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# Checklist of benthic phytomacrofauna associated with water hyacinth in Iyagbe Lagoon, Southwest Nigeria.

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## Abstract

*A checklist of benthic phytomacrofauna in 0.1 $m^2$ quadrat samples collected on a monthly basis from eight sampling sites for a period of seven months (November, 2013-May, 2014) from Iyagbe Lagoon, Southwest Nigeria is reported. Annelida, Arthropoda and Mollusca were the phytomacrofauna groups observed in this study. Of the twenty-eight species recorded, Arthropoda contributed fourteen species, Mollusca, eight species and Annelida recorded six species. The phytomacrofauna community observed in this study is consistent with those reported for Nigerian fresh and brackish water conditions.*

**Keywords***:* Checklist; benthic phytomacrofauna; Iyagbe Lagoon.

## Introduction

Benthic phytomacrofauna are macroinvertebrates associated with aquatic vegetation. They constitute an important component of the aquatic system owing to their roles in organic matter processing and as food for fishes. Phytomacrofauna species exhibit preferences for specific macrophytes based on plant density and architecture (Dvorak and Best, 1982), and associated differences in the composition and abundance of epiphytic forage (Dudley, 1988; Cattaneo*et al*., 1998). Other characteristics important in their choice of macrophytes include seasonal patterns of macrophyte growth and senescence (Smock and Stoneburner, 1980), plant-mediated shifts in water quality (Rose and Crumpton, 1996; Unmuth*et al*., 2000) and invertebrate vulnerability to fish predation (Junk, 1977; Dvorak, 1996). The relationship between the diversities of benthic phytomacrofauna and macrophytes characteristics has long been established (Cattaneo*et al*., 1998), and the fact that high density, complexity and architecture are likely to favour abundance and diversity of phytomacrofauna has been observed by different workers (Brown *et al*., 1988).

A checklist of benthic fauna species has many uses, in addition to providing baseline information and important data for comparative studies on aquatic biodiversity, it also plays an important role in the recognition and delimitation of areas for management and assessment of anthropogenic impacts (Nwankwo, 1988a; Uwadiae, 2010). Comprehensive inventories serve as the basis for local practices of conservation, which is relevant in areas where utilization of aquatic resources is poorly regulated (Nwankwo, 1988a, b; Uwadiae, 2010). Also, the fact that water hyacinth *Eichhorniacrassipes* (Mart.) Solms (Pontederiaceae), is invasive, and alien to the Nigerian aquatic system, it is most likely to alter the structure of benthic community since it can serve as an alternative colonizing point, owing to its vegetative mass and architecture, hence capable of providing habitat conditions such as better substrate, macrophyte biomass and organic detritus necessary for the survival of macroinvertebrates in a relatively better proportion compared to indigenous aquatic macrophytes (Cattaneo*et al*., 1998; Uwadiae*et al.*, 2011).

Many checklists of different aquatic communities particularly the plankton community (Nwankwo, 1988a; b) of South-western Nigerian lagoons have been compiled and this has assisted in the taxonomic study and species identification. However, information on the taxonomic composition of phytomacrofauna communities, especially those associated with the ubiquitous pest, water hyacinth is scarce. This has made it impossible for assessment of differences in community variation among various water bodies where the plant is found and to attempt an ecological explanation for these variations (Uwadiae*et al.*, 2011). The aim of this investigation is to identify and present a taxa checklist of the phytomacrofauna associated with water hyacinth in Iyagbe Lagoon thereby adding to the existing record of benthic species in South-western Nigeria lagoons. The intention of this checklist is to serve as a valuable tool for the effective teaching of the ecology of benthic phytomacrofauna in Nigeria as well as basis for comparing the lagoon biodiversity with other water bodies where the plant is found.

## Materials and methods

*Study area*

Iyagbe Lagoon is a two-arm lagoon (Fig. 1) located in South-west Nigeria. It is separated from the ocean by a barrier bar system along the Western Nigeria shoreline, and the only opening to the ocean is through the Lagos Habour which links directly with the Lagos Lagoon (Hill and Webb, 1958). It lies between Latitude 6° 23'N and Longitude 3° 06' E (Onyema, 2008) and comprised of the Porto-Novo Creek in one arm and Badagry Creek in another arm. The depth of the lagoon in the area used for this study ranged from 0.74 to 1.74 m and transparency varied between 0.39 and 0.67 m. The major climatic factor operational in the area of the lagoon is the annual dual-seasonal pattern in the rainfall distribution. This to a large extent has a significant control on the salinity of the lagoon. At the fringes of the lagoon especially at sampling points towards the Lagos Harbour, is a littoral Mangrove vegetation. The surface of the lagoon is covered with patches of water hyacinth at different points especially close the lagoon shore.

**Field investigation**

Phytomacrofauna samples were collected within Water hyacinth canopy by placing a 0.1 $m^2$ quadrant over stands of the plant, the roots of Water hyacinth stands enclosed in the quadrant were carefully placed in a bowl containing 10% Formalin solution (this facilitates the removal of attached organism). The plants were then vigorously shaken to detach all the animals inhabiting the roots into the bowl. Detached animals were then washed into a screw cap plastic container through a 0.5 mm mesh size sieve. The remaining animals were handpicked into the plastic container. The samples were fixed in 10% Formalin solution and taken to the laboratory for taxonomic studies.

**Laboratory investigation**

The animals contained in the sieved residue were sorted on a white tray into their respective taxonomic groups using suitable identification guides (e.g. Edmunds, 1978; McCafferty, 1981; Barnes *et al*. 1988 and Barbou*et al.*,1999; Yankson and Kendall, 2001).

**Result**

The taxonomic list of the benthic phytomacrofauna recorded in this study is presented in Table 1. Organisms recorded are listed under their different phyla which are presented in alphabetical order (Annelida, Arthropoda and Mollusca). Three phyla made up of 22 families, five classes, and 28 species were recorded. Among the species observed, Arthropoda contributed the highest number (14), followed by Mollusca (8) and the least number (6) was recorded for Annelida.

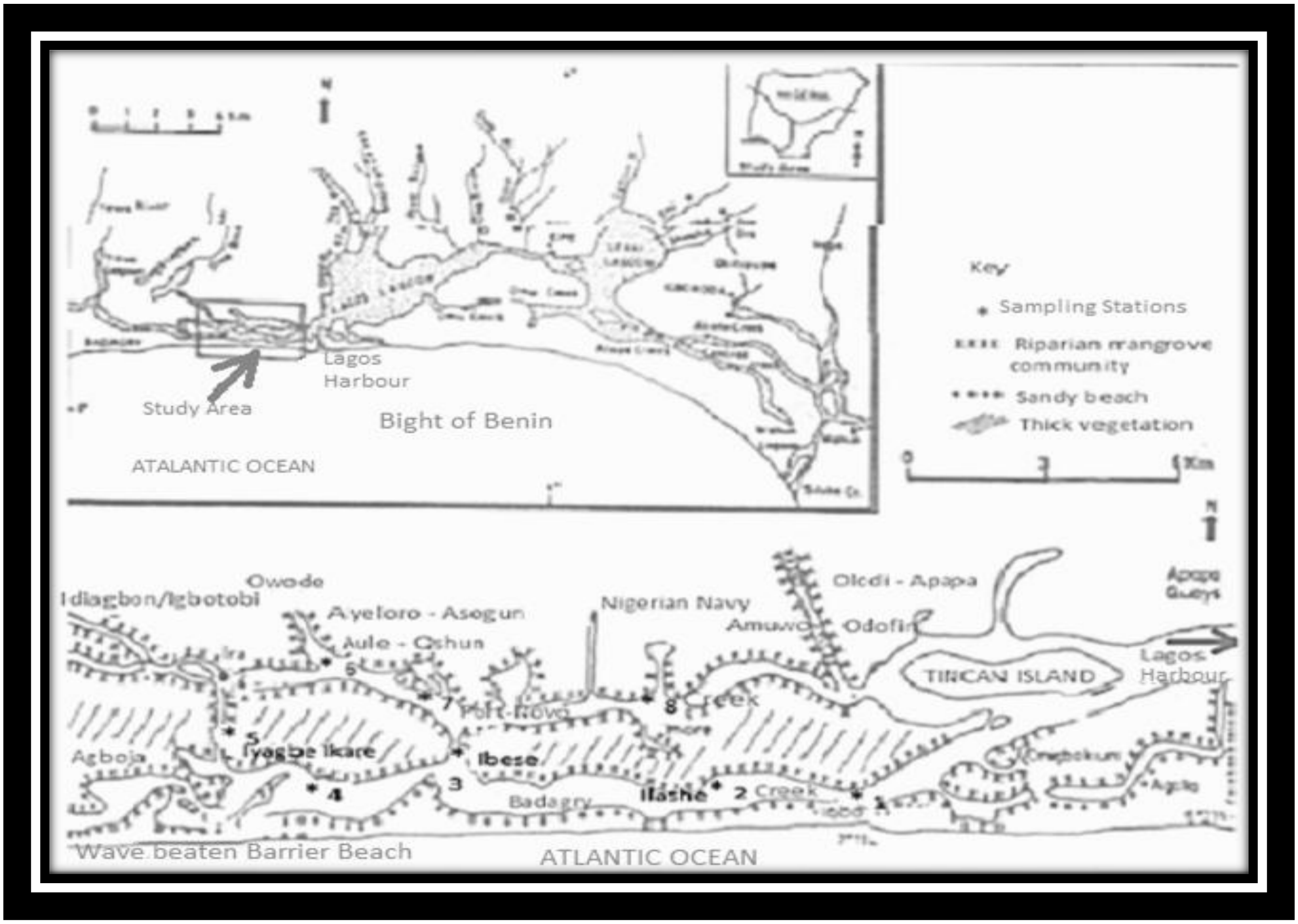


Fig. 1. Map of study area showing sampling points.

Phylum: ANNELIDA
Class: Polychaeta
Family: NEREIDAE
NereisindicaKinberg, 1866
NereissuccineaLeuckart, 1847
Family: NEPHTYIDAE
Nephtyshombergii Lamarck, 1818
Family: CAPITELLIDAE
Notomastuslobatus Hartman, 1947
Phylum: ARTHROPODA
Class: Insecta
Family: CHIRONOMIDAE
Chironomusplumosus Linnaeus, 1758
Family: CERATOPOGONIDAE
CulicoidesimpunctactusGoetghebuer, 1920
Family:GOMPHIDAE
ParagomphuslineatusSelys, 1850

Family: CORDULEGASTRIDAE
Cordulegasterdorsalis Leach, 1815
Family: PHILOPOTAMIDAE
Dolophilodesdistinctus Walker
Family: PSEPHENIDAE
Psephenusfalli Casey, 1893
Family: GYRINIDEA
Gyrinusnatator Linnaeus, 1758
Family: ELMIDAE
StenelmiscanaliculataGyllenhal, 1808
Family: CYBAEIDAE
Agyroneta aquatic Clerck, 1757
Class: CRUSTACEA
Family: AMPHILOCHIDAE
Amphilochusneapolitanus Della Valle, 1893

Family: PENAEIDAE
Penaeusnotalis Perez Fanfante, 1967
Family: CIROLANIDAE
Eurydice pulchra Leach, 1815
Family: IDOTEIDAE
Idoteasp
Family: SESARMIDAE
SesarmahuzardiiDesmarest 1825
Phylum: MOLLUSCA
Class: Gastropoda
Family: NERITIDAE
Neritina glabrataSowerby, 1849
Neritina kuramoensisYoloye and Adegoke, 1977
Family: Eulimidae
Eulimafisceri
Family: Planorbidae

Gyraulusparvus Say, 1817

Family: MELANIDAE
Pachymelaniaaurita Muller, 1776
Pachymelaniafuscaquadriseriata Gray,1831
Family: POTAMIDIDAE
Tympanotonusfuscatus Linnaeus, 1758
Tympanotonusfuscatus var. radula Linnaeus, 1758
Class: Bivalvia
Family: Tellinidae
Tellinanymphalis Lamarck, 1818
Macomacumana O.G. Costa, 1829

**Discussion**

Information on the phytomacrofauna community of Iyagbe Lagoon has not been reported, this study is the first major investigation on the benthic phytomacrofauna community in the two-arm lagoon. The phytomacrofauna community recorded in this study shares some similarity (phyla represented) with those reported by previous investigators but, also differs in some remarkable ways, especially with respect to number of species and individuals observed. The number (3) of macroinvertebrate phyla recorded (Annelids, Arthropods, and Molluscs) in this investigation is the same with those reported for Epe Lagoon (Edokpayi, *etal.*,2008), Ogbe Creek (Edokpayi, *et al.*, 2009) and Lekki Lagoon (Uwadiae, *et al*., 2011). Annelids, Arthropods, and Molluscs are the common invertebrate groups in the coastal water system of Nigeria (Uwadiae, 2009). Other groups are scarce owing to the degraded nature of the environment and inability of fragile life forms to survive the androgenic stress prevalent in this area (Uwadiae, 2009).

The differences observed in the number of individuals and diversity of phytomacrofauna associated with Water hyacinth in Iyagbe Lagoon and those reported for other water bodies may be attributed to a number of factors. First, the season in which sampling was carried out. This study was conducted in the dry season, between November, 2013 and May, 2014. Water hyacinth like many other plants usually experience senescing leading to loss of vegetative parts (Luu and Getsinger, 1990). This affects the proportion of colonizing surfaces available to phytomacrofauna. There can be multiple and complex relationship between plant density or biomass and macroinvertebrate communities (Cyr and Downing, 1988). Many studies (e.g. Cyr and Downing, 1988; Humphries, 1996) have reported such a positive correlation between plant density and macroinvertebrate density. High plant density provides large surface area for colonization by periphyton and invertebrates. High plant density has also been known to generally lead to high primary production and increase shelter from predation, which appears generally to be important in structuring macroinvertebrate communities in plant beds (Humphries, 1996).

Secondly, the influence of salinity variation resulting from the combined effects of freshwater inflow into the two arms of the lagoon from the western part and tidal influx of saline water from the Lagos Harbour through the Lagos Lagoon (Eastern part) is another factor that affected the number and diversity of phytomacrofauna associated with water hyacinth in Iyagbe Lagoon.

Water hyacinth is a freshwater plant and can only survive in a low salinity aquatic systems all year round (Luu and Getsinger, 1990; Uwadiae, *et al.*, 2011). During the early period of the dry season, stands of water hyacinth occurred throughout the stretch of the lagoon but, were absent from three of the sampling sites at the peak of dry season when the salinity was relatively higher. Therefore, sampling was not carried out in these sites hence reducing the area from which the animals were collected. Also, water chemistry in relation to salinity is well known to affect macroinvertebrates in plant beds, either through the direct physiological effects of variables, such as pH (Carpenter and Lodge, 1986; Bryan, 1993), or indirect effects of variables like nutrients, which presumably affect macroinvertebrates through their effects on periphyton and phytoplankton (Cyr and Downing, 1988).

This study reveals that although aquatic macrophytes provide habitat, food and hiding place for macroinvertebrates, the abundance and diversity of macroinvertebrates a macrophyte can sustain depend largely on the prevailing local conditions. Human activities such as sand mining, fishing and other activities which disturb the water column may have also impacted on the animals attached to water hyacinth. At the shoreline of the lagoon where most of the sampling points were located, there is one form of anthropogenic activity or the other, ranging from human habitation, sand piling to destruction of mangrove vegetation. A larger percentage of the shoreline is bare devoid of plant cover, so most water hyacinth stands occurred in patches of few stands hence reducing habitat complexity and amount of surfaces for attachment.

Macrophyte bed complexity and heterogeneity are important factors affecting aquatic organisms like invertebrates, fishes and water birds. The degree of bed complexity is known to affect the abundance and diversity of phytomacrofauna in a number of ways: Firstly, nutrient cycling through transference of chemical elements from sediment to water, by both active and passive processes such as decomposition (Camargo *et al*., 2003). Secondly, by limiting nutrients released by macrophytes, like phosphorus and nitrogen and thirdly, complex bed make it possible for the rapid utilization of nutrients by micro-algae and bacteria (which also use organic carbon released by macrophytes) which may be free-living or attached to macrophyte surfaces and their detritus (Stets *et al*., 2008).

In addition, several species of macrophytes produce an elevated percentage of refractory matter (basically fibrous material) that is relatively slow to decompose

(Bianchini Jr., 2003); thus they also contribute to a return of carbon to sediment (Esteves, 1998). Macrophytes may also influence nutrient cycling in two other ways: retention of solids and nutrients by their submersed roots and leaves (Meerhoff*et al.*, 2003) and reduction of nutrients released from sediment by protection against wind (and wave) action (Madsen *et al*., 2001). Moreover, this protection against waves also promotes the stabilization of shores and a reduction in erosion (Esteves, 1998). Macrophytes may also influence several other physico-chemical properties of the water column in favour of attached organisms. For example, conspicuous changes in oxygen, inorganic carbon, pH and alkalinity may result from their metabolism (Caraco and Cole, 2002). Owing to their high rate of biomass production, macrophytes have primarily been characterized as an important food resource for aquatic organisms, providing both living (grazing food webs) and dead organic matter ((Caraco and Cole, 2002).

The paucity of macrophyte stands in the study area may account for the low number of taxa recorded. Comparing the result of this study with the report of Uwadiae*et al*. (2011), on LekkiLagon, it shows that the number of taxa and quality of assemblage observed in this present study is poor. A major reason that may be adduced for this is the paucity of water hyacinth stands. In Lekki Lagoon, an extensive water hyacinth bed was observed, much so that it hindered boats access in some cases.

Phytophilous community is an important component of the aquatic biota helping to sustain fish population and self-purification mechanism of aquatic systems. They are also very valuable research tools, therefore, management procedures to be adopted for the control of macrophytes must take cognizance of the fact that some amount of these plants are needed to sustain the phytophilous community.

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