis</i>	<i>aspera</i> (Ehrenb.) Cleve var. <i>aspera</i>
<i>Triceratium</i>	<i>favus</i> Ehrenb.
T.	<i>formosum</i> Brightw.
T.	<i>pentacrinus</i> (Ehrenb.) Wall.
T.	<i>robertsianum</i> Grev.
T.	<i>thwaitesianum</i> Grev.
<i>Tropidoneis</i>	<i>pusilla</i> (Greg.) Cleve
b. Dinoflagellates:	
<i>Ceratium</i>	<i>arietinum</i> Cleve
C.	<i>azoricum</i> Cleve
C.	<i>belone</i> Cleve

Table 1. Continued.

Species	
C.	<i>boehmii</i> Graham et Bion.
C.	<i>breve</i> (Ostenf. & Schm.) Schroder
C.	<i>breve</i> var. <i>parallelum</i> (Schm.) Jorg.
C.	<i>candelabrum</i> (Ehrenb.) Stein.
C.	<i>candelabrum</i> var. <i>depressum</i> (Pouchet) Jorg.
C.	<i>compressum</i> Gran
C.	<i>declinatum</i> Karst.
C.	<i>declinatum</i> var. <i>majus</i> Jorg.
C.	<i>declinatum</i> var. <i>normale</i> Jorg.
C.	<i>deflexum</i> (Kofoid) Jorg.
C.	<i>dens</i> . Ostenf. et Schm.
C.	<i>ehrenbergii</i> Kofoid
C.	<i>euarcuatum</i> Jorg.
C.	<i>extensum</i> (Gourr.) Cleve
C.	<i>falcatum</i> (Kofoid) Jorg.
C.	<i>furca</i> (Ehrenb.) Clap. et Lachm.
C.	<i>furca</i> var. <i>bergii</i> (Ehrenb.) Lem.
C.	<i>furca</i> var. <i>eugrammum</i> (Ehrenb.) Jorg.
C.	<i>fuscus</i> (Ehrenb.) Duj.
C.	<i>fuscus</i> var. <i>seta</i> (Ehrenb.) Duj.
C.	<i>gibberum</i> Gourret
C.	<i>humile</i> Jorg.
C.	<i>hexacanthum</i> Gourret
C.	<i>horridum</i> (Cleve) Gran
C.	<i>horridum</i> var. <i>claviger</i> (Kofoid) Sournia
C.	<i>horridum</i> var. <i>inclinatum</i> (Grun.) Kofoid
C.	<i>horridum</i> var. <i>molle</i> (Gran) Kofoid
C.	<i>horridum</i> var. <i>tenue</i> Gran
C.	<i>inflatum</i> (Kofoid) Jorg.
C.	<i>incisum</i> (Karst.) Jorg.
C.	<i>kofoidii</i> Jorg.
C.	<i>lineatum</i> (Ehrenb.) Cleve
C.	<i>longirostrum</i> Gourret
C.	<i>lunula</i> (Schimper) Jorg.
C.	<i>macroceros</i> (Ehrenb.) Vanhoffen
C.	<i>massiliense</i> (Gourret) Jorg.
C.	<i>massiliense</i> var. <i>armatum</i> (Karst.) Jorg.
C.	<i>massiliense</i> var. <i>protuberans</i> (Karst.) Jorg.
C.	<i>minutum</i> Jorg.
C.	<i>pennatum</i> Kofoid
C.	<i>pennatum</i> var. <i>scapiforme</i> Kofoid
C.	<i>pentagonum</i> Gourret
C.	<i>setaceum</i> Jorg.
C.	<i>strictum</i> (Okamura & Nishikawa) Kofoid
C.	<i>trichoceros</i> (Ehrenb.) Kofoid
C.	<i>tripos</i> (O.F. Müller) Nitzsch

Table 1. Continued.

Species	
C.	<i>tripos</i> var. <i>atlanticum</i> (Ostenf.) Paulsen
C.	<i>tripos</i> var. <i>pulchellum</i> (Schrod.) Paulsen
C.	<i>vultur</i> Cleve
C.	<i>vultur</i> var. <i>japonicum</i> Schroder
<i>Ceratocorys</i>	sp.
<i>Dinophysis</i>	<i>acuminata</i> Clap. & Lach.
D.	<i>caudata</i> Saville-Kent
D.	<i>caudata</i> var. <i>tripos</i> Gourret
D.	<i>diegensis</i> Kofoid
D.	<i>homunculus</i> Stein
D.	<i>truncata</i> Cleve
<i>Diplopsalis</i>	<i>lenticula</i> Bergh.
<i>Exuviaella</i>	<i>compressa</i> Ostenf.
E.	<i>marina</i> Cienkowski
<i>Glenodinium</i>	<i>danicum</i> Pauls.
<i>Gonyaulax</i>	<i>conjuncta</i> Wood
G.	<i>diacantha</i> (Meun.) Schiller
G.	<i>diegensis</i> Kofoid
G.	<i>digitalis</i> (Pouchet) Kofoid
G.	<i>ligustica</i> Rampi
G.	<i>minima</i> Matzenauer
G.	<i>minutum</i> Kofoid
G.	<i>monocantha</i> Pavill.
G.	<i>poyedra</i> Stein
G.	<i>polygramma</i> Stein
G.	<i>scrippsae</i> Kofoid
G.	<i>spinifera</i> (Clap. & Lach.) Diesing
<i>Gymnodinium</i>	<i>arcticum</i> Wulff
<i>Hemidinium</i>	<i>nasutum</i> Stein
<i>Histioneis</i>	<i>vouckii</i> Schiller
<i>Noctiluca</i>	<i>miliaris</i> Suriray ex Lamarck
<i>Ornithocercus</i>	<i>magnificus</i> Stein
O.	<i>thurnii</i> (Schm.) Kofoid & Skogsberg
<i>Oxytoxum</i>	<i>areolatum</i> Rampi
O.	<i>curvatum</i> Kofoid
O.	<i>elegans</i> Pavill.
O.	<i>sceptrum</i> (Stein) Schrod.
O.	<i>scolopax</i> Stein
O.	<i>tesselatum</i> (Stein) Schütt
<i>Peridinium</i>	<i>lomnickii</i> Wolosz
P.	<i>trochoideum</i> Lemm.
<i>Protoperidinium</i>	<i>brevipes</i> (Paulsen) Balech
P.	<i>brochi</i> (Kofoid & Swezy) Balech
P.	<i>cerasus</i> (Paulsen) Balech
P.	<i>compressum</i> (Bail.) Balech

Table 1. Continued.

Species	
<i>P.</i>	<i>conicoides</i> (Paulsen) Balech
<i>P.</i>	<i>conicum</i> (Gran) Balech
<i>P.</i>	<i>crassipes</i> (Kofoid) Balech
<i>P.</i>	<i>curvipes</i> (Ostenf.) Balech
<i>P.</i>	<i>depressum</i> (Bail.) Balech
<i>P.</i>	<i>diabolus</i> (Cleve) Balech
<i>P.</i>	<i>divergens</i> (Ehrenb.) Balech
<i>P.</i>	<i>fatulipes</i> (Kofoid) Balech
<i>P.</i>	<i>globulus</i> (Stein) Balech
<i>P.</i>	<i>grande</i> (Kofoid) Balech
<i>P.</i>	<i>granii</i> (Ostenf.) Balech
<i>P.</i>	<i>granii</i> var. <i>mite</i> (Pavill) Schiller
<i>P.</i>	<i>heteracanthum</i> (Dangeard) Balech
<i>P.</i>	<i>leonis</i> (Pavill.) Balech
<i>P.</i>	<i>longispinum</i> (Kofoid) Balech
<i>P.</i>	<i>minusculum</i> Pavill.
<i>P.</i>	<i>minutum</i> (Kofoid) Loeblich
<i>P.</i>	<i>murrayi</i> Kofoid
<i>P.</i>	<i>nipponicum</i> (Abé) Balech
<i>P.</i>	<i>oblongum</i> (Aurivillius) Parke & Dodge
<i>P.</i>	<i>obtusum</i> (Karst.) Parke & Dodge
<i>P.</i>	<i>oceanicum</i> (Vanhoffen) Balech
<i>P.</i>	<i>okamurai</i> (Abé) Balech
<i>P.</i>	<i>orbiculare</i> Paulsen
<i>P.</i>	<i>ovatum</i> Pouchet
<i>P.</i>	<i>oviforme</i> (Dangeard) Balech
<i>P.</i>	<i>ovum</i> (Schiller) Balech
<i>P.</i>	<i>pallidum</i> (Ostenf.) Balech
<i>P.</i>	<i>pellucidum</i> Bergh
<i>P.</i>	<i>pendunculatum</i> (Schütt) Balech
<i>P.</i>	<i>pentagonum</i> (Gran) Balech
<i>P.</i>	<i>quarmerense</i> (Schröder) Balech
<i>P.</i>	<i>sphaericum</i> Okamura
<i>P.</i>	<i>spiniferum</i> (Clap. & Lach.) Balech
<i>P.</i>	<i>steini</i> (Jorg.) Balech
<i>P.</i>	<i>subinermis</i> (Paulsen) Loeblich
<i>P.</i>	<i>tenuissimum</i> (Kofoid) Balech
<i>Phafacroma</i>	<i>operculatum</i> Stein
<i>P.</i>	<i>ovum</i> Schütt
<i>P.</i>	<i>parvulum</i> Schütt
<i>P.</i>	<i>pulchellum</i> Lebour
<i>P.</i>	<i>rapa</i> Stein
<i>P.</i>	<i>rotundatum</i> Kofoid & Michener
<i>Podolampas</i>	<i>bipes</i> Stein
<i>P.</i>	<i>elegans</i> Schütt
<i>P.</i>	<i>palmipes</i> Stein
<i>Prorocentrum</i>	<i>gracile</i> Schütt

Table 1. Continued.

Species	
<i>P.</i>	<i>micans</i> Ehrenb.
<i>P.</i>	<i>rostratum</i> Stein
<i>Pseudophalacroma</i>	<i>nasatum</i> Jorg.
<i>Pyrocystis</i>	<i>fusiformis</i> (Wyville - Thomson) Murray
<i>P.</i>	<i>lunula</i> Apstein
<i>P.</i>	<i>noctiluca</i> Murray ex Haeckel
<i>P.</i>	<i>obtusa</i> Pavill.
<i>P.</i>	<i>pseudonociluca</i> Wyville - Thomson in Murray
<i>Pyrophacus</i>	<i>horologium</i> Stein
<i>Triadinium</i>	<i>sphaericum</i> (Murray et Whiting) Loeblich
<i>T.</i>	<i>polyedricus</i> Drugg. et Loeblich.
c. Silicoflagellates:	
<i>Dictyocha</i>	<i>fibula</i> Ehrenb.
<i>Mesocena</i>	<i>polymorpha</i> Lemm.
d. Blue green algae:	
<i>Anabaena</i>	sp.
<i>Chroococcus</i>	sp.
<i>Lyngbya</i>	sp.
<i>Merismopedia</i>	<i>teuissima</i> Lemm.
<i>M.</i>	sp.
<i>Oscillatoria</i>	<i>amphibia</i> Agardh
<i>O.</i>	<i>formosa</i> Bory
<i>O.</i>	<i>limosa</i> Agardh
<i>Phormidium</i>	<i>contor</i> Lemm.
<i>P.</i>	sp.
<i>Richelia</i>	sp.

دراسة العوالق في الخليج العربي I - قائمة أولية لأنواع العوالق النباتية في المياه القطرية .

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تمت دراسة تركيب مجموعة أنواع العوالق النباتية الموجودة في المياه القطرية ضمن الخليج العربي . وقد عرضت النتائج التي تم الحصول عليها من تحليل العينات التي جمعت في فصول عام ١٩٨٤ م . وقد تم تسجيل ٣٩٠ مصنفاً متضمنة ٢٢٥ طحلباً مشطورياً (دياتومات) و ١٥٢ من السوطيات السيللوزية (ثنائية السوط) و ٢ من السوطيات السيليكية و ١١ من الطحالب الخضراء المزرققة .

ويمثل الجدول الذي نستعرضه في هذا البحث أول قائمة شاملة لأنواع العوالق الموجودة في المياه القطرية .