Aquatic Macrophytes and Limnological Implications on Fisheries Resources: A Case Study of Obio Akpa Stream in Akwa Ibom State, Nigeria

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ABSTRACT

This preliminary survey of aquatic macrophytes in Obio Akpa stream was undertaken to establish the composition and limnological implications on the aquatic ecosystem and the fisheries resources. The study area, structured with a frame survey into three principal sampling units (PSU) was randomly sampled with the instruments of complete enumeration, direct observation and personal interview to obtain the data analyzed statistically into simple percentages for this work. Thirty- two species of aquatic plants variously provide food source, shelter, refuge sites, manure, anchorage/holdfast, breeding sites, nursery grounds, drugs and beautification amongst others, to thirteen fish types that inhabit this perennial inland water. The excessive growth of Eichhorina crassipes (water hyacinth) and Pistia stratiotes into non-permanent dense mats on the water surface is believed to harbour invertebrate fauna, facilitate flooding and block water routes thereby impairing fish movement and fishing activities.

Keywords: *Aquatic Macrophytes, fisheries resources, Obio Akpa Stream,*

INTRODUCTION

Aquatic macrophytes constitute an essential component of the freshwater ecosystem; predominantly inhabiting the littoral shallow water of the shoreline up to a depth exceeding 3 meters. Their presence in the freshwater bodies influence the physical and chemical conditions of the water, sediments, organic matter production, nutrient recycling and biotic interactions to produce a balanced community structure in the ecosystem. Petr (2000) defined aquatic macrophytes as vegetations of angiosperms (flowering plants), ferns, moses (pteridophytes) and macroscopic algae (stoneworts) that inhabit the freshwater ecosystem. Aquatic plants represent an important habitat for fish used for feeding, reproduction, breeding sites, nursery grounds, shelter, nutrient trap/recycling and escape from predation. They consist of a wide range of flora. Knowledge of fish behaviour and aquatic macrophytic management is very necessary in order to improve upon fish catches since fish may inhabit

the water surface above the plants, the periphery of the plants beds or the very bottom below the submerged aquatic plants; where they obtain forage, protection, refuge, escape from predation or use them as breeding sites and nursery grounds. Dutta (1981), Petr (2000) and Whetstone (2005) have identified three groups of aquatic macrophytes namely:

i Floating macrophytes - which have greater part or all the leaves floating on the water surface while the roots hang down the water column as in Azolla sp. Eichhornia sp, Pistia sp, Lemma sp (duckweed), etc.

ii Submerged macrophytes are rooted in the substratum while the remaining parts are wholly submerged in water and are represented by Myriophyllum, Potamogeton sp, Hydrilla sp, Elodea and Ceratophyllum, etc

iii emergent macrophytes; include aquatic macrophytes that are rooted at the bottom with stems and flowers extending above the water surface as in Nymphea, Echinocloa, Cyperus, Saggittaria sagittifolia (Arrowhead) and Polygonum.

Aquatic plants determine species composition and spartial distribution of fish which are evidenced in species patchiness on sandy, muddy and plant litter substrata; with herbivorous fishes exclusively inhabiting vegetated habitat. Petr (2000) has reported of aquatic macrophytes as the predominant vegetative diet for Tilapia zilli, Oreochromis sp, Tilapia rendalli etc. According to him, submerged and floating macrophytes of Ceratophyllum, Miriophyllum, Pomatogeton, Nymphea and Pistia harbour Tilapia zilli, Oreochromis sp, captured with traps and seine nets. Baijot et al (1997) stated that littoral macrophytes contribute to the development of fish communities. Young fishes need aquatic macrophytes for shelter, food source, protection from predation and cannibalism. This study aimed at establishing the limnological implications of aquatic macrophytes on the fisheries resources. The control methods for excessive (invasive) macrophytes are however not considered in these investigations.

METHODOLOGY

Aquatic plants and fish types were identified with standard resource materials (Reed Burchard, Hopson, Jennes and Yaro, 1967; Dutta, 1981; Olaosebikan & Raji, 1998; Etukudo, 2003). This preliminary survey was conducted along the water stretch of Obio Akpa stream. The perennial stream originates from a small upland known as "Odiong" at Eriam Afaha Obong in Abak Local Government Area; flowing over 20km through many villages before finally empting into Qua Iboe River at Ekpene Okpo in Oruk Anam Local Government Area. The study area which lies between latitude $7^{o}3^{l}$ - $4^{o}45^{l}$ N and longitude $7^{o}30^{l}$ E - $4^{o}55N^{l}$ was stratified with a frame survey into 3 principal sampling units (PSU) from where random sampling using complete enumeration, direct observation and personal interview were used as sampling instruments to collect the data for this work. The data were analyzed statistically using frequency counts, means as well as computed into simple percentage. The results are presented on tables.

RESULTS AND DISCUSSION

Table 1 shows the summary of aquatic macrophytes composition in Obio Akpa stream. Thirty two species of macrophytes were collected and identified. Bambosia vulgaris was the most abundant followed by Echinocloa sp with 8.57%, 8.00% relative percentage occurrence respectively while the least abundant were Shagnum sp and Marsilea sp with 1.37% each, followed by Alocasia sp of 1.14% . There was no difference in the composition of the macrophytes in the sampling stations ('Ikot Udo Edem', 'Idim Ekpe' and 'Akada ekpo'). Almost all the aquatic plants had roles to play in the aquatic ecosystem especially in strengthening the food chain/foodweb and habitat maintenance/stability.

Table 2 shows the summary of fish composition in Obio Akpa stream, their habit/ relationship with the macrophytes. Thirteen fish species inhabit the water body. The most abundant fish was Tilapia dubia (11.11%), followed by Clarias anguilaris (10.56%) and Heterobranchus sp and Ophiocephalus with 9.44% respectively, while the least abundant species was Calamoichthys and Notopterus sp with 5.56% relative percentage occurrence each. The aquatic ecosystem understudied consist of a wide variety of flora and fauna resource which continually provide a balanced ecosystem structure that contribute to solving human needs and serving ecological, economic, scientific, medicinal and recreational purposes in the freshwater environment.

Aquatic plants such as Lemma (duckweed), Pistia stratiotes (water lettuce), Eichhornia crassipes (water hyacinth) and Musanga cecropioides present in the study area are widely associated with the provision of fodder/food source to fish. Moreover, the occurrence of Pistia stratiotes, lemma sp, Nymphea lotus (water lily) and Eichhornia crassipes, are associated with the provision of manure. Others include Musanga cercropioides, Raphia hookeri and Elaeis guinensis, where their rotten part are decomposed to enrich the ecosystem with manure.

Equally, fish fries and fingerlings have Pistia stratiotes, lemma sp and Eichhornia crassipes as their food source. According to Petr (2000) young fishes need aquatic macrophytes as food source, shelter, protection from predation and cannibalism. Plant cover generally serve as the spawning sites of some fish, attachment/ holdfast to fish eggs, fodder, net-building sites, nursery ground of fish, nutrient recycling, bank stabilization, water purification and aeration. The submerged, floating and emergent weeds were grazed by Tilapia, Oreochromis sp, Heterobranchus sp and Clarias sp. Petr (2000) has reported of Ceratophyllum, Pomatogon, Nymphea as the predominant vegetative diet and macrophytes habitat for Tilapia zilli Oreochromis and Tilapia rendalli from where they were largely caught with traps and seine nets.

Eichhornia crassipes (water hyacinth) is widespread in tropical waters with less aquatic macroinvertebrates inhabiting the roots when the plants form mats to offer protective purpose and breeding sites to invertebrate host and vectors of parasitic diseases like malaria, schistosomiasis, encephatis and elephantiasis. Their excessive growth threatens fishery by blocking water routes, fish movement and thereby encouraging flooding. Water hyacinth serves as food and feed component to Common Carp and Grass Carp and provides shade to protect fish under cage culture (Petr 2000). The free floating Pistia stratiotes, was found to occasionally occur in non-permanent dense mats on the water

surface that could be dispersed by wind current. The roots which usually hang down the water surface are believed to harbour invertebrate fauna that may be preyed upon by fish.

Hemichromis and Tilapia spp are also associated with this plant. However, the substrate type and submerged vegetation are important factors in Cichlid preferences. Food and habitat provided by plant beds, support diverse fish populations, provide refuge sites and reduce predation and cannibalism on the fishery resources. The decomposition of dead macrophytes is often associated with increase in nitrate and nitrite, which enhanced soil fertility. Whetstone (2005) has found, grass carp to consume more than their body weight of fresh vegetation in a single day, growing more than 50 pounds and feeding largely on soft -stemmed submerged weeds of Hydrilla, pondweed, spikerush and Naids in USA. According to him, Ceratophyllum harbour freshwater snail that transmits schistosomiasis in the Upper Volta. Snail eating fishes transmit the disease to humans. Excessive growth of the aquatic plants is nuissance to the functioning of the ecosystem and faunal community. Eichhornia sp and Pistia block the water route, harbour disease causing animals, hinder fish movement, accelerate flooding and prevent light penetration that could warm up the water. This affects fishing, warmwater fish spawners and synthesis of organic compound.

CONCLUSION

Thirtytwo macrophytes and thirteen fish spp inhabit the study area. The aquatic macrophytes did not only serve a serene and aesthetic aquatic environment but variously provided fodder, refuge sites, bank stabilization , habitat, drugs, manure, anchorage/holdfast, breeding sites of fish/vectors and nursery grounds for the fisheries resources. They also influence fish species composition and spartial distribution which resulted in species patchiness in the sandy, muddy and plant litter substratum. These vegetated habitats tend to harbour abundant herbivorous and omnivorous fishes while the carnivorous and piscivorous fishes take to predation and cannibalism.

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TABLE 1: SUMMARY OF AQUATIC MACROPHYTES COMPOSITION OF OBIO AKPA STREAM

Botanical Name	Family	English /Trade Name	Local Name (Annang/Ibibio)	Qty	Relative % Occurrence	Habit	Usefulness in Aquatic Environment/Fisheries
Pistia stratiotes grounds water Cause	Araceace	Water Lettuce	-	40	4.57	Free-floating	*Food for fish, fries &fingerlings *shelter/ breeding for disease-carrying water snails & mosquitoes * block ways/navigation & aeration. *Prevent fish abundance anoxic condition *Fodder to animals *Manure
Caladium saggitifolius	-	-	Ikongidim	31	3.54	Emergent	*Perennial herb for decoration * beautify aquatic environment * rhizome and leaves heal boils, wounds sores. *Provide shade
Neptunia postrata against flood. Anchorage for free	Mimosaceae	Water shame	Nyamaidim	37	4.22	Floating	* Grow to from carpet/mat *fodder, bank stabilization floating plankton. *Shade/hiding place for fish, fries & juveniles *Reduce water flow
Costus afer	Costaceae	Bush cane,	Mbritem	31	3.54	emergent	*Fodder, juicy stem and leave heal cough, pains, stomach. ache, wounds, cuts, sores, burns, eye problems etc
Bambosia vulgaris		Indian bamboo	Okpo-nnyanyaha	75	8.57	emergent	*Provide shade, dampens the environment. Bind soil particle, anchorage. Dead leaves form plant litter/manure, its presence ensure growth of earthworms.
Echinocloa sp	Poaceae	Water grass Nsai		70	8.00	Free-floating	*Fodder, bank stabilization Restriction of flood, Habitat for fish
Leersia hexandra	Poceae	Water grass	Nsana idim/	35	4.00	Floating	Shade/habitat for fish Aya mbakara Reduce light intensity, water oxygenation. create anoxic condition.
Elodea sp	Hydrocharitacea	Water weed	Nkwuo idim	34	3.89	Submerged	*Cosmopolitan & tropical aeration of water. breeding site and nursery ground for fish water purification and nutrient tention /reycling.
Marantochloa cuspidata	-	Soft cane	Mboko ekpo	25	2,36	emergent	*fodder to fish, stem edible
Phyllanthus amorus	Euphorbiaceae	Eggwoman	Oyomokiso	20	2.29	emergent	*Medicinal/drug plant, fodder eaten by aquatic fowls/birds and fish. cures cholera, ring worm, ulcers, scabies arthritis. has antibacterial, antifungal and antiviral action.leaves chewed to cure diarrhea dysentery and malaria.
Diaplazium summanti	-		Nyama idim	60	6.86	emergent	*fodder to fish, stem and young shoots edible
Centrosema Fabaceae		Cowitch	Okotic ekpo	18	2.06	emergent	-
Musanga cecropioides	Ceceropiaceae	Corkwood/	Uno idim	12	1.37	emergent	*Tree canopy for shade to aquatic umbrella tree animals (fish). Fallen leaves cools & fertilizes soil/sediment. fruits edible for fish, bats and birds *Monkey climbing the branches produce dungs that fertilize the water fish growth. Leaf litter forms breeding, nursery habitat and manure to fish. *A good site for growth of earthworm used as fish baits. pens the soil.
Caladium Sp	Araceae	Ornamental Cocoyam	Ikpong ekpo	24	2.74	emergent	Perennial herb for decoration/beautification of aquatic environment Rhizome heals boils, ulcers, wounds, sores, bruise. Vegetable for fish.
Lemma Sp	Lennaceae	Duckweed		27	3.09	Free floating	Fodder for fish manure to aquatic environment food for fries & fingerling.
Potamogeton Sp	Potamogetonaceae	Pond weed		25	2 .86		Submerged *Forms underwater garden/fodder for animals. Food source to fish. Cosmopolitan in fresh water

Ceratoperis thalistroides		Waterfern/ hornwork		14	1. 60	emergent	*Restrict water margins, promote bank stabilization. Restrict/moderate flood water * Occur in dense
Shagnum Sp	Sphagnaceae	bog moss/peat moss		12	1.37	-	cushions. Good stuffingmaterial. Its presence neutralize alkalinity in antiseptive, used for surgical dressing Retards decay of dead plants.
soils. Forms peat used as fuel. *Soft							
Thallies Sp	-	Wild starch	Ikong Aya	30	3.43	emergent	*Provides shade with the leaves.retend organic debris for fish Holdfast for other organisms.
Chromolaena odorata	Asteraceae/ compositae	Independent Plant	Aworowo	21	2.40	emergent	*Annual weed. Fertilizer soil. good mulch material heals malaria, fever etc. used as enema. Expels mosquito
Nymphea lotu	Nympheaceae lily	White water	Ikpong idim	27	3.09	-	*Food for fries fingerlings, manure to soil. fruits bulbs are edible for fish & man. Aquatic perennial herb. fodder to aquatic animals. Decoration/beautify aquatic environment. Rhizome edible. Stem & root infusion treats veneral diseases, urethral discharge, gastrointes-tinal troubles, Veneral sores etc. *Leaf lotion treats sores, eye conjunctivis. Stem & root infusion induce urination.
Lophotocarpus		Water weed	Nyereotong	17	1.94	-	Habitat for fish, fodder, breeding sites for guianensis fish.
Comelina nudiflora	Commenlinaceae	Water/zebra grass		21	2.40	-	*Annual perennial herb, habitat and vegetable for fish
Sphenodea Sp	-	Soap weed	Otong- Idim	18	2.06	-	Poisonous weed used as ichthyotoxin by fishers to catch fish.
Ipomea aquatica	Convovulaceae	Wild potato	Ediam Idim	13	1.49	emergent	*creeping perennial climber in sand/muddy substratum. Binds soil particle together. Vegetable fodder to fish. Good mulch material, drugs (purgatives), Ornamentals.
Alocasia sp	Araceace	-	Ukum idim	10	1.14	emergent	Aquatic herb, grown in moist shady places * juice/latex poisonous
Marsilea sp	Marsileaceae	Water lily	Nkwo idim	12	1.37	emergent	Shade and habitat to fish
Eichhornia crassipes		Water hyacinth		32	3.66	Free floating	* Food for fish, fries & fingerling. manure, impedes water flow, swimming. Block navigation. * Displace fish & Aquatic live when invasive. * Cause flooding * provides shade/ habitat for fish
Mimosa pudica	Gramminaceae	Sensitive plant	Ukod	15	1.71	emergent	* Beautification/ ornamental * provide good habitat/ plant cover to shelter fish. * Provides green manure * Leaves treat guinea worm, sores etc. * Leaf extract used as enemas.
Aspillia africana		Compost Weed	Ndinuene/edemerong	22	2.51	emergent	Herbs, fodder to fish. sap treat eye cataract *Juice accelerate healing of cuts, sores, wounds * Haemonhage plant *Dead plant form good compost/manure.
Raphia hookeri	-	Wine palm	Ukot	17	1.94	emergent	* Tree grows in swamps, provide shelter * Has economic traditional, social, cultural & religious purposes Rotten trunks breed beetles larvae use as baits. *fronds for making fish smoking roofs & fish basket. fish rags from midrib.
Elaeis guinensis		Oil palm	Eyop	30	3.43	emergent	* grows as trees along water banks/swamps * anchorage, shelter * fruit bunch & inflorescence provide potassic fertilizer/good manure. * Rotten trunk breed beetle larvae & fungi used as baits * Food source of fat & oil. * fruits edible to fish & oil heals sores, pains etc. * provide serene & esthetic appearance to water Banks. their presence cools the aquatic environment for fish habitation.

Sources: Survey, 2008; Etukudo (2003) Ethnobotany; Conventional and Traditional use of Plants. The Verdict Press. Uyo.

TABLE 2: SUMMARY OF FISH COMPOSITION IN OBIO AKPA STREAM

Family	Genus	Species	Common Name	Qty caught (kg)	Relative occurrence	Habit
Cichlidae	Tilapia	Tilapia dubia	Nile Tilapia	19	11.11	*Herbivorous *Vegetarian, widespread, plankton feeders. on sandy - muddy substratum
Cichlidae	Tilapia	Tilapia zilli	Tilapia	13	7.22	Herbivorous/ feed on vegetation, plankton.
Cichlidae	Hemichromis	Hemichromis fasciatus	-	12	6.67	Widely distributed, herbivorous. vegetarian. Mostly in clear water
Malaptervridae	Malapterurus	Malapterurus electricus	Electric catfish	11	6.11	Mostly in swamps. Muddy substratum, widespread in emergent vegetation and leaf litter.
Clarridae	Clarias	Clarias anguilaris	-	19	10.56	* In swampy area, feeds on weeds, plankton, insect larvae worms, rustaceans, water snails. Widespread In leaf litter & muddy substratum fished with long line baited and Unbaited (Reed et al 1967).
Claridae	Heterobranchus	Heterobranchus sp	-	17	9.44	* In swamp areas. Long lines on receding floods, nets, traps, fish -fence
Mormyridae	Mormyrus	Macrophthalmus sp	Trunk fish	15	8.33	Bottom dweller. Common in swamps Sandy substratum / shallow sandy flats. Inhabit submerge vegetation. Feeds on chronomid insect, debris, worms.
Polypteridae	Polypterus	Calamoichthys calabaricus	Birchir African sailfin	10	5.56	* Common in submerged vegetation to emergent. Sandy and muddy areas. Feed on tiny fishes & fish (synodontis) fries
Gymnarchidae	Gymnarchus	Gymnarchus	Nile perch niloticus	12	6.67	*Common in swamyp areas. Feeds on insect, fries of other fishes inhabit mid water/emergent vegetation. Traps, long lines with baits. Build nest during flood, piscivorous.
Mochokidae	Synodontis	Synodontis sp	jumping fish	13	7.22	*From submerged to emergent vegetation. Feeds on small fishes, palm fruits. Hooks and longlines
Hepsetidae	Hepsetus	Hepsetus odoe	African pike	11	6.11	Widerspread & predatory, feed voracious on small fish. Caught with net & baited long lines.
Notopteridae	Notopterus/	Notopterus afer Papyrocranus	Feather back	10	5.56	Mostly in swampy areas, plant litter. widerspread. Muddy substratum, submerged vegetation
Channidae	Parachana	Ophiocephalus	Snake head obscurus	17	9.44	Inhabit vegetation and flood plains, swamps muddy substratum, under submerged vegetation
Total				180	100	

Sources: Survey, 2008; Reed W; Burchard J; Hopson A. J; Jennes J; Yaro , I. (1967) Fishes of Northen Nigeria. Ministry of Agriculture. Gaskiya Cooperation. Zaria, Nigeria

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