Research Report

Open Access

The Phytoplankton Species Composition and Abundance of Ogun River, Abeokuta, Southwestern Nigeria

Benjamin Onozeyi Dimowo✉

Department of Aquaculture and Fisheries Management, College of Environmental Resources Management, Federal University of Agriculture, Abeokuta, Ogun state, Nigeria

✉ Corresponding author email: benjamindimowo@yahoo.com

International Journal of Aquaculture, 2013, Vol.3, No.2 doi: 10.5376/ija.2013.03.0002

Received: 9 Jan., 2013

Accepted: 17 Jan., 2013

Published: 7 Feb., 2013

Copyright: © 2013 Dimowo. This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Dimowo B. O., 2013, The Phytoplankton Species Composition and Abundance of Ogun River, Abeokuta, Southwestern Nigeria, International Journal of Aquaculture, Vol.3, No.2 4-7 (doi: 10.5376/ija.2013.03.0002)

Abstract The phytoplankton species composition and abundance in Ogun River, Ogun state, Southwest Nigeria was studied for a period of seven months (December, 2011 - June, 2012), a total of forty-one genera belonging to five taxonomic groups were recorded from Ogun River. The phytoplankton species composition was surpassed by *Chrysophyta* with 15 species consisting of 36.6% followed by *Chlorophyta* with 14 consisting of 34.1%. This was followed by *Cyanophyta* (7 species) consisting of 17.1%, *Euglenophyta* with 3 species consisting of 7.3% and *Pyrrophyta* with 2 species consisting 4.92%. *Cyanophyta* was the highest in abundance consisting of 41% while the lowest in abundance was *Pyrrophyta* consisting of 1.5%. The low nature of phytoplankton abundance and diversity observed in this study must have been caused by the polluted nature of the water due to the anthropogenic activities carried out around its shores. The dominance of *Cyanophyta* in this river is similar to findings from Lake Victoria, Lake Bishoftu, Lake Chaohu and the temple pond of *Thirupour*.

Keywords Phytoplankton species; Abundance; Composition; Southwestern Nigeria; Ogun River

Introduction

Phytoplankton (singular-phytoplankter) is very small (microscopic) free floating plants that drift with water currents. They exist in both freshwater and marine environments (Microsoft Corporation, 2009; Lindsey and Scott, 2010; Encyclopædia Britannica, 2012). Like terrestrial plants, they use carbon dioxide, release oxygen and convert minerals to the form that animals can use. They are responsible for 50 percent of all photosynthetic activity on Earth. They can be divided into two divisions which include: phototrophic bacteria (which is made up of purple sulphur bacteria and green sulphur bacteria) and algae (which is made up of *euglenophyta*, *chrysophyta*, *phaecophyta*, *rhodophyta*, *pyrrophyta* and *cyanophyta*) (Edmondson, 1958). Their composition and abundance is highly dependent on the availability of sunlight, carbon dioxide and nutrients such as nitrate, phosphate and silicate etc. These factors influence their density and distribution throughout the water column. Phytoplankton is very important because they form the base with which the aquatic ecosystem is culminating (Reynolds, 1984). They are a source of food to almost all aquatic life either directly or indirectly. In aquaculture, they serve as a food stock

for zooplankton which are in turn fed to fish larvae reared in fish hatcheries (Moncheva and Parr, 2010; Lindsey and Scott, 2010). As beneficial as phytoplankton are, they could also be harmful. Under certain conditions such as pollution of water body with sewage and human excreta, certain harmful phytoplankton predominate and produce bio toxins which affect the taste and colour of water, impact bad taste on fish and harbor diseases thereby causing massive fish kills. Examples of such harmful phytoplankton include: *Cyanophyta* (*Cyanobacteria* / blue green algae) which produces geosmin which is a toxin that impacts a bad flavor on fish especially bottom dwellers (such as Cat fish and carp) and *rhodophyta* which causes red tides following massive fish kills. The beneficial and harmful importance of phytoplankton cannot be undermined. There is therefore need to carry out routine checks on the phytoplankton species composition and abundance of water bodies worldwide.

River Ogun is a perennial river prone to pollution due to the human activities carried out around its borders. This study is therefore aimed at investigating the phytoplankton abundance and species composition of River Ogun.

1 Results

Five taxonomic groups consisting of forty-one species were discovered from Ogun River (Table 1). *Chrysophyta* was represented by 15 species consisting of 36.6%, *Chlorophyta* with 14 species consisting of 34.1%, *Cyanophyta* (7 species) consisting of 17.1%, *Euglenophyta* with 3 species consisting of 7.3% and *Pyrrophyta* with 2 species consisting of 4.92%. The abundance of phytoplankton species is presented in Figure 1 and Table 2. *Cyanophyta* was the most abundant with 41%. This was followed by *Chrysophyta* (31.4%), *Chlorophyta* (23.6%), *Euglenophyta* (2.5%) and *Pyrrophyta* (1.5%).

Table 1 Number of species in each taxonomic group of phytoplankton sampled (December, 2011 – June, 2012)

Taxonomic group	Total No. of species	Percentage (%)
<i>Chrysophyta</i>	15	36.6
<i>Chlorophyta</i>	14	34.1
<i>Cyanophyta</i>	7	17.1
<i>Euglenophyta</i>	3	7.3
<i>Pyrrophyta</i>	2	4.9
Total	41	100.0

Figure 1 Taxonomic group abundance of phytoplankton in River Ogun (December, 2011 - June, 2012)

2 Discussion

Cyanophyta (also known as Blue green algae, *Cyanobacteria* and *Myxophyceae*) surpassed the phytoplankton in terms of abundance while *Chrysophyta* surpassed in terms of number of species/genus. The dominance of *Cyanophyta* has been observed by several authors among which are: Sekadende et al., (2004) who observed *Cyanophyta* dominance in Lake Victoria basin, Ogato, (2007) who observed dominance of *Cyanophyta* in Lake Bishoftu, Deng et al., (2007) who reported dominance of *Cyanobacteria* in summer and autumn in Lake Chaohu; Shakila and Natarajan (2012) who also

observed dominance in the Temple Pond of Thiruporur, Chennai. The abundance of *Cyanophyta* observed in this study must have been caused by the polluted nature of the water due to the anthropogenic activities carried out around its shores. The dominance of *Cyanophyta* is a signal that the river is polluted. Consequently, there is therefore need to regulate the amount of pollutants discharged into the river so as to avoid total ecological collapse and extinction of the populace. It is hereby recommended that relevant laws in respect to sustainability of the river should be implemented.

3 Materials and Methods

3.1 Geography of the river

Ogun State is a state in the South-western region of Nigeria. It has boundary with Lagos State to the South, Oyo and Osun states to the North, Ondo State to the east and the republic of Benin to the west. Abeokuta is the capital and largest city in the state (NBS, 2012). River Ogun is one of the main rivers in the southwestern part of Nigeria with a total area of $2.24 \times 10^6 \text{ m}^2$ and a fairly large flow of about $393 \text{ m}^3 \text{ sec}^{-1}$ during the wet season (Oketola et al., 2006). It is $3^\circ 28' \text{E}$ and $8^\circ 41' \text{N}$ from its source in Oyo state to $3^\circ 25' \text{E}$ and $6^\circ 35' \text{N}$ in Lagos where it enters the Lagos lagoon (Ayoade et al., 2004). Two seasons are distinguishable in Ogun river basin, a dry season from November to March and a wet season between April and October. Mean annual rainfall ranges from 900 mm in the north to 2 000 mm towards the south. The estimates of total annual potential evapotranspiration have been put between 1 600 mm and 1 900 mm (Bhattacharya and Bolaji, 2010). The water is used for agriculture, transportation, human consumption, various industrial activities and domestic purposes. Along its course, it constantly receives effluents from breweries, slaughterhouses, dyeing industries, tanneries and domestic wastewater before finally discharging to Lagos lagoon (Ayoade et al., 2004; Oketola et al., 2006). A 100 square kilometer area around River Ogun has an approximate population of 3 637 013 (0.03637 persons per square meter) and an average elevation of 336 m above the sea (Travel Journals, 2012). Numerous human activities such as bathing, washing of clothes, fishing, locust bean processing, mangrove cutting, and transportation were noticed. These are potential sources of pollution to the environment. Indiscriminate dumping of human excreta was observed at two of the sampling stations. Four sampling stations were established along the length of Ogun River.

Table 2 Abundance of phytoplankton in River Ogun (December 2011 – June 2012)

Phytoplankton groups	Genus/Species	Genus/Species Abundance	Phytoplankton group abundance	Percentage (%)
<i>Chrysophyta</i>	<i>Pinnularia</i>	4	148	31.4
	<i>Nitzschia</i>	43		
	<i>Navicula</i>	22		
	<i>Ophiocytium</i>	9		
	<i>Eunotia</i>	4		
	<i>Cyclotella</i>	10		
	<i>Oscillatoria</i>	14		
	<i>Synedra</i>	8		
	<i>Tabellaria</i>	10		
	<i>Chlorogibba</i>	3		
	<i>Monallantus</i>	2		
	<i>Gloeochloris</i>	4		
	<i>Gomphonema</i>	2		
	<i>Fragillaria</i>	12		
	<i>Diatoma</i>	1		
<i>Chlorophyta</i>	<i>Gonatoxygon</i>	4	111	23.6
	<i>Ankistrodesmus</i>	29		
	<i>Closterium</i>	19		
	<i>Ulothrix</i>	1		
	<i>Spirotaenia</i>	9		
	<i>Penium</i>	9		
	<i>Pleurotaenium</i>	2		
	<i>Protococcus</i>	9		
	<i>Spirogyra</i>	4		
	<i>Zygnema</i>	11		
	<i>Mougeotia</i>	1		
	<i>Netrium</i>	1		
	<i>Tetraspora</i>	6		
	<i>Closteriopsis</i>	6		
<i>Cyanophyta</i>	<i>Phormidium</i>	10	193	41.0
	<i>Spirulina</i>	7		
	<i>Anabaena</i>	17		
	<i>Aphanocapsa</i>	45		
	<i>Merismopedia</i>	17		
	<i>Coelosphaerium</i>	55		
	<i>Polycystis</i>	42		
<i>Euglenophyta</i>	<i>Phacus</i>	5	12	2.5
	<i>Euglena</i>	6		
	<i>Menoidium</i>	1		
<i>Pyrrophyta</i>	<i>Peridinium</i>	5	7	1.5
	<i>Chilomonas</i>	2		
Total		471	471	100.0

3.2 Station 1 (Ibẹrẹkodo)

It is located just downwards the Ogun State Water Works Corporation at Arakanga. The water is cured by the corporation and dispensed through underground pipes to respective homes. The river here is characterized by a dam/spillway and high concrete dykes. The water is generally very clear and has good aesthetic quality. The activities here are majorly fishing, bathing, dam maintenance and fishing gear

mending. No farmland was observed at this station.

3.3 Station 2 (Agò ika)

It is located close to the FADAMA III supported ferry for transportation to Lafenwa. The vegetation around the banks is very dense. The activities here includes: locust bean processing, bathing, washing of clothes, refuse dumping and transportation by ferry. The activities of the ferry men could lead to siltation of the water body causing high turbidity conditions.

Indiscriminate discharge of human wastes into the river was noticed.

3.4 Station 3 (Ènu gada)

It is located some few meters after the bridge connecting to Lafenwa. It is characterized by less dense vegetation and slow flowing water. Activities carried out here includes: washing of clothes, farming, indiscriminate dumping of refuse and human excreta.

3.5 Station 4 (Off Pepsi bus stop)

It is characterized by rocky outcrops with fast flowing water. The vegetation consists of terrestrial vegetation which is less dense. The water is clear and has good aesthetic quality. Activities carried out here includes: bathing, washing of clothes and drying of fishing gear on the rocks.

3.6 Sample collection

Samples for phytoplankton analysis were collected by the hand trawling method. This involves trawling horizontally at the littoral zone (i.e. at the shore) with 55 µm mesh size plankton net. The net content of the plankton net was put into a 120 ml plastic bottle. This was preserved with 4% formalin solution within 5 minutes of sample collection. The sample was then taken to the Laboratory for identification and enumeration.. A drop of the sample was placed onto the glass slide of the binocular microscope and was covered with a cover slip for identification and enumeration. Phytoplankton was identified at magnifications of 10x, 40x and 100x using suitable keys. Enumeration of phytoplankton was carried out following the drop count method adapted from Verlecar and Desai (2004) and was reported as units or organisms per drop.

3.7 Statistical analysis

Descriptive Statistics in the form of tables and bar charts were used in the presentation of the data. MS EXCEL statistical package was used for the analysis.

Acknowledgement

All the members of staff especially Dr. (Mrs.) F.O.A. George of the Department of Aquaculture and Fisheries Management, College of Environmental Resources Management, Federal University of Agriculture, Abeokuta, Ogun state, Nigeria are appreciated for their various contributions. I also thank Mrs. Binyotubor of the National Institute of Freshwater Fisheries Research for her technical support. May God be with you all.

References

- Ayoade A. A., Sowunmi A. A., Nwachukwu H. I., 2004, Gill asymmetry in *Labeo ogunensis* from Ogun River, Southwest Nigeria, *Rev. Biol. Trop.*, 52 (1): 171-175, PMID:17357414
- Bhattacharya A. K., and Bolaji G. A., 2010, Fluid flow interactions in Ogun River, Nigeria, *IJRRAS* 2(2): 173-180
- Deng D. G., Xie P., Zhou Q., Yang H., and Guo L. G., 2007, Studies on temporal and spatial variations of phytoplankton in Lake Chaohu, *Journal of Integrative Plant Biology*, 49 (4): 409-418, <http://dx.doi.org/10.1111/j.1744-7909.2007.00390.x>
- Edmondson W. T., ed. (1959) *Freshwater Biology*; John Wiley and Sons Inc, New York, USA
- Encyclopædia Britannica, 2012, 'Phytoplankton' *Encyclopædia Britannica Ultimate Reference Suite*, Chicago: Encyclopædia Britannica
- Lindsey R., Scott M., and Simmon R., 2010, What are Phytoplankton? NASA Earth Observatory, <http://earthobservatory.nasa.gov/Library/phytoplankton/2010>
- Microsoft Corporation, 2008, 'Phytoplankton' Microsoft Encarta Dictionaries
- Moncheva S., and Parr B., 2010, Manual for phytoplankton sampling and analysis in the black sea, *Phytoplankton Manual*, UP-GRADE Black Sea Scene Project, FP7 No: 226592 Black sea Commission
- National Bureau of statistics (NBS), 2012, State Information, (www.nigerianstat.gov.ng/information/details/ogun)
- Oketola A. A., Osibanjo O., Ejelonu B. C., Oladimeji Y. B., and Damazio O. A., 2006, Water quality assessment of River Ogun around the cattle market of Isheri, Nigeria, *Journal of Applied Sciences*, 6(3): 511-517, <http://dx.doi.org/10.3923/jas.2006.511.517>
- Reynolds C. S., 1984, *The ecology of freshwater phytoplankton*, Cambridge University Press, Cambridge, UK, pp.384
- Sekadende B. C., Mbonde A. S. E., Shayo S., and Lyimo T. J., 2004, Phytoplankton species diversity and abundance in satellite lakes of Lake Victoria basin (Tanzanian side), *Tanz. J. Sci.*, 31(1): 83-91
- Shakila H., and Natarajan S., 2012, Phytoplankton diversity and its relationship to the physico-chemical parameters in the temple pond of Thiruporur, Chennai, *International Journal of Environmental Biology*, 2(2): 81-83
- Tadesse O., 2007, Dynamics of phytoplankton in relation to physico-chemical factors in Lake Bishoftu, Ethiopia, M.Sc. Thesis, School of Graduate Studies, Addis Ababa University, Ethiopia
- Travel Journals, 2012, River Ogun, Nigeria on world map coordinates and short facts, (www.Traveljournals.net)
- Verlecar X. N., and Desai S. R., 2004, *Phytoplankton Identification Manual*, National Institute of Oceanography, Goa