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Occlusion of the Niger Delta Rivers and creeks by aquatic weeds: Impact on humans and fisheries

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Abstract
The term occlusion emanated from Latin word "occlusio" which implies restriction or blockage. The aquatic weeds aside other negative features, obstruct the water ways wherever they are found. Aquatic plants, notably water hyacinth, duck weed, water lettuce and hypha grass have become ubiquitous in the Niger Delta Rivers, Creeks, lakes and reservoirs for nearly three decades. The presence of these sufficive weeds according to previous studies showed they are of grave consequences to man as they hinder economic or social activities such as reduction of capacity of water bodies for fish production, inhibit fishing, hampering on netting and passage of ships, harbors insect pests thereby hosting pathogens. Other problems posed by aquatic plants include impairment of navigation, reduction of water availability to the local communities, prevention of proper functioning of pumps and turbines of power stations where available. The problem is predicted to become greater since there is increased trade across the borders which facilitate spread and growth of weeds. This will be further aggravated with human settlement and its attendant waste generation and intensive use of fertilizers which get washed into the water ways. The nutrient enrichment triggers luxuriant growth of aquatic weeds. The aquatic weeds, spread quickly on the water through movement of boats/ships, water current downstream and flood push, besides agent of dispersion such as birds, wildlife and wind. Various management tools advocated to put the weeds under control include prevention through monitoring and early detection. Other means of Aquatic Plants control include mechanical and biological methods as well as the use of chemicals and more recently the adoption of wide applications in utilization as food for man and feed formulation and as fabric in craft making.

Keywords: Suffisive aquatic weeds, Occlusio, rivers, creeks pollutants

Introduction
Occlusion in medical sense implies the obstruction or closing of a blood vessel or hollow organ. The word occlusion emanated from Latin "Occlusio" which means to obstruct, restrain, shut up or close up. This term however, has been used not only in medicine but also in other disciplines. For the meteorologist (it refers to cloudy day), to Linguistics (it is the closure of the vocal tract that produces an oral stop or nasal stop), in Physics (it refers to absorption of a gas/liquid by metal), in computer (it is the blocking of the view or part of an image by another) (en.m.wiktionary.org)

Many rivers in the Niger Delta including the Warri, Ethiope, Forcados, and Nun rivers and their creeks at some points, experiencing what could be described as occlusion imposed by aquatic weeds (Charudattan *et, al.*, 1999). Aquatic weeds have severely reduced the flow capacity of rivers, canals (Goldman, 1978; Murphy, 1988 Ndinwa *et al*., 2012) [7, 20], cause salinity and alkalinity problems (Kusemiju *et al*, 1978) [12], serve as habitats for vectors (Adekulo - John, 1982; Groove *et, al.*, 1995) [3] prevent navigation (Goldman, 1973., Perna and Burrows, 2005) [7].

This paper identifies some common aquatic plants species; states the problems they posed, enumerates some of their benefits and explains how they can be managed.

Origin and Distribution of Aquatic Plants
The origin of aquatic plants is still speculative, but it is believed to be from South America (Cordo *et al.*, 1981) [5]. They have spread virtually to all the continents through ballast water in ship from South America (Made *et al*., 2000).

The emergence of aquatic plants in Africa dates back to the end of the HoD nineteenth century (Tackholm and Drar, 1950) [24], and their massive presence on Nigeria waters became obvious in the early 1950s (Mitchel *et al*., 1990) [19].

Known for their extremely lavish growth rate, the aquatic plants have invaded agricultural fields, canals ponds, lakes and rivers of the Niger Delta region.

Types of aquatic plants

According to (NIFFR, 2013), aquatic weeds can be classified as follows: Floating, Emergent, submerged, Marginal, filamentous and Planktonic algae.

Floating aquatic weed: These are aquatic plants that have their roots below the water surface or both roots and their vegetable parts floating at the water surface (Lichtenstein, 2017). Examples are: water lettuce (*Pistia stratiotoies*), water *hyacinth* (*Eichhornia crassipes*) and duck weed (*Lemna spp*)

Emergent aquatic weeds: These are aquatic plants that have their roots firmly fixed on soil or substrates in water while their leaves and vegetative parts extended above the water surface (Beck, 2019). Examples are Water Lilly *(Nymphaea spp), Myriophyllum, spp, Valliseneria. spp*

Submerged aquatic weeds: These consist of plants which are either rooted or rootless, that grows below the water surface with both leaves and roots totally covered by water (Beck, 2019). Examples include *Hydrilla verticillata, Najas minor and Caratyphyllum.*

Marginal aquatic weeds: These are plants that grow at the sides of water body often known as shoreline plants (Lichtenstein, 2017) Examples: *Typha species and Phargnites.*

Filamentous algae: These are aquatic plants with vegetative parts invisible to the two naked eye or could be interpreted as plants with no vegetative parts or also called aquatic microphytes (Beck, 2017). These form mats at the periphery of the water bodies and form scum at the main water body. Some common examples are: *Spirogyra* and *Pithophora.*

Planktonic algae: These are otherwise known as aquatic microphytes, and have the tendency to multiply rapidly and form algal bloom in water (Lichtenstein, 2019). Examples are: *Microcystis* and *Anabaena.*

Problems posed by aquatic plants

- **Hinders Fishing Activities:** The overwhelming presence of the aquatic plants on water bodies has created lot of problems to fishers (Rockwell, 2003). Their massive physical presence hampers on ability to gain access to fishing grounds (Uka and Chukwuka, 2011) [25], see plates A,B,C and D. Fishing gears also entangle the plant roots, stems and leaves and thereby leading to fish catch reduction and loss of equipment. Annual loss of fish resulting from this, is put at 45 million kilogrammes in Bengal (Gopal and Sharma, 1981) [8].
- **Increased Evapotranspiration:** Water bodies lose water to the atmosphere by 3-5 times the normal rate due to accelerated evapotranspiration. Suton (1983) [23], opined that the rate of water loss due to evapotranspiration could be up to 1.8 times that of evaporation from the surface area.
- **Hindrance to Navigation Vessels**: Aquatic plants drastically impede navigation and transportation and by preventing free movement of navigation vessels (Goldman, 1978; Perna and Burrows, 2005; De, Groote *et al.,* 2003) [7].
- **Aquatic Plants as Shelter to Variety of Vectors:** Aquatic plants serve as habitat for invertebrates such as aquatic snails, crustaceans and insects as well as predators (reptiles and other aquatic wildlives) (Mitchqell, 1974 [18] cited by Uka and Chukwuka, 2011) [25]. Majority of these kind of animals cause both human and animal diseases. These vectors are carriers of diseases such as malaria, lymphatic filariasis and *schistosomiasis* (Pieterse *et al*., 1990). The consequences of incidence of diseases, had led to health problems, disruption of food supply and socio-economic structure of several people in the riverine communities (Julian and Wright, 1997; Johnson, 1993) [10].

Other problems include the impediment to water flow, which in turn increases sedimentation, causing flooding and soil erosion (Mitchell *et al.,* 1990) the early 1950s (Mitchel *et al*., 1990) [19]. It may also lead to drastic change in the physical and chemical properties of water and the environment (Colon – Gaud *et al*., 2004). Aquatic plants incidence is a serious threat to agricultural production as a result of blockage to irrigation canals and drainage systems (Uka and Chukwuka, 2011) [25]. More so, they cause reduction in the activity of electrical power stations thereby jeopardizing the power supply of the country (Goldman, 1973) [7].

Ways to tackle problems caused by aquatic plats

Several approaches have been propounded by various scholars on how to drastically reduce the menace of aquatic plants. This study acknowledges some of the aquatic plants control methods. These are notably mechanical, biological and chemical control (NIFFR, 2013). The mechanical control is usually an effective method, but its success is on a short run, whilst manpower and machine are engaged to control their upsurge. The limitation of this method of Aquatic plants control is that the plant flowers and seeds fall on substrates and begin the growth process again. As for the herbicides (chemical method), it is noted to be effective except for the method of application which is broad spectrum and could therefore affect non-target aquatic biodiversity including humans in terms of water use and poisoning.

The biological method appears to be the most effective and affordable and self-sustaining means of management which include the use of agent like insects -*Neochietina bruchi* and *Cyrtobagous salviniae* which are natural enemies of aquatic macro plants such as water hyacinth and ferns respectively (Charudattan and Chandramohan, 2002) [4]. The reports of many authors including this study, may have proven many of the conventional control methods for aquatic plants ineffective on the long run. This paper is therefore of the view that the best way to achieve a more robust and result oriented solution is to involve all stakeholders - the government, scientists, fisheries officers, fishers and indeed every Nigerian especially the unemployed. Just as it obtains in Nigeria today where metal, plastic and paper scraps are gathered from the environment by some individuals for sales to industries. This scavenging work is paying off as we speak. The efforts people put in picking plastics, metals and other wastes from the environment are sold for by those involved. This has resulted not only in cleaning the environment, but has positively

influenced their personal earnings. They don't see the drudgery involved as a problem compared to the financial gain they derive from the work done. This paper holds the view that similar model could be adopted to get people involved in clearing the aquatic weeds off the water ways. The simple analogy given should be applied to aquatic plants. This paper is aimed at unveiling the hidden treasures that abound in them. Below are some of the uses of aquatic plants. The following pieces of information, shall be of immense benefit to industrialist, medical practitioners and others.

- **Use of Aquatic Plants as Source of Energy:** Aquatic Plants of note, are used as fuel for fish smoking and domestic energy. In China and India *Eichhornia crassipes* is digested directly to produce biogas that serve as inexpensive energy supply for local communities. Equally in Nigeria, the stems of *Eichhornia crassipes* and *Cyperus papyrus* are used as fuel for cooking and fish smoking (Kio and Ola-Adams, 1987) [11]. The utilization of these weeds as alternative to wood could drastically reduce felling of trees from our forest for domestic cooking and thereby aid in reducing desert encroachments.
- **Industrial Use:** Aquatic plants have numerous materials that could meet the needs of creative minds and revolutionary industry. The materials could fit in pulp/paper making, production of mats and beddings etc (UKa and Chukwuka, 2011) [25].
- **Aquatic plants as fertilizers:** Most aquatic plants are rich in nitrogen and phosphorus. This makes them first class option as bio-fertilizers for crops (UKa and Chukwuka, 2011) [25]. Examples include, *Azolla spp* a free floating fern which characteristically fixes nitrogen in a symbiotic interaction with *Cyanobacterium, Anabaena azollae*; a known biofertilizer for rice production. The use of *Azolla* sp as biofertilizer in paddy/fish integrated farming is widely known and practiced in Asia (Maltby, 1988) [14]. Ratchance (1972) [22] emphasized the successful use of dried water hyacinths as a bedding material for cultivating mush rooms (*Volvaria sp*). In Nigeria there are a whole lot of potentials in utilizing water hyacinth, take for instance, paper pulp, biogas, organic fertilizer production and sewage treatment (UKa and Chukwuka, 2011) [25].
- **Aquatic plants as source of food, fodder and medicine/pharmacy**

Table 1: List of some aquatic weeds and their uses.

Plant species	Part of plant	Uses
Echinocloa stagnina	Seed	Food for fishers in Niger river.
	Stalk of the grass	Sugary syrup.
Nymphae lotus (water lily)	Rhizome, floral receptacle and fruits.	Eaten raw or cooked as food spice ingredient of soup.
Ludwingia stolonifera	Leaves	Spice/ingredient of soup.
Eichhornia crassipes	Leaves	As feed in mixture with other grasses.
Polygonum senegalenses	Leaves pounded with hydrated sodium carbonate	Cure rheumatic pain and swellings.
Althermanthera nodiflora	Leaves	Cure stomach disorder
Pistia stratiotes	Leaves	Cure ulcer of mouth and tongue.
Neptuna oleracea	Leaves	Treatment of yellow fever, guinea worm.
Nymphia lotus	Stem and roots.	Fever, urethral discharges.
Nymphia lotus	Flow	Narcotive and sedative.
Aframomum melegueta	Leave	Cure cough.

Sources: Kio and Ola- Adam, 1987., Uka and Chukwuka,2011 [11, 25].

Plate 1: *Saccioleois Africana*

Plate 2: *Pistia stratiotes*

Plate 3: *Eichhornia crassipes*

Plate 4: *Ludwigia stolonifera*

Other approaches to solve problems caused by aquatic plant:

- To carry out a study on the aquatic weed relating to why they are persistent in the aquatic environments (Sousa, 2011).
- To create indigenous or national capacity for enduring aquatic weeds control.
- To engender collaboration through seeking assistance from foreign countries that have recorded success in aquatic plants control.
- To partner regional and sub-regional member countries of the economic community of West African States (ECOWAS on integrated aquatic weeds control)
- To identify the prevalence of weed species and the cover.
- Encourage fish feed production using aquatic macrophytes as replacement for expensive feed ingredients (Aghoghovwia *et al.*, 2018) [1].

Solving the Problem

- Establish surveillance systems of aquatic weeds in the country through engagement of the local community.
- Introduction and rearing and release of biological control agent to use against water hyacinth, water lettuce, water fern. Examples is the use of some herbivorous fish like largemouth (*Micropterus salmoides*) including their juveniles to feed on the plants (Tate *et al*., 2003).
- Establish a rearing unit for the biological control agents.
- Conduct public awareness campaign on aquatic weed problem and method of their control among the rural population, involving rural communities in the release of the selected biological control agent.
- Ensure the members of the local community buy into the project - aquatic weed control. They must be made to very important citizens Vizavizi their contribution.
- Establish inter country cooperation and exchange of information on matters related to aquatic weed control.

Conclusion

The pervasive presence of the aquatic plants on surface areas of many Niger Delta waters interferes directly with the water use. Put differently, the aquatic macro plants pose nuisance characteristics to man's wellbeing. In the wake of the many other problems or challenges facing Nigeria today (notably, recession, insecurity, poverty, corruption and likes), the aquatic weed incidence thus appear to be another environmental and socio-economic problem. The threat of its growing trend gives room for concern, while the cost it might gulp in tackling this ugly trend besides the lack lustre trait or insincerity on part of leadership, are unequivocally nightmares. This paper however noted that the detrimental aquatic plants invasion, presents valuable opportunities that could be of benefits to the Nigerian state. It is another gray area of wealth creation. The onus is therefore on all stakeholders (government, environmentalist, and industrialist) to make the most use of this problematic weeds, which are at the moment seem intransigent or too expensive to control.

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