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Phytoplankton Bio-Indicators of Water Quality Situations in the Iyagbe Lagoon, South-Western Nigeria.

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ABSTRACT

An investigation into the use of phytoplankton species as bio-diagonistic tools and in relation to associated water quality conditions were carried out from October, 2004 to September, 2006 for the Iyagbe lagoon in South-western Nigeria. Water chemistry conditions ranged from fresh, through brackish to sea situations. Other water chemical parameters showed marked variations and trends. For instance salinity ranged from 1.06 – 35.1‰. The phytoplankton spectrum (76 species) was represented by six divisions namely Bacillariophyta (diatoms, 38 taxa), Cyanophyta (blue-green algae, 18 taxa), Chlorophyta (green algae, 10 taxa), Euglenophyta (euglenoid, 4 taxa), Pyrrophyta (dinoflagellate, 3 taxa) and Chrysophyta (chrysophytes, 2 taxa). Diatoms formed the dominant group and represented a wider array of conditions than any other group. Water quality characteristics reflected by the phytoplankton crop in this study include levels for salinity, pH, cations, depth, nutrients and pollution. Further exactitudes on the bio-diagnostic characteristics of specific organisms are detailed within.

Keywords: Water chemistry, creek, lagoon, Iyagbe, algae, pollution, mangrove.

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INTRODUCTION

Biological indicators are species used to monitor or assess the health and environmental integrity of an ecosystem (Odiete, 1999). For instance, indicator organisms in perturbed ecosystems are known to provide valuable information with regard to water quality peculiarities of aquatic systems. Changes in water quality could be reflected by the type of species present, abundant, absent or their distributive pattern. According to Onyema (2007a) planktonic micro-algae satisfy conditions to qualify as suitable indicators in that they are simple, capable of quantifying changes in water quality, applicable over large geographic areas and can also furnish data on background conditions and natural variability.

Lagoons in south-western Nigeria are generally of two types namely oligohaline and mesohaline lagoons. A few reports exist with regard to available literature on the use of phytoplankton as bio-diagnostic components in assessing water quality status in lagoons of South-western, Nigeria. For instance where as Nwankwo and Akinsoji (1989) investigated and provided a list of pollution tolerant species in an eutrophic creek, Nwankwo and Akinsoji (1992) recorded few species reflecting notable water quality situations in some aquatic systems and associated to the water hyacinth in South-western Nigeria. Furthermore, Nwankwo (2004b) gave record of a number of blue-green algae indicative of a range of polluted scenarios and reported 28 species. Nwankwo *et al.,* (2003) also reported 16 species as harmful algal species for the region. More recently, Onyema and Nwankwo (2006) enunciated 134 species from a polluted tidal creek where as Onyema (2007b) and Onyema and Nwankwo (2009) reported at least 49 and 19 species respectively from suspected polluted aquatic systems in the Lagos area.

Apart from the Lagos lagoon which is probably the most studied of the 10 lagoons in the region, little is known of the physico-chemical variability and phytoplankton diversity and distribution in some other coastal waters, lagoons and their adjoining creeks. Presently only four phycological reports exist for the Iyagbe lagoon, namely Onyema (2008) on a checklist of species and Onyema and Nwankwo, (2009) on seasonal primary production level, Onyema (2010) on the diversity and distribution of phytoplankton and Onyema (2013a) on the nutrients and primary production parameters within the estuarine system Additionally however, no single material of the aforementioned acts as a compendium of phytoplankton bio-indicator species in the area at present.

The aim of this investigation was to document the indigenous phytoplankton bio-indicator species of a range of water quality situations in the Iyagbe lagoon in south-western Nigeria. This is a first step towards phytoplankton bio-mapping for the region.

MATERIALS AND METHODS

Study site.

The Iyagbe lagoon (Fig 1) is located in Lagos state, Nigeria and is one of the ten lagoons in South-western Nigeria (Onyema, 2013b). The Porto-Novo and Badagry creeks are the main creeks that make up the Iyagbe lagoon system. For this study 12 stations were chosen as sampling points within the lagoon. The Porto-Novo creek arm of the lagoon is deeper when compared to the Badagry creek. However, the lagoon was generally shallow and is open all year round via the Lagos harbour to the sea. Most locations around the lagoon shore area are devoid of any human presence or activities and are largely rural. The Iyagbe lagoon is a micro-tidal environment.
Like all parts of South-western Nigeria, the lagoon is exposed to two distinct seasons namely the wet (May – October) and the dry (November – April) (Nwankwo, 2004b; Onyema, 2009c). Dense rain forest zone vegetation preceded by littoral mangrove assemblages is the common macro-floral assemblages especially in areas with reduced anthropogenic influence(s).

Collection of samples.

Collection of water samples

The twelve sampling stations were selected to cover the lagoon area and for the collection of samples. Table 1 shows the G.P.S. location, names and number of sampling stations. Monthly surface water samples was collected for twenty-four consecutive months (October, 2004 – September, 2006) for physico-chemical characteristics analysis using 500ml plastic containers with screw caps. Collection of samples from the stations was between 10 and 15hr each time. Water samples were collected just a few centimeters below the water surface at each of the twelve stations. The plastic containers was then labeled appropriately and transported to the laboratory immediately after collection for further analysis.

Table 1: G.P.S. location and station name of sampled areas in the Iyagbe lagoon.

Station No.	Station name	G.P.S. locations
Station 1	Calabash Island	Latitude 6o 251.987 N, Longitude 3^{o} 231.400 E
Station 2	Tin-can Island	Latitude 6^{o} 251 .833 N, Longitude 3^{o} 211 .532 E
Station 3	Ibafon	Latitude 6^{o} 251 .964 N, Longitude 3^{o} 191 .244 E
Station 4	Imore	Latitude 6^{o} 251 .755 N, Longitude 3^{o} 191 .915 E
Station 5	Ito-ogba	Latitude 6^{o} 251 .409 N, Longitude 3^{o} 141 .624 E
Station 6	Abule-oshun	Latitude 6^{o} 261 .134 N, Longitude 3^{o} 131 .224 E
Station 7	Idiagbon / Igbolobi	Latitude 6^{o} 261.214 N, Longitude 3^{o} 111 .826 E
Station 8	Iyagbe	Latitude 6^{o} 251 .603 N, Longitude 3^{o} 111 .990 E

Station 9	Agbaja	Latitude 6^{o} 241 .473 N, Longitude 3^{o} 121 .744 E
Station 10	Ikare	Latitude 6^{o} 241 .632 N, Longitude 3^{o} 131 .705 E
Station 11	Ilashe	Latitude 6^{o} 241 .676 N, Longitude 3^{o} 161 .938 E
Station 12	Idimangoro	Latitude 6^{o} 241 .717 N, Longitude 3^{o} 191 .307 E

Collection of phytoplankton samples.

Phytoplankton sample was collected on each occasion and station with a 55µm mesh size standard plankton net towed from a motorized boat for 5mins 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 48hours and prior to microscope analysis, samples were concentrated to 10 ml (Onyema *et al*., 2007).

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, adapted by Onyema (2007a) was used. Appropriate texts were used to aid identification (Smith 1950; Hendey, 1958, 1964; Desikachary, 1959; Wimpenny, 1966; Patrick and Reimer, 1966, 1975; Whitford and Schmacher, 1973; Vanlandingham, 1982; Nwankwo, 1984, 1990, 2004a; Bettrons and Castrejon, 1999; Siver, 2003; Rosowski, 2003).

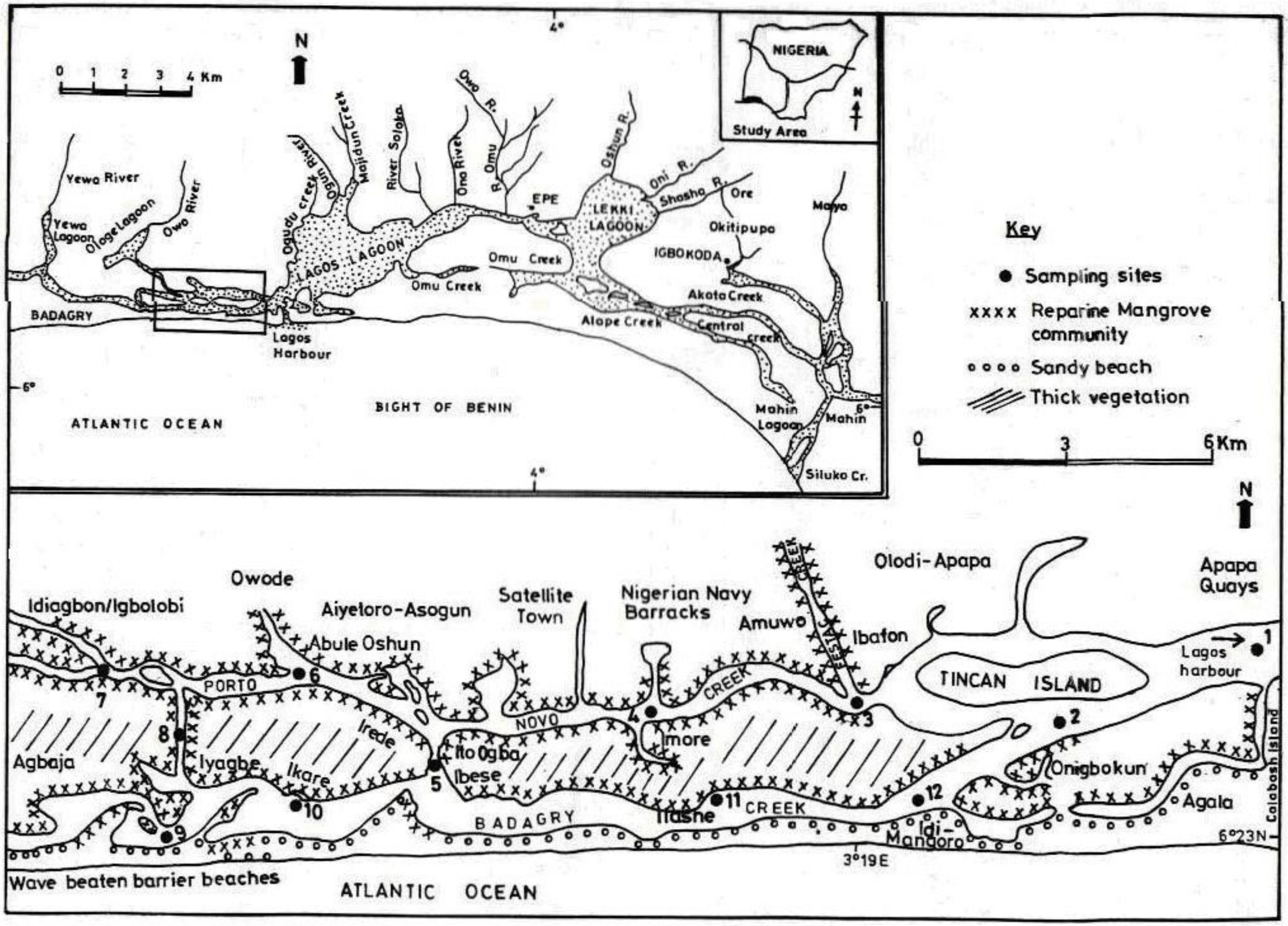

Fig. 1 Iyagbe Lagoon, Porto-Novo and Badagry Creeks Showing Sampling Sites.

RESULT

Summary of physical and chemical results.

Presented below, is the summary of physical and chemical characteristics results for the Iyagbe lagoon and for the duration of the study (Onyema and Nwankwo, 2009). Whereas air temperature, surface water temperature, total dissolved solids, transparency, sulphate, silica, dissolved oxygen, conductivity, salinity, chloride, pH, acidity, alkalinity, total hardness, calcium and magnesium recorded increasing values in the dry season, chemical oxygen demand, biological oxygen demand, total suspended solids, nitrate, phosphates, copper, zinc and iron recorded higher values in the wet seasons at all stations.

Table 2: A summary of the minimum, maximum and mean estimated values for environmental factors from the Iyagbe lagoon (October, 2004 – September, 2006).

	Parameter / Unit	Minimum value	Maximum value	Mean value ± S.D.
1	Air temperature (°C)	26	34	30.07 ± 1.98
2	Water temperature (°C)	26	33	29.42 ± 1.81
3	Transparency (cm)	22	231	102.42 ± 51.47
4	Total Dissolved Solids (mgL^{-1})	90	25000	8467.65 ± 6641.66
5	Total Suspended Solids (mgL^{-1})	18	2310	172.48 ± 259.01
6	Rainfall (mm)	6	315.7	141.83 ± 116.87
7	Chloride (mgl^{-1})	20.5	15015	6316.55 ± 24167.13
8	Total hardness (mgL^{-1})	18	6875	2035.82 ± 1485.42
9	pH	6.7	8.42	7.40 ± 0.28
10	Conductivity (µS/cm)	110	40850	13208.59 ± 10418.71
11	Salinity (‰)	0.06	35.1	14.43 ± 18.10
12	Alkalinity (mgL^{-1})	15.3	330	74.32 ± 74.25
13	Acidity (mgL^{-1})	3.8	44	11.80 ± 7.48
14	Dissolved oxygen (mgL^{-1})	4	5.6	4.67 ± 0.23
15	Biological oxygen demand (mgL^{-1})	2	22	7.15 ± 3.52
16	Chemical oxygen demand (mgL^{-1})	8	89	30.21 ± 21.08
17	Nitrate – nitrogen (mgL^{-1})	3.3	59.8	10.54 ± 8.37
18	Phosphate – phosphorus (mgL^{-1})	0.01	1.68	0.26 ± 0.29
19	Sulphate (mgL^{-1})	20.8	1140	279.71 ± 232.16
20	Silica (mgL^{-1})	0.9	6.0	2.63 ± 0.91
21	Calcium (mgL^{-1})	10	720.1	188.49 ± 130.05
22	Magnesium (mgL^{-1})	1.4	900	333.36 ± 264.92
23	Copper (mgL^{-1})	0.001	0.079	0.003 ± 0.001
24	Iron (mgL^{-1})	0.06	1.08	0.29 ± 0.25
25	Zinc (mgL^{-1})	0.001	0.015	0.002 ± 0.002
26	Chlorophyll *a* (µg/L)	4.2	55	19.63 ± 7.90

Phytoplankton

The wet season algal community was dominated by freshwater species especially in more inland areas from the sea. The green algae, chrysophytes, euglenoids and pennate diatoms were prevalent in the wet season plankton, whereas dinoflagellates and most centric diatoms dominated the dry season. However the genus *Aulacoseira* with a number of varieties (centric diatoms) were reported only in the wet season / low salinity periods in the lagoon. Notable freshwater condition indicator included *Aulacoseira granulata, Aulacoseira granulata* var. *angustissima, Aulacoseira granulata* var. *angustissima* f. *curvata, Aulacoseira granulata* var. *angustissima* f. *spiralis, Microcystis aureginosa* and *Microcystis flos – aquae*. Similarly, mid to high brackish water / marine forms included *Coscinodiscus centralis, Coscinodiscus eccentricus, Coscinodiscus radiatus, Coscinodiscus marginatus, Thalassionema frauenfeldii, Actinoptychus splendens, Melosira nummuloides, Melosira moniliformis, Bacillaria paxillifer, Parabelius delognei Pleurosigma* and *Gyrosigma* spp. The dinoflagellates also fall into this latter category (*Ceratium macroceros* , *Ceratium tripos* and *Peridinium africana*).

Most pennate diatoms were prevalent in shallow eco-zones, whereas chrysophytes (*Chrysotepphanosphaera globulifera* and *Synura uvella*) reflected fresh and acidic water conditions and were only found in the furthest extreme of the Iyagbe lagoon system and only in the Porto-Novo creek wing. The blue-green algae on the other hand (notably *Oscillatoria* spp.) were common in areas of fresh to low brackish water and moderate to high levels of nutrients, likely from organic pollution. *Merismopedia gluca* on the other hand was only recorded at times when mid to high brackish water situations were prevalent. Additionally, *Trichodesmium thiebautii* Gomont was recorded in sea conditions with low nutrient levels.

The euglenoids (*Euglena acus*, *Phacus curvicauda*, *Phacus acuminatus* and *Trachelomonas hispida*) were all found in the wet season associated with freshwater conditions and in areas with high nutrient levels throughout the study. Table 3 shows some elicited micro-algal bio-indicators of a range of water condition in the Iyagbe lagoon for the study.

Table 3: Some recorded micro-algal bio-indicators of a range of water quality condition in the Iyagbe lagoon.

	TAXA	PREFERENTIAL ECOLOGICAL SITUATION
	CLASS - CYANOPHYCEAE	
	ORDER I - CHROCCOCALES	
1	*Chroococcus turgidus* (Kutz.) Lemm.	Fresh – brackish water situation / moderate organic pollution
2	*Microcystis aureginosa* Kutzing	Fresh – low brackish / moderate – high organic pollution condition
3	*Microcystis flos-aquae* Kirchner	Fresh – low brackish / moderate – high organic pollution condition
4	*Merismopedia gluca* (Ehr.) Nageli	Mid – high brackish / moderate – high organic pollution condition
	ORDER 11– HORMOGONALES	
5	*Anabaena constricta* Geitler	Fresh water situation / moderate – high organic pollution condition
6	*Anabaena spiroides* Klebahn	Fresh – low brackish / moderate – high organic pollution condition
7	*Anabaena torulosa* Lagerheim	Fresh – low brackish / moderate – high organic pollution condition
8	*Lynbgya limnetica* Lemm	Fresh – low brackish / moderate organic pollution condition
9	*Lynbgya martensiana* Meneghini	Fresh – low brackish / moderate – high organic pollution condition
10	*Oscillatoria borneti* Zukal	Fresh – low brackish / high organic pollution condition
11	*Oscillatoria chalybea* Gomont	Fresh – low brackish / moderate – high organic pollution condition
12	*Oscillatoria curviceps* C.A. Agardh	Fresh water situation / moderate – high level organic pollution
13	*Oscillatoria formosa* Bory	Fresh water situation / moderate organic pollution
14	*Oscillatoria limnosa* Agardh	Fresh – low brackish / moderate – high organic pollution condition
15	*Oscillatoria tenius* Agardh	Fresh water situation / moderate organic pollution
16	*Oscillatoria sancta* Sancta	Fresh water situation / moderate organic pollution
17	*Spirulina platensis* Geitler	Fresh – low brackish / moderate – high organic pollution condition

18	*Trichodesmium thiebautii* Gomont	Low nutrient levels / warm sea situation / alkaline pH and high cation levels
	CLASS – EUGLENOPHYCEAE	
	ORDER – EUGLENALES	
19	*Euglena acus* Ehrenberg	Fresh water situation / very high nutrient levels / organic pollution
20	*Phacus curvicauda* Swirenko	Fresh water situation / very high nutrient levels / organic pollution
21	*Phacus acuminatus* Stokes	Fresh water situation / very high nutrient levels / organic pollution
22	*Trachelomonas hispida* (Perry) Stein	Fresh water situation / very high nutrient levels / organic pollution
	CLASS - BACILLARIOPHYCEAE	
	ORDER 1 – CENTRALES	
23	*Actinoptychus splendens* Ehrenberg	Low brackish – sea situations / alkaline pH, high cation levels
24	*Aulacoseira granulata* Ehrenberg (Ralfs)	Moderate nutrient levels / fresh water – low brackish water situation
25	*Aulacoseira granulata* var. *angstissima* Muller	Moderate nutrient levels / fresh water – low brackish water situation
26	*Aulacoseira granulata* var. *angstissima* f. *spiralis* Muller	Fresh water situation / moderate level nutrient levels / moderate organic pollution
27	*Aulacoseira granulata* var. *angstissima* f. *curvata* Simon	Fresh water situation / moderate level nutrient levels / moderate organic pollution
28	*Aulacoseira islandica* (O.F. Muller) Simonson	Fresh water situation / moderate level nutrient levels
29	*Melosira moniliformis* Agardh	High brackish – sea situations / alkaline pH, high cation and nutrient levels
30	*Melosira nummuloides* Agardh	High brackish – sea situations / alkaline pH, high cation and nutrient levels
31	*Ditylum brightwelli* (T. West) Grunow	High brackish – sea situations / alkaline pH, high cation levels
32	*Hemidiscus cuneiformis* Wallich	High brackish – sea situations / alkaline pH, high cation levels
33	*Cyclotella menighiniana* Kutzing	High nutrient level / fresh – low brackish situations / shallow ecozone/ organic pollution
34	*Leptocylindricus danicus* Cleve	Low brackish – sea situations
35	*Chaetoceros convolutus* Castracane	Low brackish – sea situations / alkaline pH, high cation levels
	ORDER II – PENNALES	
36	*Bacillaria paxillifer* (O. F. Muller)	Mid – high brackish water situation / alkaline pH, high cation and nutrient levels
37	*Eunotia monodon* Ehrenberg	Fresh / acidic water situation
38	*Fragillaria construens* Ehrenberg	Fresh – low brackish / moderate – high level nutrient levels/ organic pollution
39	*Gomphonema parvulum* Grunner	Fresh – low brackish situations / High nutrient level / organic pollution
40	*Gyrosigma balticum* (Ehr.) Rabenhorst	Low – high brackish water situation / alkaline pH, high cation and nutrient levels.
41	*Gyrosigma spenceri* Wm. Smith	Low – high brackish water situation / alkaline pH, high cation and nutrient levels / shallow aqua-zone
42	*Gyrosigma scalproides* (Rabh) Cleve	Low – high brackish water situation / alkaline pH, high cation and nutrient levels
43	*Hantzschia amphioxys* (Ehr.) Rbenhorst	High brackish - sea water situation / alkaline pH, high cation and nutrient levels
44	*Navicula cryptocephala* (Kutz.) Hustedt	Moderate – high level nutrient levels / shallow aqua-zone / organic pollution
45	*Navicula mutica* Kutzing	Moderate – high level nutrient levels / shallow aqua-zone/ organic pollution
46	*Navicula rhynchocephala* Kutzing	High nutrient level / organic pollution / fresh – low brackish situations /
47	*Nitzschia closterium* Wm. Smith	Low – high brackish water situation/ alkaline pH and high cation levels
48	*Nitzschia obtusa* Wm. Smith	Low – high brackish / low nutrient water situation.
49	*Nitzschia palea* (Kutzing) Wm smith	High nutrient level / organic pollution / fresh situations
50	*Nitzschia sigmoidea* (Witesch) Wm. Smith	Low – high brackish / high cation and nutrient situation.
51	*Odontella regia* (Schultze) Ostenfeld	Mid – high brackish water situation / alkaline pH, high cation and nutrient levels
52	*Odontella sinensis* Greville	Mid – high brackish water situation / alkaline pH, high cation and nutrient levels
53	*Parabelius delognei* E.J. Cox	High brackish - sea water situation / proximate attachment loci
54	*Pleurosigma angulatum* (Quekett) Wm.	Mid – high brackish water situation / alkaline pH, high cation and nutrient levels

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	Smith	
55	*Pinnularia major* (Kutzing) Rabenh	Fresh water situation / moderate – high level nutrient levels/ organic pollution
56	*Pinnularia gibba* Ehrenberg	Fresh water situation / moderate – high level nutrient levels/ organic pollution / shallow area
57	*Synedra ulna* (Nitzsch) Ehrenberg	Fresh water situation / low - moderate level nutrient levels/ moderate organic pollution
58	*Synedra ulna* var. *biceps* Ehrenberg	Moderate – high level nutrient levels / Fresh – low brackish
59	*Surirella ovata* Kutzing	Shallow nutrient rich / Fresh – low brackish conditions/ moderate organic pollution
60	*Surirella splendida* Wm. Smith	Shallow nutrient rich / Fresh – low brackish conditions/ moderate organic pollution
61	*Surirella striatula* Turpin	Shallow nutrient rich / Fresh – low brackish conditions/ moderate organic pollution
	CLASS – DINOPHYCEAE	
	ORDER – PERIDINALES	
62	*Ceratium macroceros* (Ehr.) Cleve	Warm sea situations / alkaline pH
63	*Ceratium tripos* (O.F.M.) Nitzsch	Warm sea situations / alkaline pH
64	*Peridinium africana* Kofoid	Fresh – low brackish conditions / shallow aqua-zone
	CLASS – CHLOROPHYCEAE	
	ORDER I – ULOTHRICALES	
65	*Microspora flocca* (Vaucher) Thuret	High nutrient level / fresh situations / moderate organic pollution
66	*Spirogyra africana* Fritsch Cruda	High nutrient level / fresh situations / organic pollution
	ORDER II - CLADOPHORALES	
67	*Cladophora glomerata* (L) Kutzing	High nutrient level / fresh situations / organic pollution
	ORDER III - CHLOROCOCCALES	
68	*Akistrodesmus* sp.	Fresh / acidic water situation / shallow aqua-zone
69	*Scenedesmus obliquus* (Turp.) Kutzing	High nutrient level / fresh situations / organic pollution
70	*Scenedesmus quadriquada* (Turp.) de Brebisson	High nutrient level / fresh situations / organic pollution
	ORDER IV - ZYGNEMATALES	
71	*Closterium ehrenbergii* Meneghini	Fresh / acidic to neutral water pH / organic pollution
72	*Gonatozygon monotaenium* De Bary	Fresh / acidic to neutral water pH / moderate organic pollution
73	*Gonatozygon* sp.	Fresh / acidic to neutral water pH / moderate organic pollution
74	*Staurastrum paradoxum* var. *cingulum* Wm. and G.S. West	Fresh / acidic to neutral water pH / organic pollution
	CLASS – CHRYSOPHYCEAE	
75	*Chrysotepphanosphaera globulifera* Scherffel	Fresh / acidic water situation / shallow aqua-zone
76	*Synura uvella* Ehrenberg	Fresh / acidic water situation / shallow aqua-zone

DISCUSSSION

According to Onyema and Nwankwo (2009), the water quality indices in the Iyagbe lagoon reflected seasonal changes closely related to rainfall distributive pattern and the effect of tidal seawater incursion. In the lagoon system, there were clear differences in phytoplankton species in the fresh, brackish and sea-like zones especially in the dry season. This corresponded with differences in the water quality.

The occurrence of pennate diatoms in the plankton during the survey may be reflections of possible stirring of the lagoon phytobenthic community into the plankton. According to Onyema *et. al.* (2003) frequently occurring pennate forms in the plankton samples from the Lagos lagoon was a likely reflection of the mixing of the shallow lagoon and phytobenthic community by tides and flood waters at different seasons. Nwankwo and Akinsoji (1989), Onyema and Nwankwo (2006) and Onyema *et. al.* (2007) are also of similar views for studies in the Lagos lagoon. According to Nwankwo (1984), the occurrence of pennate forms during the rainy season suggests their dislodgement from the substratum probably during high water discharge, while tidal inflow accounted for the appearance of some marine forms in the plankton at the same period. In this regard, the presence of known marine forms like *Amphora alata, Asterionella japonica, Ditylum brightwellii, Melosira moniliformis, M. nummuloides, Triceratium favus* and the various species of *Coscinodiscus, Odontella, Chaetoceros, Rhizosolenia, Leptocylindricus, Thalassosira* and *Thalassionema* further confirms the incursion of seawater to the lagoon as they were recorded in the mid-high brackish water situation only (Nwankwo and Onyema, 2003; Onyema *et al*., 2008).

According to Kadiri (1999) *Actinoptychus splendens, Aulacoseira granulata* and *Aulacoseira granulata* var. *angustissima* f. *curvata* had a wide distribution. The author is of the view that the prominence of *A. granulata* in all Nigerian coastal states, adds to the impressive array of evidence attesting to the cosmopolitan nature of this species. Its prevalence has been reported in other southern waters in Nigeria – (Lagos lagoon - Fox 1957, Nwankwo, 1988, 1996, Kadiri, 1999; Onyema *et al*. 2003; Onyema, 2008; Eleiyele reservoir - Imevbore, 1968; River Niger - Eaton, 1966; River Oshun - Egborge, 1973, 1974; Warri River - Opute, 1990).

Oscillatoria spp. according to Vanlandingham (1982) is by far the most significant of all blue-green algae genera in determining water quality and it is highly important as a diagnostic indicator among other major algal groups. Palmer (1969) is of the view that only *Euglena* is more important than *Oscillatoria* as a genus of algae indicative of organic pollution. Desikachay (1959), Epstein (1995), Hallegraeff *et. al.* (1995) and Nwankwo *et. al.* (2003) have reporded that *Trichodesmium thiebautii* is commonly found in the supra thermocline, nutrient poor and warm waters of the tropics. Further to this, Dugale *et. al.* (1964) reporting for the Arabian sea and Nwankwo *et. al.* (2003) reporting for the Nigerian coast has reported massive blooms of *Trichodesmium thiebautii* clogging fishing nets and reducing fish catch. The presence of *Trichodesmium thiebautii*, the only true marine cyanobacteria also confirm the water chemistry at the time (Nwankwo, 1993; Nwankwo and Onyema, 2003; Onyema *et al*., 2008). Its source to the lagoon in definetly the sea (Atlantic ocean) via the Lagos habour.

According to Siver (2003), chrysophytes especially the synurophyceae are euplanktonic in nature and occur almost exclusively in freshwater habitat. The most diverse floras of scaled chrysophytes are typically found in slightly acidic condition. Chrysophytes encountered in this study were found only in such conditions which were also fresh at the time of occurence. Wujek *et al*. (2004) have recently listed new records of chrysophytes for Nigeria from the Lekki lagoon and this included *Synura uvella* encounted in this study but not *Chrysotepphanosphaera globulifera*.

With regard to diatoms, whereas *Coscinodiscus, Odontella* and *Parabelius* spp. and the dinoflagallates were more biodiganostic of marine condition and the dry season in the Iyagbe lagoon, *Aulacoseira granulata, Aulacoseira granulata* var. *angustissima, Aulacoseira granulata* var. *angustissima* form *curvata, Aulacoseira granulata* var. *angustissima* form *spiralis, Microcystis aureginosa* and euglenoids better represented fresher water conditions in the Iyagbe lagoon. According to Onyema (2007b), the community of *Biddulphia sinensis, Beggiotoa alba, Microcyctis flos – aquae, Spirulina platensis* and *Phormidium uncinatum* recorded in high numbers at one time or the other in the polluted Ijora creek were clear indicators of the alkaline, nutrient rich and brackish nature of the creek.

Aulacoseira granulata var. *angustissima* and *Microcystis aeruginosa* bloom in the wet season may be indication of a number of situations. Firstly, that the levels of nutrient in the waters are high. Secondly other associated hydro-climatic characteristics at such times may exist in favourable levels or state. Thirdly, these waters are very likely fresh as these organisms have been reported by other authors in coastal water of Nigeria as prevalent in freshwater situations hence indicative of fresh water conditions (Nwankwo, 1988, Kadiri, 1999, Nwankwo *et al*. 2003, Onyema *et al*. 2003). It is also possible that these organisms had bloomed in the adjoining Elete creek, Badagry, Yewa and Ologe lagoons and as a result of the rains and associated flood, overflows into the western extreme of the Iyagbe lagoon. Nwankwo (1998) and Onyema *et al.* (2003) are of the view that high densities of *Aulacoseira granulata* and *Aulacoseira granulata* var*. augustissima* recorded in the Lagos lagoon in the wet season were possibly recruited from the eastern extremes of the Lagos lagoon system known to be fresh all through the year.

It is important to note that this study is not near exhaustive nor is the bio-diagonistic list presented in this material sacrosanct. Hence the need to continue to elucidate relevant biological data from ecological investigations in a bid to better understand phytoplankton species vis-à-vis the environmental conditions they portend. Apt identification in this regard is therefore very key.

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