UTILIZATION OF SOME AQUATIC MACROPHYTES IN NIGERIAN IN-LAND WATER BODIES: A REVIEW

By

H.A. MOHAMMED, F. DADDY AND G.O. ADESINA

National Institute for Freshwater Fisheries Research, P.M.B. 6006, New Bussa, Niger State.

ABSTRACT

Aquatic vegetation is an essential component of the aquatic ecosystem with both positive and negative implications on the water body. Efforts are always made to curtail the excessive growth of aquatic plants in order to prevent them from becoming a nuisance in the ecosystem. One of the ways of solving such problem is the positive economic use of such plants. Utilization as a method of weed control within the aquatic ecosystem is considered to be one of the safest methods of weed control as this provides the riparian communities double advantages in terms of save environment and personal benefits of the plant. The flora diversity of freshwater and brackish environments posses a great potential to both man and higher animals alike. Due to this fact, this paper attempt to review the exploited and unexploited aquatic plants resources of many of our water bodies in Nigeria both economically and socially. to the populace. Recommendations are also advanced for further studies that will enhance sound management of the resources for maximum benefits and sustainability.

INTRODUCTION

Generally, aquatic ecosystem is comprised of a wide diversity of floral and fauna genetic resources and other minor products that increasingly serve human needs through their contributions to agriculture, industry, medicine and energy. The composition of the flora species of the Nigerian aquatic environment has not been fully studied and documented (Imevbore, 1971; Obot, 1984; Obot and Mbagwu, 1988). Many individuals regard aquatic macrophytes as "weeds" which infest waterways and interfere with navigation, irrigation, fisheries production and water quality, while they inadvertently tend to overlook the benefits and services rendered by aquatic macrophytes.

The term aquatic macrophytes excludes filamentous algae and basically a grassland species that grows as a natural biotic component in most shallow depth, still, slow flowing and running water bodies. Fresh water macrophytes include all members of chaeophyta e.g. (stonewort), bryophyte (e.g. mosses and liver worts), Pteridophyta (e.g. Ferns and Ferns allies) and spermatophyta (e.g. Seed bearing plants and the cone bearing plants) which grow in freshwater aquatic environment. Pyne, (1986) & Nather Khan (1990) classified the freshwater macrophytes into four categories:

i. Free-floating: These are plants with roots if present hanging in water or plants that float on the surface of water bodies and their roots are being swimmers. E.g. *Azolla africana, Eichhornia crassipes, Pistia stratiotes, Lemna pausicostata, Lemna gibba, Lemna perpusilla, Lemna trisulca, Salvinia sp* etc

ii. Submerged species: These are usually rooted in substrate with vegetative parts permanently submerged. E.g. *Myriophyllum sp, Ceratophyllum dermersum, Potomogeton crispus, p. pectinatus, Najas marina* etc

iii. Emergent species: These are rooted in shallow water with the vegetative parts emerging above the water surface. E.g. *Nymphaea lotus, Typha australis, Phragmites sp, Echinochloa stagnina, E. pyramidalis, E obtusiflora, Cyperus sp, Sesbarnia dalzelii etc.*

iv. Marginal Species: These are macrophytes that can survive on land or water. Most of which belong to the Families Araceae, Cyperaceae and Poaceae.

Aquatic macrophytes are among those factors, which a fishery manager will try to understand and include in his strategies for optimizing capture fisheries in inland waters. Plant species composition, distribution and percentage cover of aquatic plants have been reported to determine the fish species composition, species production, access to fish stocks by fishermen and fishing gear (Okojie, 1998). Sometimes, boat access and transport possibilities for getting the fishery product to the markets also have vital role to play. Aquatic macrophytes (e.g. duck weed) can also be efficient indicators of water quality, and their presence may enhance water quality due to their ability to absorb excessive loads of nutrients and heavy metals. These properties have been used in wastewater treatment as well as in bio- manipulation of water bodies for enhancing fish production (Silkworm, *et al* 1996)

Apart from their ecological role, aquatic macrophytes contribute greatly to the economic, scientific and recreational importance of Nigerian water bodies. The present tendency to annihilate these resources without adequate knowledge of their ecology population dynamics and socio-economic importance may spell doom to other organisms, which also depend on aquatic plants. This paper reviews the value of aquatic macrophytes in tropical West Africa generally and with particular reference to aquatic macrophytes in Nigerian in-land water bodies.

VALUES OF AQUATIC PLANTS.

Payne, (1986) and Okojie, (1998) had reported a variety of products and services of considerable benefits offered by aquatic macrophytes, which include:

FOOD FOR FISH AND OTHER AQUATIC VERTEBRATES

It has been reported that aquatic plants play an important role in the life cycle of fish. A free- floating aquatic macrophyte *Lemna pausicostata* is eaten directly by *Tilapia species* (Mbagwu & Adeniji, 1988) while other fish species feed on periphytic algae growing on the surfaces of aquatic plants.

Opuszynski and Shireman (1995) reported that there are 24 fish families in the freshwater ecosystem which some are herbivorous species. He asserted that 37 fish species are feeding on macrophytes, and 20 of the macrophyte-feeding species belong to the family Cyprinidae, 8 to the family Cichlidae. Among these, grass carp is reported to be the only fish used on a large scale for aquatic weed control.

BREEDING GROUNDS FOR AQUATIC LIFES.

Aquatic vegetation also provides breeding substrate for a large number of insects and other invertebrates, which serve as fish food. Under non-explosive, non-invasional conditions, fishery managers consider floating aquatic plants as beneficial except where they interfere with methods of harvesting fish. Imevbore and Bakare (1974) had reported that fish fry used aquatic vegetation for shelter purpose as well as their spawning grounds. In Kainji Reservoir aquatic vegetation has been identified as a valuable spawning and breeding ground for a large variety of economically important fish species.

AQUATIC PLANTS AS BIO- FERTILIZERS

Aquatic plants accumulate large quantities of nitrogen and phosphorus in their tissues. They will therefore improve soil if applied as soil additives. The concept of biofertilizers, the growing of a minor crop that provides nutrients to a major crop, though relatively new to aquatic science, is already becoming popular. *Azolla* sp., a free-floating fern that fixes nitrogen in a symbiotic relationship with the Cyanobacterium *Anabaena azollae*, is widely used as a bio-

fertilizer for rice crops. Rice-fish polyculture, with *Azolla* sp. as a bio-fertilizer, has become popular in Asian flooded rice field. Maltby, (1986) reported that *Azolla sp* has been used to a lager extent to fuel rice production in waterlogged areas in china. In a report from the Philippines, dried water hyacinth has been successfully used as a bedding material that enhances the formation of mushrooms (*Volvaria sp*) (Ratchance 1972).

Source of energy

The value of aquatic plants as energy source centers mainly on its use as fuel for fish smoking and for domestic energy. Meanwhile, by subjecting aquatic plants to bio-chemical reaction, they can be converted to energy source (fuels) whether in liquid, gaseous or solid forms. For example, it has been reported that the stems of *Aschynomene crassicaulis, Echinochloa spp.* and *Cyperus papyrus* among others are used as fuel especially for cooking and fish smoking (Kio & Ola-Adams 1987). In NIFFR, Eyo, (2000) highlighted the use of water hyacinth in the production of biogas, and proposed the construction of dome type biogas digester to utilize water hyacinth for biogas production that will provide energy for the local community and the slurry that will be ready source of fertilizer for the farmland.

Industrial uses of macrophytes

Aquatic plants offer a wide range of materials that could serve the needs of innovative industry. The materials could be used for construction, matting, bedding and pulp/paper.

Obot, (1984) reported that the mature silky inflorescences of the spike of *Typha australis* are used in stuffing pillows and mattresses and the fragrant dry tuber of *Cyperus maculatus* is also sold in Northern Nigeria as perfume. He asserted that perfume is also produced from underground stems of *Cyperus articulatus*, when the leaves are burnt over the fire as a mosquito repellent, and that the aerial stems are used in the weaving of colourful mats commonly sold in northern part of Nigeria. *Vossia cuspidata, Cyperus papyrus* and *Eichhornia crassipes* has also been identified to possess economic potentials for pulp, paper and fibre.

The potential for aquatic plants in water treatment has also been investigated. Some aquatic plants are very sensitive to pollutants and could be used as biomonitoring agents. Ogunlade (1992) has reported the potentials of water hyacinth as a mopping agent and scavenger of heavy and toxic element in industrial domestic effluents.

The inflorescence of the Nypa palm (*Nypa fruticans*) has been reported to yield palm wine and sugar while the foliage has been extensively used for thatching, and Raphia *vinifera* has been identified as raw material used in making brushes, brooms and mats (Obot 1984). It is also identified to be used locally in making roofing poles and bed sheets, cards, fishing tackle and snares for game. According to Kio & Ola-Adams (1990) strips of the young, unopened fronds and mid ribs of *Phoenix rectinata* are used for weaving sleeping mats, sieves and bags. *Laguncularia racemosa* yields timber, tannin and dyeing materials.

SOURCE OF HUMAN/ OR ANIMAL FOOD

It has been reported that floating rice (*Oriza sativa*) is the most widely known aquatic plant used as food. Other aquatic plants offer various food items. For example, the seeds of burugu (*Echinochloa stagnina*) are collected for food in Monai on the western shore of Lake Kainji. The seed of *Echinochloa stagnina* is also an important food item for fishermen in the Inner Delta of the Niger River and prized sugary syrup is obtained from the stalks of the grass. Kio & Ola-Adams (1987) reported that the rhizome, floral receptacle and fruits of *Nymphaea lotus* (water lily) are either eaten raw or cooked for food and *Ludwigia stolonifera* is used as an ingredient of soup in the Yelwa area of Kebbi State (Obot and Ayeni, 1987).

Imevbore, (1971) and Obot, (1984) in a survey of aquatic environments; identified 52 macrophytes but only 14 of these were found utilizable for livestock production. Some aquatic plants can be processed as animal feeds. Even water hyacinth can be used in limited quantities in a mixture with other feeds by cattle, sheep, goats and other ruminants. Aquatic macrophytes

used as fodder include *Vossia cuspidata, Leersia hexandra. Bracharia mutica, Echinochloa pyramidalis, Sorghum arundinaceum, Paspalum virginatum* and *Echinochloa stagnina.*

MEDICINAL VALUE

A variety of aquatic plants are also used in curative therapy in traditional communities. A good number of these ethno- botanic materials have been reported to yield compounds, which could be of use as modern drugs and pharmaceuticals Okojie (1998). Kio & Ola-Adams (1987) reported that *Polygonum senegalense* is pounded with native hydrated sodium carbonate and rubbed on the limbs for rheumatic and other swellings. This concoction is also applied to syphilitic sores. *Althernanthera nodiflora*, on the other hand, is used for simple stomach disorders and *Pistia stratiotes* is used for ulcerative conditions of the mouth and tongue. Obot and Ayeni (1987) also report that *Pistia stratiotes* is used as part of a concoction for the treatment of 'flu. The emergent nitrogen-fixing legume *Neptunia oleracea* is used in the treatment of yellow fever and Guinea worm infection.

Bubayero (1986) confirmed that between 75 and 80% of the Nigerian populace patronise the traditional healers that make use of a variety of plants including aquatic macrophytes. Many of these aquatic medicinal plants yield exceptionally promising compounds for use in modern drugs and pharmaceutical industries. *Polygonum senegalense* and *Nymphaea lotus* stems and roots are traditionally used in eruptive fevers and for urethral discharges. The stems and roots are also regarded as emollient and diuretic while the decoction of the flower is narcotic and sedative. In some parts of the country *Heliotropium indicum* is used for treatment of fever in children and also as a vermifuge and eye-lotion. In Ghana, it is commonly mixed with clay to arrest abortion. The juice of *Ethulia conyzoides* can be squeezed into the eyes for headache; the root when mixed with red pepper treats constipation, and the leaves are given in food to prevent abortion. *Cyperus articulatus* is used to treat cough and when mixed with grains of paradise (*Aframomum melegueta*) would cure headache if applied to the forehead. Dried and pulverised *Cyperus articulatus* is useful as fumigant and can be mixed with scented resins for the clothing, and air-fresheners in rooms.

Dalziel (1937) reported that the bark of mangroves is extensively used in many parts of West Africa for diarrhea or dysentery especially in children, to check hemorrhage, for sore throat and also for urethral infection. Kio & Ola-Adams (1990) also confirmed that, in Cameroon, mangrove bark is used for leprosy and craw-craw, when pulverised and rubbed into the scarified skin and it is also boiled for use as a lotion.

SOURCE OF RECREATION, TOURISMS, AESTHETICS AND OTHER USES

Some aquatic plant species of great potentials in horticulture and recreation have been identified. Of greater potential are some members of the Family Orchidaceae such as *Eulophia caricifolia. Eulophia horsfallii* and *Eulophia angolensis*, smaller aquatic plants such as *Najas* sp. may also be used in the aquarium as ornamentals and as agents of aeration (Okojie, 1998).

The presence of aquatic plants has favoured the possibilities of most Nigerian water-bodies being developed into recreation centres that will include sport, hunting, fishing, bird watching, nature photography etc. It has been reported that the annual income from visitors to Kenya's Amboseli National Park was estimated as US $1.3 million in 1979, where the associated aquatic systems are one of its principal attractions (MENR, 1981). US Dept. of the interior and Dept. of Commerce (1982) have shown that in 1980, 5.3 million Americans spent US $638 million on hunting macrophyte-dependent water fowl and migratory birds in the USA. The most developed, and in fact the first National Park in Nigeria, is the Kainji Lake National Park. However, Ibeun and Nehir (1989) reported that emphasis is placed on the terrestrial wildlife, the Kainji Lake hydroelectric dam complex and historic sites without due attention to the variety of the associated aquatic fauna and flora.

Table 1: Socio-economic/Importance of some preserved aquatic plant families within Kainji and Jebba lake basins

Families	Species	Uses
Araceae	*Pistia stratiotes*	Part of concoction to treat flu.
Ceratophyllaceae	*Ceratophyllum dermersum*	Aquarial material.
Convulvulaceae	*Ipomoea aquatica*	Livestock fodder, part of concoction to wash new baby
	I. ascarifolia	Livestock fodder
Cyperaceae	*Cyperus maculatus*	Seeds eaten by avian
	C. rotundus	Tuber eaten by avian
Febaceae	*Aeschynomene indica*	Part of concoction to treat yellow fever.
Marantaceae	*Thalia geniculata*	
	Mimosa pigra	Fuel wood, fencing
Mimosaceae	*Neptunia oleracea*	To fuel yield of fadama crops
Nymphaeaceae	*Nymphaea lotus*	Edible fruit leaves & stems.
Onograceae	*Ludwigia abyssnica*	
	L. erecta & L. hyssopifolia	
Poaceae	*Echinochloa ruspavonis*	
	E. staginina. E. pyramidalis & E. obtusiflora	"
	Ischaemum rugosum, Leersia hexandra	"
	P. polystachyma	"
	P. subalbidum	"
	Sacciolepsis africana	"
	Sorghum arundinaceum	"
	Vossia cuspidata	
	Phragmites karka	Mat weaving & fencing
Polygonaceae	*Polygonum lanigerum*	
	P. senegalensis	
Potendriaceae	*Heterathera callifolia*	
Typhaceae	*Typha australis*	Mat weaving. Stuff for pillow

Table 1 shows the list of some preserved aquatic plants within Kainji and Jebba lake basins that are of both ecological and economical values. Majorities are used as livestock fodder, which helps in reducing cost of feeding livestock.

CONCLUSION

Despite the general belief that most aquatic macrophytes pose obnoxious threat to the ecosystem, could still be used in various ways to make them environmentally friendly particularly if its utilization is integrated with mechanical control which favours consistent but sustainable aquatic macrophyte control by the riparian communities at low cost and for added economic benefits.

RECOMMENDATIONS

1. That a comprehensive chemistry of these macrophytes be studied with the objective of ascertaining the potency as regards their utilization in both orthodox and traditional medicine.
2. Need for nutritional investigation be conducted into some of these macrophytes as regards their inorganic minerals contents and their subsequent use as supplements in animal diets
3. Need for training of personnel as regards to the techniques entails in conversion of aquatic plants to biogas and fuel as the prices of conventional household fuel goes up.
4. Centers for utilization of aquatic macrophytes be established in order to put more emphasis in research as it bothers on the positive and ecosystem friendly use of the plants.
5. The use of the macrophytes as supplement to conventional fertilizers (inorganic fertilizers) should be adequately studied as organic alternatives capable of eliminating or abating the deleterious impacts of the inorganic fertilizers on the environment.
6. Extra effort be put in place to make objective comparison between the use of the animal manure and manure that are derivatives of aquatic macrophyte with the aim of establishing their positive effects on phytoplankton \zooplankton production in ponds.

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