A Checklist of Phytoplankton Species of the Iyagbe Lagoon, Lagos

I.C. Onyema
Department of Marine Sciences, University of Lagos,
Akoka, Lagos, Nigeria

Abstract: The phytoplankton diversity of the Iyagbe lagoon, Lagos was investigated from October, 2004 to September, 2006. Seven main algal groups were recorded namely: Bacillariophyta, Cyanophyta, Chlorophyta, Euglenophyta, Prymnesiophyta, Chrysophyta and Rhodophyta. A total of 129 species belonging to 64 genera were observed. Diatoms formed the most abundant group making up 90 species from 39 genera. This was followed by the cyanobacteria with 19 species from nine genera, the green algae with 10 species from eight genera, the euglenoids with four species from three genera, the dinoflagellates with three species from two genera, the chrysophytes with two species from two genera and the red algae represented by one species. Comparatively, a higher number of species was recorded in the dry than in the wet season. 18 species of diatoms, nine species of cyanobacteria, four species of euglenoids and green algae each, one species of dinoflagellates, red algae and chrysophytes each, are first reports for south-western Nigeria with regard to existing checklists in the region.

Keywords: Lagoon, checklist, algae, phytoplankton, diatoms, cyanobacteria, Iyagbe lagoon

INTRODUCTION

Checklists of phytoplankton species in Nigeria have been documented by different workers even from the last century (Mills, 1932; Fox, 1957; Holden and Green, 1960; Imevbore, 1965; Egborge, 1973; Nwadiaro and Ezefili, 1986). More recently, a checklist of algae in the plankton from the Bonny River have received attention from Chinda and Pudo (1991) while Kadiri (1999) presented a list of phytoplankton species in some coastal waters of Nigeria and Opute (1991) presented a similar list for the phytoplankton of Warri/Forcados estuary.

In the last 50 years or so, there has been increasing interest in phytoplankton studies of the Lagos lagoon complex (Nwankwo et al., 2003a). Nwankwo (1988) compiled a list of 195 species of planktonic algae for the Lagos lagoon. Furthermore, Nwankwo et al. (2003a, b) published an additional list of 125 taxa to the already existing checklist for the Lagos lagoon (Nwankwo, 1988) after 15 years of additional investigations in the Lagos lagoon. A first list of chrysophytes has also been documented by Wujek et al. (2004) for the Epe lagoon. In a pioneering report of phytoplankton species in off shore waters of Nigeria, Nwankwo and Onyema (2004) published a list of 63 species from offshore Lagos.

Presently, there is no published work on the phytoplankton of the Iyagbe lagoon. These species form the primary foundation of this environment hence their dire importance to trophic relationship in the lagoon. The aim of this study was to investigate the phytoplankton community of the Iyagbe lagoon and provide a systematic list that will therefore be useful in measuring our knowledge of the lagoon phytoplankton in the region and Nigeria.
MATERIALS AND METHODS

Study Site

The Iyaigbe lagoon (Fig. 1) is located in Lagos state, Nigeria and is one of the nine lagoons in South-western Nigeria (Webb, 1958; Nwankwo, 2004b). It is located between Latitude 6° 23’N and Longitude 3° 06’E. It is mainly made up of the Porto-Novo and Badagry creeks. The Iyaigbe lagoon is centered about the town of Iyaigbe (Webb, 1958). Twelve stations were chosen for sampling within the lagoon. The lagoon is shallow at some point especially in the Badagry creek arm and is open all year round via the Lagos harbour to the sea (Hill and Webb, 1958; Sandison, 1966; Sandison and Hill, 1966). Like all parts of South-western Nigeria, the Iyaigbe lagoon is exposed to two distinct seasons namely the wet (May–October) and the dry (November–April) (Nwankwo, 2004b). The harmattan, a short season of dry, dusty North-East Trade winds is experienced occasionally between November and January in the region reducing visibility and lowering temperatures. Dense rain forest zone vegetation preceding by littoral mangrove assemblages is the common macrofloral assemblages especially in areas with reduced anthropogenic influence.

Collection of Phytoplankton Samples

Phytoplankton sample was collected on each occasion and station with a 55 µm mesh size standard plankton net towed from a motorized boat for 5 min at low speed (<4 knots). The net was hauled in and the sample transferred into a 250 mL well labeled plastic container with screw cap. Each sample was preserved with 4% unbuffered formalin and stored in the laboratory. After 48 h and prior to microscope analysis, samples were concentrated to 10 mL (Nwankwo, 1984).

Fig. 1: Parts of Iyaigbe lagoon, Porto-Novo and Badagry creeks showing sampling sites
Biological Analysis

In the Laboratory, one drop of the concentrated sample, five different times for each sample was investigated at different magnifications (X100 and X400) using a Wild M11 binocular microscope with a calibrated eye piece. The microtransect drop count method described by Lackey (1938) and employed by Nwankwo (1984) was used. Since each drop is 0.1 mL and two drops were used for each sample mount, results on abundance were multiplied by 5 to give the values as numbers of organisms per mL. Appropriate texts were used to aid identification (Smith, 1950; Hendey, 1958, 1964; Desikachary, 1959; Wimpenney, 1966; Patrick and Reimer, 1966, 1975; Whitford and Schnauber, 1973; Vanlandingham, 1982; Nwankwo, 1984, 1990, 2004a; Bettrons and Castrejon, 1999; Siver, 2003; Rosowski, 2003).

RESULTS

The Phytoplankton Flora of the Iyagbe Lagoon

Seven major algal groups were represented in the micro-flora of sampled areas of the Iyagbe lagoon. These were the Bacillariophyceae, Cyanophyceae, Euglenophyceae, Chlorophyceae, Dinophyceae, Chrysophyceae and Rhodophyceae. A total of 129 species from 64 genera were recorded. Diatoms were the most abundant group making up 90 species from 39 genera. The cyanobacteria recorded 19 species from nine genera, green algae with 10 species from eight genera, euglenoids with four species from three genera, dinoflagellates with three species from two genera, the chrysophytes with two species from two genera and the red algae represented by a sole species. Table 1 shows a checklist of Iyagbe lagoon phytoplankton species and their classification. Species that are first reports for South-western Nigeria with regard to existing checklists (Nwankwo, 1988; Nwankwo et al., 2003a, b, Nwankwo and Onyema, 2004; Wuiek et al., 2004) are preceded by an asterisk on the list (Table 1).

Bacillariophyceae

The occurrence of diatoms were more in the dry season than in the wet season. The bacillariophyceae were the predominant group at all stations for the duration of the study in terms of phytoplankton species diversity. Ninety diatom species were recorded with the pennate forms being more diverse than the centric forms throughout the lagoon. Actinopychus splendens, Aulacoseira granulata var. augustissima, Aulacoseira granulata var. angustissima f. curvata, Aulacoseira granulata var. augustissima f. spiralis, Coscinodiscus centralis, Coscinodiscus eccentricus, Coscinodiscus lineatus, Coscinodiscus marginatus, Coscinodiscus radiatus, Skeletonema costatum, Odontella regia and Odontella sinensis were the more abundant and frequently occurring centric species recorded. More frequently occurring pennate diatoms included Bacillaria paxillifera, Parabelus delongei, Synedra crystallina, Synedra ulna, Thalassionema frauenfeldii, Thalassionema longissima and Thalassionema nitzechoiides. Rarely occurring diatoms included Amphipora alata, Aulacoseira granulata, Asterionella japonica, Cyclotella menhuitiana, Cyclotella siritata, Fragilaria construens, Fragilaria oceanica, Grammatophora marina, Melosira nummuloides, Melosira moniliiformis, Nitzchla closterium, Rhizosolenia alata, Paralia sulcata, Pleurosigma angulatum, Trachytreis ergadensis and Terpsinos musca.

Chlorophyceae

A total of ten species were recorded for the green algae. Akistrodesmus sp., Cladophora glomerata, Gonatozygon mononothum, Gonatozygon sp., Microspora fioeae, Saurastrum paradoxum var. cingulum, Pediasastrum simplex, Spirogyra africana, Scenedesmus obliquus and Scenedesmus quadrigaude were species recorded.
Table 1: A checklist of phytoplankton species of the Lygbe lagoon

<table>
<thead>
<tr>
<th>Division</th>
<th>Bacillariophyta</th>
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<tbody>
<tr>
<td>Class</td>
<td>Bacillariophyceae</td>
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<td>Order 1</td>
<td>Centrales</td>
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<tr>
<td>Genus</td>
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<tr>
<td>Genus</td>
<td>Amphíproa odata Ehrenberg</td>
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<td>Genus</td>
<td>Aulacoseira granulata Ehrenberg (Ralfs)</td>
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<td>Genus</td>
<td>Aulacoseira granulata var. angustissima f. spiralis Muller</td>
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<td>Genus</td>
<td>Aulacoseira montififormis Agardh</td>
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<td>Genus</td>
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<tr>
<td>Genus</td>
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<td>Genus</td>
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<td>Odontella mobiliaea Bailey</td>
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<td>Genus</td>
<td>Coscinodiscus jonesianus (Greville) Ostenfeld</td>
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<td>Genus</td>
<td>Coscinodiscus gigas Ehrenberg</td>
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<td>Genus</td>
<td>Coscinodiscus lineatus Ehrenberg</td>
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<td>Cyclotella striata (Kützing) Grunow</td>
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<td>Diálylum bright威尔 (T. West) Grunow</td>
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<td>Genus</td>
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<td>Podavina sp.</td>
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<td>Rízosexualia alata Brightwell</td>
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<td>Genus</td>
<td>Rízosexualia styliformis Brightwell</td>
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<td>Genus</td>
<td>Skeletonema coastasum Cleve</td>
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<td>Genus</td>
<td>Terpsino musica (Ehr.) Hustedt</td>
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<td>Genus</td>
<td>Thalassionia subtillis (Ostenfeld) Gran</td>
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<td>Genus</td>
<td>Triceratium foros Ehrenberg</td>
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<td>Order 2</td>
<td>Pennales</td>
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<td>Genus</td>
<td>*Achnanthes longipes Agardh</td>
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<td>Amphícora ovalis Kützing</td>
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<td>Genus</td>
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<td>Cymbella affinis Kützing</td>
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<td>Dictyota hyalina Kützing</td>
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<td>Fragilaria construens Ehrenberg</td>
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<td>Fragilaria islandica Grunner</td>
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<td>Genus</td>
<td>*Fragilaria oceanica Cleve</td>
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<td>Genus</td>
<td>*Gomphonema parvulum Grunner</td>
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<td>Genus</td>
<td>Gyrasigma bédicam (Ehr.) Rabenhorst</td>
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<tr>
<td>Genus</td>
<td>Gyrasigma spenceri W. Smith</td>
</tr>
<tr>
<td>Genus</td>
<td>*Gyrasigma hippocampus Ehrenberg</td>
</tr>
</tbody>
</table>

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Table 1: Continued

*Gyrosigma litorale (W. Sm) Griffith and Henfrey
Gyrosigma scleroideum (Rb) Cleve
Gyrosigma warneckii (Grunow) Cleve
Hantzschia amphioxys (Hae) Rhenhorst
Navicula bicapitata Ehrenberg
Navicula cryptcephala (Kutz) Hustd
*Navicula cuneipilosa Kuttig
*Navicula erucoides Kalfs
Navicula mutica Kuttig
*Navicula rhynchocephala Kuttig
Nitzschia closterium Wm. Smith
Nitzschia obtusa Wm Smith
Nitzschia paeae (Kutting) Wm smith
Nitzschia sigmoidea (Wissh) W. Smith
Nitzschia sigma Grunow
Parabelus dolognot E.I. Cox
*Pleurosigma australi Brebisson
Pleurosigma angulatum (Quekett) Wm Smith
Pleurosigma elongatum Wm Smith
Pinnularia major (Kutting) Rabenh
*Pinnularia gibba Ehrenberg
Surirella ovata Kuttig
*Surirella splendula Wm. Smith
*Surirella striatula Turpin
Synedra unia (Nitzsch) Ehrenberg
*Synedra ulna var. bicea Ehrenberg
Synedra crystallina (Ag) Kuttig
Synedra sp.
Thalassiothrix frausfeldii Cleve and Grunow
Thalassionema longissima Cleve and Grunow
Thalassionema nitzioides Cleve and Grunow
*Thalassiosira granulita Ehrenberg

Division Cyno phyta
Class Cynophyceae
Order 1 - Chroococcales
*Chroococcus turgidus (Kutz.) Lemm
Microcystis aeruginosa Kuttig
Microcystis flurescu Kirchner
Merismopedia ghara (Bhr.) Nageli
Order 2 - Harmoccales
*Aphanosa constricta Geitler
Aphanosa spiruloides Klebahn
*Aphanosa turulosa Lagerheim
Lyngbya imitativa Lemm
Lyngbya maritima Meeregini
*Oscillatoria bornetii Zakal
*Oscillatoria chalybea Guernon
*Oscillatoria curviceps C.A. Agardh
*Oscillatoria formosa Bory
Oscillatoria limosa Agardh
Oscillatoria tenusi Agardh
*Oscillatoria sancta Sancta
*Stenomena crustaceum C.A. Agardh
Spinulina platensis Geitler
Trichodesmium thiebautii Guernon

Division Euglenophyta
Class Euglenophyceae
Order Euglenales
*Euglena acus Ehrenberg
*Phacus curvicauda Swirenko
*Phacus acuminatus Stokes
*Oxychelomonas hispida (Perry) Stein
Table 1: Continued

Division Chlorophyta
Class Chlorophyceae
Order 1 Ulvophyceae
*Microspora floccae (Voucher) Thuret
Spirogyra africana Frisch Cruda
Order 2 Cladophorales
Cladophora glomerata (L.) Kutzin
Order 3 Chlorococcales
Akhioecoccus sp.
Scevolaecoccus obliquus (Turp.) Kutzin
Scevolaecoccus quadrifida (Turp.) de Brebisson
Order 4- Zygnematales
*Clenonema ehrenbergii Meneghini
*Gonatozyston monorotaicum De Bary
Gonatozyston sp.
*Staurostomum paradoxum var. cingulatum W. and G.S. West

Division Dinophyta
Class Dinophyceae
Order Peridiniales
Ceratium macroceros (Ehr.) Cleve
Ceratium tripos (O.F.M.) Nitsch
*Peridinium africana Kofoid

Division Rhodophyta
Class Rhodophyta
Order Bangiales
*Botryocystis sp.

Division Chrysophyta
Order Chrysophyceae
*Chrysophyllum phalosphaera globulifera Scherffel
Synura uvella Ehrenberg

* : Species that are first reports to South-western Nigeria with regard to existing checklists

Dinophyceae
The dinoflagellates recorded only three species namely Ceratium macroceros, Ceratium tripos and Peridinium africana.

Euglenophyceae
The euglenoids were represented by Euglena acus, Phacus acuminatus, Phacus curvicauda and Trachelomonas hispida.

Chrysophyceae
The chrysophytes recorded two species namely Chrysophyllum phalosphaera globulifera and Synura uvella.

Rhodophyceae
The red algae recorded a sole species namely Botryocystis sp.

DISCUSSION

In the Iyagbe lagoon phytoplankton diversity was higher in the dry than the wet season and diatoms were the more important group among the phytoplankton categories recorded. Nwankwo (1988) have already reported that phytoplankton production in the Lagos lagoon was high and principally dominated by diatoms. Similar dominance of diatoms among phytoplankton assemblages have been reported by other ecologists in the coastal waters of Nigeria (Imevbore, 1965; Kadri, 1999; Nwankwo, 1988, 1998a, b; Nwankwo and Onyema, 2004; Onyema and Nwankwo, 2006). Similarly,
Onyema et al. (2003, 2007) reported diatoms dominating the phytoplankton spectrum of the Lagos lagoon. In the Ijagbe lagoon, perennate diatoms (50 taxa) were more in number than the centric diatoms (43 taxa). These phenomena recorded to the effect of tidal mixing that probably secures up the phytoenditic forms into the plankton of the Lagos lagoon. The flushing of planktonic algal forms towards the sea during the rains by flood waters, could also account for the reduced phytoplankton diversity in the wet season. Similarly, reduced phytoplankton diversity in the wet season may be linked to the low water clarity which reduces the amount of light available to the planktonic algal component for photosynthesis. Onyema and Nwankwo (2006) have also reported similar inferences for the Ilora creek phytoplankton regime.

Whereas diatoms were prominent in both seasons (dry and wet), the Euglenoids, green algae, cyanobacteria and chrysophytes were more important in terms of diversity in the wet season and were recorded in the more inland stations of the lagoon. Conversely, the dinoflagellates were recorded only in the dry season and only in stations close to the Lagos harbour. A good number of the species encountered for this study have been recorded before now in marine situations in the region (Nwankwo, 1988, 1998a, b; Kadiri, 1999; Onyema et al., 2003, 2007; Nwankwo and Onyema, 2004).

Notable encountered genera for the study were Coscinodiscus (9 taxa), Odontella (6 taxa), Aulacoseira (5 taxa) (centric diatoms), Navicula (6 taxa) and Nitzschia (5 taxa) (perennate diatoms). These taxa have been reported as prominent in other studies (Nwankwo, 1988, 1998b; Kadiri, 1999; Onyema et al., 2003, 2007; Nwankwo and Onyema, 2004).

In the Ijagbe lagoon, there existed environmental gradients from the harbour to areas in the lagoon further inland and the phytoplankton assemblages and distribution reflected these trends. The exact trend of environmental characteristics and trends were not known for the lagoon till now.

At least 14 phytoplankton species within the lagoon were reported to be potentially harmful/toxic bloom species. Nwankwo et al. (2003b) have already reported on the toxins/potential danger and reported harmful effects of some of these species in south-western Nigeria and especially for the Lagos lagoon. There is need for other extensive ecological studies to be carried out in the Ijagbe lagoon.

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