Current Research Journal of Biological Sciences 6(1): 1-6, 2014
DOI:10.19026/crjbs.6.5490
ISSN: 2041-076X, e-ISSN: 2041-0778

Submitted: December 10, 2012 Accepted: January 07, 2013 Published: January 20, 2014

Research Article

A Checklist of the Phytoplankton Flora of a Southern Nigerian Lotic Ecosystem

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Abstract: This study presents a first compilation of phytoplankton species composition of a stretch of fresh and brackish water ecosystem in Southern Nigeria. Samples collection spanned a period of sixteen months (January 2003 to April 2004). Phytoplankton samples were collected monthly in the open water using plankton net of 55 µm mesh size towed horizontally for about five minutes. The net hauls were transferred into 200 mL properly labelled plastic containers and immediately preserved with 4% formation solution. Samples were examined and illustrations made with a Leitz Orthoplan Research Microscope equipped with a tracing and measuring devices at the phycology laboratory in University of Benin, Benin City. A seasonal pattern of phytoplankton variation was observed with a hundred and 154 phytoplankton species recorded. The taxa recorded belong to four divisions namely: Bacillariophyceae (diatoms), Cyanophyceae (blue-green algae), Euglenophyceae (euglenoids) and Chlorophyceae (green algae). The Diatoms were the predominant group and account for 79% of total species composition. Others are Chlorophyceae 19.77%; Cyanophyceae 1% and Euglenophyceae, 0.23%. The brackish water stations recorded relatively higher number of species and number of individuals of each species than the freshwater stations. An array of floristically diverse phytoplankton was observed with notable common and cosmopolitan diatom species like *Coscinodiscus* and *Nitschia* spp in abundance.

Keywords: Brackishwater, freshwater, Nigeria, Osse River, phytoplankton, taxa

INTRODUCTION

The term plankton refers to any small biota (usually microscopic) living in the water adrift in the water column and incapable of maintaining its position and at the mercy of currents. Phytoplankton (algae) such as diatoms, grow in the presence of sunlight and nutrients such as nitrogen and phosphorus. They are mostly unicellular, filamentous or aggregate of cells and form the base of the trophic structure in the aquatic food chain. Some of these plants are in turn grazed upon by zooplankton, which is dominated by small crustaceans such as copepods, shrimps and their larvae. The amount of phytoplankton in the water column reflects the influence of a number of environmental factors and processes (Suthers and Rissik, 2009). Some phytoplankton species may be considered as villains-producing red tides or toxic algae-but there are only a few species responsible. Most phytoplankton is enormously beneficial, such as those used in the aquaculture industry (Suthers and Rissik, 2009). Phytoplankton has immense values as they play a vital role in aquaculture feed since they form the primary food producer. The great fishing grounds of the seas are found in where algae are found in abundance. As the most sensitive organisms, they serve as indicators of water quality with their ability to detect even the subtle changes taking place in their ambient environment (Sithik *et al*., 2009).

Reports on phycological information in similar freshwater bodies are available in Kadiri and Opute (1989), Kadiri (1993), Kadiri and Opute (2003), Kadiri (2000b), Kadiri and Omozusi (2002), Kadiri (1996), Opute (2003, 1991), Kadiri (2002a), Opute (2000), Nwankwo (1998), Davies *et al*. (2008), Akoma (2007, 2008), Akoma and Opute (2010), Ekwu and Sikoki (2006), Adesalu and Nwankwo (2010), Uttah *et al*. (2008), Onyema *et al*. (2010), Mustapha (2010), Adejare and James (2010), Adesalu and Nwankwo (2008), Kadiri (2002b) and Nwankwo and Onyema (2003).

The study is important because it is a pioneer investigation of this nature in Osse River and therefore will contribute to the knowledge of phycological information in Nigeria.

Study area: The Osse River takes its source from the Akpata hills in Ekiti State, Nigeria (Fig. 1). It flows through Ovia North-East Local Government Area of Edo State and empties into the Benin River through the Gwato Creek which anddrains into the Atlantic Ocean at the Bight of Benin. The climate has the unique

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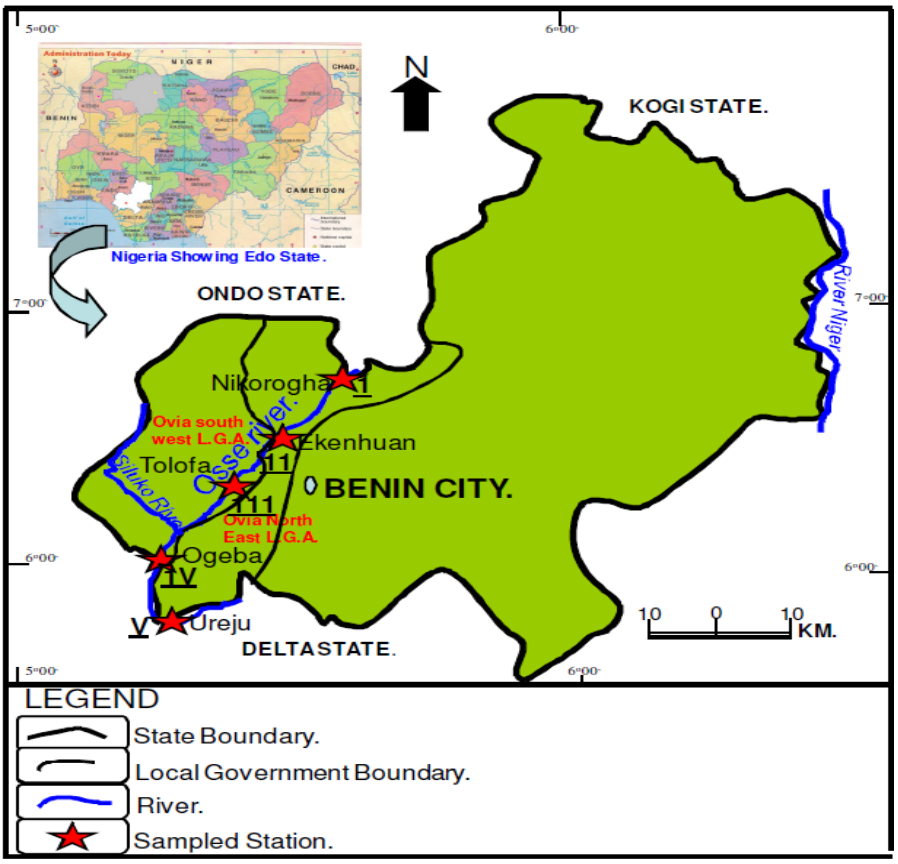

Fig. 1: Map of Osse River showing sample stations

features of the humid tropical wet season and dry seasons. In the wet season, the river is characterized by increased flow rate, high turbidity and muddy water especially after heavy rainfall while dry season is characterized by moderate or slow flow rate and clearer water. Several streams and creeks drain into the river. The river is the major source of drinking water for the inhabitants of these communities (Omoigberale and Ogbeibu, 2007).

METHODOLOGY

Phytoplankton samples were collected by towing 55 µm mesh size plankton net against the current at subsurface level for ten minutes. The samples were preserved in a solution of four per cent formaldehyde. Phytoplankton samples were examined in the laboratory using a Leitz Orthoplan Universal Wide-Field Research microscope equipped with tracing and measuring devices. Identification and classification of phytoplankton were carried out with the aid of standard monographs and publications including Prescott (1975), Kadiri (1987) and Opute (1990, 1991, 2000, 2003).

Result: Phytoplankton checklist

A CHECKLIST OF PHYTOPLANKTON SPECIES IN OSSE RIVER

In this list, algal species are arranged according to their divisions, classes, orders and families.

Taxanomic list:

Division : Bacillariophyta
Class : Bacillariophyceae
Order : Centrales
Family : Coscinodiscacea
Genus : Coscinodiscus Ehrenberg
Coscinodiscus centralis Ehr.
Family : Thalassiosiraceae
Genus : Aulacoseira Thwaites
Aulacoseira ambiqua (Grun.) Simon
A. graulata (Ehr.) Ralfs
A. granulata var. angustissima Muller
A. granulata var. *angustissima* f.*spiralis*
Family : Melosiraceae
Genus : Melosira Agardh
Melosira monoliformis (Muller) Agardh
M. nyassensis Muller var. *victoriae* Muller
Genus : Cyclotella Kutz.
Cyclotella sp.

Family : Heliopeltaceae
Genus : Actinoptychus Ehrenberg
Actinoptychus splendens (Shadbolt) Ralfs
Family : Biddulphiaceae
Genus : Terpsinoe Ehrenberg
Terpsinoe musica Ehr.
Genus : Hydrosera G.C.Wallich
Hydrosera sp
Family : Lithodesmiaceae
Genus : Ditylum Bailey
Ditylum brightwelli (West) Grunow
D. sol Grunow
Family : Eupodiscaceae
Genus : Odontella Agardh
Odontella regia (Schultz) Simonsen
O. sinensis (Grev.) Grun.
Genus : Triceratium Ehrenberg
Triceratium favus Ehr.
Genus : Biddulphia Graville
Biddulphia longicruris Grev.
Order : Pennales
Family : Diatomaceae
Genus : Fragillaria Lyngb.
Fragillaria javanica Hustedt
Fragillaria sp.
Genus : Desmogonium Ehrenberg
Desmogonium rabenhorstianum var. *elongatum* Patr.
Genus : Synedra Ehrenberg
Synedra acus Kutz.
S. ulna (Nitzsch) Ehr.
S. superba Kutz.
Genus : Tabellaria Ehrenberg
Tabellaria fenestrata (Lyng.) Kutz.
T. flocculosa (Rothe) Kutz. var. *asterionelloides* Grun. in var. Heurick
Genus : Thalassiothrix Cleve et Grun
Thalassiothrix frauvenfeldii (Grun.) Cleve and Grun.
Family : Eunotiaceae
Genus : Eunotia Ehrenberg
Eunotia flexuosa Breb. & Kutz.
E. monodon Ehr. var. *tropica* Hustedt
E. asterionelloides Hustedt
E. pectinalis (Dillw and Kutz) Rabh.
Family : Naviculaceae Kutz.
Genus : Frustulia Rabenh.
Frustulia rhomboides (Ehr.) DeToni.
Genus : Gyrosigma Agardh
Gyrosigma balticum W. Smith
Genus : Navicula Bory
Navicula vaucheriae Pet.
N. gastrum (Ehr.) Dokin
N. sp.
Genus : Pinnularia Ehrenberg
Pinnularia cardinaliculus Cleve
P. subcapitata Greg.
P. rivularis Hustedt
P. divergens W. Smith f. *capitata* Cleve – Euler
P. viridis (Nitzsch) Ehr.
P. nobilis Ehr.
Genus : Cymbella Agardh
Cymbella sp
Genus : Pleurosigma. Smith
Pleurosigma delicatum W. Smith
P. decorum W. Smith
P. formosum W. Smith
P. angulatum (Quek.) Smith
Family : Nitzschiaceae Grunow
Genus : Nitzschia Hass.
Nitzschia palaceae Grun.
Family : Surirellaceae
Genus : Stenopterobia Breb.
Stenopterobia rautenbachiae Choln.
Genus : Surirella Turp.
Surirella robusta Ehr.
S. elegans Ehr.
S. gemma Ehrenberg
S. celebesiana Hustedt
S. engleri Muller. f. *genuina* recta
Division : Chlorophyta
Class : Chlorophyceae
Order : Zygnematales
Family : Desmidiaceae
Genus : Actinotaenium Teiling
Actinotaenium mooreanum (Arch) Teil var. *Mooreanum*
Genus : Bambusina (Kutzing) Ralfs
Bambusina brebissonii Kutz. var. *maius* (Racib.) Croasd.
Genus : Closterium (Nitzsch) Ralf
Closterium monoliferum (Bory) Ehr.
Cl. kuetzingii Breb.
Cl. setaceum Ehr.
Cl. gracile Breb. ex. Ralf var. *elongatum* W. and G. S. West
Cl. ehrenbergii (Schr.)Ehr.
Cl.acerosum (Schr) Ehr.
Cl. lineatum (Ehr.)
Cl. ralfsii Breb. var. *hybridum* Raben
Cl. lunula (Mull.) Nitzsch. var. *maximum* Borge
Cl. lunula (Mull.) Nitzsch
Cl. dianae Ehr. var. *arcuatum* (Breb.) Raben
Cl. turgidum Ehr. var. *borgei* (Borge) Defl.
Cl. lunula (Mull.) Nitzsch var. *Maximum* Borge f. *crassissimum* Croasdale
Genus : Cosmarium Corda
Cosmarium monodii Bourrelly
C. decoratum (West and West)
C. depressum (Nag.) Lund
C. askenasyi Schmidle. f. *latum* Scott and Presc.

C. subauriculatum West and West var. *bogoriense* (Bern.) Bourrelly
C. birectum var. *floridense* Wolle
C. sabbulteum Schmidle var. *maius* Thom.
C. salisburi Fritsch and Rich
C. pyramidatum Breb.

Genus : Desmidium (Agardh) Ralfs
Desmidium swartzii Agardh
D. quadratum Nordst
D. baileyi (Ralfs) De Bary. f. *tetragonum* Nordst

Genus : Euastrum (Ehrenberg) Ralfs
Euastrum spinulosum Delp. var. *lindae* Groubi. & Scott.
Euastrum didelta (Ralfs) var. *bengalicum* Lagerh

Genus : Hyalotheca (Ehrenberg) Ralfs
Hyalotheca dissiliens (Smith) Breb.

Genus : Micrasterias (Agardh) Ralfs
Micrasterias fimbriata Ralfs
M. mahabuleshwarensis Hobs. var. *dichotoma* Smith
M. torreyi Bail. var. *curvata* Krieger
M. apiculata (Ehr.) Menegh var. *stuhlmanii* (Hieron) Bourrelly
M. americana (Ehr.) Ralfs
M. thomasiana Arch. var. *notata* (Nordst) Gronbl
M. radians Turn. var. *bogoriensis* (Breb.) West & West
M. ambadiensis (Gronbl and Scott) Thom
M. foliaceae Bailey

Genus : Pleurotaenium Nageli
Pleurotaenium ovatum Nordst var. *tumidium* (Mask) West
P. ovatum Nordst
P. coronatum (Breb.) Raben. var. *nodulosum* West and West
P. ehrenbergii (Breb.) De Bary
P. coronatum (Breb.) Raben. var. *fluctuatum* West
P. subcoronulatum (Turn.) West and West var. *africanum* Schmidle
P. subcoronulatum (Turn.) West and West

Genus : Triploceras Bailey
Triploceras gracile Bail var. *bidentum* Nordst

Family : Gonatozygonaceae

Genus : Gonatozygon De Bary
Gonatozygon monotaenium De Bary var. *angustum* Forster
G. aculeatum Hastings
G. kinahani (Arch) Raben. var. *interruptum* Forster

Family : Zygenemataceae

Genus : Spirogyra Link
Spirogyra communis (Hass.) Kutz.
S. dubia Kutz.
S. majuscula Kutz.
S. insignis (Hass) Kutz.
S. karnalae Randehawa

Genus : Mougeotia Agardh
Mougeotia sphaerocarpa Wolle

Order : Oedogoniales

Family : Oedogoniaceae

Genus : Oedogonium Link
Oedogonium grande Kutz.
O. suecicum Wittr.

Order : Ulotrichales

Family : Ulotrichaceae

Genus : Ulothrix Kutz.
Ulothrix tenuissima Kutz.

Order : Siphonocladales

Family : Cladophoraceae

Genus : Cladophora Kutz.
Cladophora oligoclona Kutz.

Order : Chlorococcales

Family : Coelastraceae

Genus : Coelastrum Naegeli
Coelastrum microporum Naegeli
C. cambrium Arch.

Family : Scenedesmaceae

Genus : Scenedesmus Meyen
Scenedesmus magnus Meyen
Scenedesmus quadricauda (Turp.) Breb.

Family : Hydrodictyaceae

Genus : Pediastrum Meyen
Pediastrum tetras (Ehr.) Ralfs
P. duplex Meyen
P. duplex var. *subgranulatum* Racib.
P. boryanum var. *longicorne* Reinsch
P. boryanum (Turp.) Menegh var. *boryanum*

Order : Volvocales

Family : Volvocaceae

Genus : Eudorina Ehrenberg
Eudorina elegans Ehr.

Genus : Pandorina Bory
Pandorina morum (Mull.) Bory
P. species

Genus : Pleodorina Shaw
Pleodorina illinoisensis Kofoid

Genus : Volvox Linnaeus
Volvox africana
V. aureus Ehr.

Division : Euglenophyta

Class : Euglenophyceae

Order : Euglenales

Family : Euglenaceae

Genus : Euglena Ehrenberg
Euglena spirogyra Ehrenberg
E. helecoides (Bern.) Lemm.
E. viridis Ehrenberg
E. oxyuris Schmarda
E. acus Ehrenberg

Genus : Lepocinclis Perty
Lepocinclis playfairiana Deflandre
L. dextrosa Thom.
Genus : Phacus Dujardin
Phacus longicauda var. *major* Swir.
Genus : Strombomonas Deflandre
Strombomonas ensifera (Doday) Defl. var. *ornata* Lemm.
S. ensifera var. *javanica* Huber-Pestallozi
S. australis (Playfair) Deflandre
Genus : Trachelomonas Ehrenberg
Trachelomonas dastuguei Balech
T. caudata Stein
T. spinosa Stockes
T. eurystoma var. *nuda* Szab.
Division : Cyanophyta
Class : Cyanophyceae
Order : Chroococcales
Family : Chroococacceae
Genus : Coelosphaerium Nageli
Coelosphaerium pallidum Lemm.
C. sp.
Genus : Merismepodia Meyen
Merismepodia elegans Braun. var. *major* G. M. Smith
Genus : Microcystis Kutzing
Microcystis aeruginosa Kutz.
Order : Nostocales
Family : Nostocaceae
Genus : Anabaena Bory
Anabaena. alatospora Gonzalves
Family : Oscillatoriaceae
Genus : Lyngbia Agardh
Lyngbia majuscula Harvey
Genus : Oscillatoria Vaucher
Oscillatoria bornettia (Kuzal) Forti.
O. princeps Vaucher
O. curviceps C. A. Agardh
O. limosa Agardh
O. proboscideae Gomont

DISCUSSION

A total of one hundred and 154 phytoplankton species were recorded in this study. The phytoplankton of Osse River was dominated by diatoms throughout the study. Similar findings have been reported by Onyema (2010), Emmanuel and Onyema (2007), Adesalu and Nwankwo (2008), Uttah *et al*. (2008), Davies *et al*. (2008), Olomukoro and Oronsaye (2009), Kadiri (2002b), Mustapha (2010), Onyema *et al*. (2010) and Nwankwo (1998). The predominance of diatoms (the Bacillariophyceae) is common feature of open lotic waters with fast flowing currents (Uttah *et al*., 2008). Diatoms (79.00%) were the largest group of the phytoplankton observed in this study with the pennate forms accounting for 67.9% while the centric forms accounted for 32.1%. This indicates that the water body is more fresh than saline as pennate forms are found more in fresh water. The order of dominance of the phytoplankton group was Bacillariophyceae (79.00%) >Chlorophyceae (19.77%) >Cyanophyceae (1.00%) >Euglenophyceae (0.23%).

REFERENCES

Adejare, L.I. and B.K. James, 2010. Nutrients and phytoplankton production dynamics of a tropical harbor in relation to water quality indices. J. Am. Sci., 6(9): 261-275.

Adesalu, T.A. and D.I. Nwankwo, 2008. Effect of water quality indices on phytoplankton of a sluggish tidal creek in Lagos, Niger. Pak. J. Biol. Sci., 11: 836-844.

Adesalu, T.A. and D.I. Nwankwo, 2010. A checklist of desmids of Lekki Lagoon, Nigeria. Int. J. Biodivers. Conserv., 2(3): 33-36.

Akoma, O.C., 2007. Phytoplankton flora of Imo River Estuary, Southeastern Nigeria. Niger. J. Bot., 20(2): 317-325.

Akoma, O.C., 2008. Phytoplankton and nutrient dynamics of a tropical estuarine system, Imo River Estuary, Nigeria. Afr. Res. Rev., 2(2): 253-264.

Akoma, O.C. and F.I. Opute, 2010. Phytoplankton species from Imo River Estuary, Nigeria. Part I: Pennate Diatoms (Diatomaceae, Eunotiaceae and Naviculaceae). Niger. J. Bot., 23(2): 343-354.

Davies, O.A., D.S. Abolude and A.A. Ugwumba, 2008. Phytoplankton of the lower reaches of Okpoka creek, Port-Harcourt, Nigeria. J. Fish. Int., 3(3): 83-90.

Ekwu, A.O. and F.I. Sikoki, 2006. Phytoplankton diversity in the cross river, Estruary of Nigeria. J. Appl. Sci. Environ. Mgt., 10(1): 89-95.

Emmanuel, B.E. and I.C. Onyema, 2007. The plankton and fishes of a tropical creek in South-Western Nigeria. Turk. J. Fish. Aquat. Sci., 7: 105-113.

Kadiri, M.O., 1987. Algae and primary productivity studies of the ikpoba reservoir. Ph.D. Thesis, University of Benin (Unpublished).

Kadiri, M.O., 1993. Records of members of the genus cosmarium corda exRalfs (Desmidiaceae, Chlorophyta) in a shallow West African reservoir. Nova Hedwigia, 57(1-2): 109-122.

Kadiri, M.O., 1996. More desmids from the Ikpoba reservoir, Nigeria: Comparison with other African records. Algol. Stud., 80: 87-98.

Kadiri, M.O., 2000b. Limnological studies of two contrasting but closely linked springs in Nigeria, West Africa. Plant Biosyst., 134(2): 123-131.

Kadiri, M.O., 2002a. A checklist of desmids in Nigeria. Global J. Pure Appl. Sci., 8(2): 223-237.

Kadiri, M.O., 2002b. A spectrum of phytoplankton flora along salinity gradient in the Eastern Niger Delta area of Nigeria. Acta Bot. Hungarica, 44: 75-83.

Kadiri, M.O. and F.I. Opute, 1989. A rich flora of micrasterias from the Ikpoba reservoir, Nigeria. Arch. Hydrobiol., 116(3): 391-399.

Kadiri, M.O. and F.I. Opute, 2003. SEM observations of some note-worthy diatoms from the Ikpoba reservoir, Nigeria. Plant Biosyst., 137(2): 215-230.

Kadiri, M.O. and H.I. Omozusi, 2002. A pre-pollution study of the phytoplankton of an oligotrophic river in southern Nigeria. Afr. J. Environ. Pollut. Health, 1(1): 19-27.

Mustapha, K.M., 2010. Seasonal influence of limnological variables in plankton dynamics of a small, shallow, tropical African reservoir. Asian J. Exp. Biol. Sci., 1(1): 60-79.

Nwankwo, D.I., 1998. Seasonal changes in phytoplankton composition and diversity in the Epe Lagoon, Nigeria. Acta Hydrobiol., 40(2): 83-92.

Nwankwo, D.I. and I.C. Onyema, 2003. A checklist of planktonic algae of Lagos coast. J. Sci. Res. Dev., 9: 75-82.

Olomukoro, J.O. and C. Oronsaye, 2009. The plankton studies of the gulf of Guinea, Nigeria. Biosci. Res. Comm., 21(2): 71-75.

Omoigberale, M.O. and A.E. Ogbeibu, 2007. Assessing the environmental impacts of oil exploration and production on the water quality of Osse River, Southern Nigeria. Global J. Env. Sci., 6(1): 1-14.

Onyema, I.C., 2010. The phytoplankton diversity and succession in the Iyangbe lagoon, Lagos. Eur. J. Sci. Res., 43(1): 61-74.

Onyema, I.C., J.A. Nkwoji and O.J. Eruteya, 2010. The water chemistry and plankton dynamics of a tropical high energy erosion beach in Lagos. J. Am. Sci., 6(1): 111-122.

Opute, F.I., 1990. Phytoplankton flora of the warri/forcades estuary of Southern Nigeria. Hydrobiologia, 208: 101-109.

Opute, F.I., 1991. A checklist of the freshwater, brackish and marine phytoplankton of the Warri/Forcados Estuaries of Southern Nigeria. Niger. J. Bot., 4: 227-254.

Opute, F.I., 2000. Contribution to the knowledge of algae of Nigeria I. Desmids from the warri/forcados estuaries. Part II. The elongate baculiform desmids. J. Limnol., 59(2): 131-155.

Opute, F.I., 2003. Contribution to the knowledge of algae of Nigeria II. Chlorophyceae from the warri/forcados estuaries. Part I. The orders volvocales and chloroccocales. Benin Sci. Dig., 1: 31-52.

Prescott, G.W., 1975. How to Know the Freshwater Algae. C. Brown Company Publisher, Dubuque, Iowa, pp: 348.

Sithik, A.M.A., G. Thirumaran, R. Arumugam, R.R. Kannan and P. Anantharaman, 2009. Studies of phytoplankton diversity from agnithearthan and Kothandaramar Koil coastal waters: Southeast Coast of India. Global J. Env. Res., 3(2): 118-125.

Suthers, I.M. and D. Rissik, 2009. Plankton: A Guide to their Ecology and Monitoring for Water Quality. CSIRO Publishing, Collingwood, Vic., pp: 272.

Uttah, E.C., C. Uttah, P.A. Akpan, E.M. Ikpeme, J. Ogbeche, L. Usip and J. Asor, 2008. Bio-survey of plankton as indicators of water quality for recreational activities in Calabar River, Nigeria. J. Appl. Sci. Environ. Manag., 12(2): 35-42.