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Full Length Research Paper

An evaluation of Iken fishing strategy in tropical Lekki lagoon, Nigeria

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This paper presents the results of the investigations of the fish aggregating device which served as fisheries enhancement techniques for the improvement of the productivity of the Lekki Lagoon between March 2006 and February 2008. The performance of the floating Island (Iken fishery) depends on the size and the thickness. *Chrysichythys nigrodigitatus* contributed 25.51, 23.42 and 25.19% of the total weight of fish from floating Island with water hyacinth, *Vossia* sp and *Cyperus* sp dominant plant respectively. *Tilapia guineensis* contributed 17.0, 21.55 and 23.18% for water hyacinth, *Vossia* sp and *Cyperus* sp as dominant plant respectively. The fishing with acoustic yielded the highest catch by weight (47.22%) followed by fishing without acoustics (33.33%) with the least recorded in the open lagoon (19.44%). Management measures to maintain optimal production from Iken fishery should include the use of luxuriant water hyacinth which will reduce deforestation and erosion of the mangrove belt. The community managed resource enhancement should evolve from the existing traditional practices to meet both economic and social objectives as a major management strategy.

Key words: Fish shelter, fish aggregating devices, Iken fishery.

INTRODUCTION

Lekki Lagoon situated at the southwestern part of Nigeria has vast aquatic resources suitable for fisheries. The lagoon supports many species of fish and aquatic plants and it's a major biodiversity reserves, it is also the largest low brackish lagoon in southwestern Nigeria. Lekki Lagoon is part of a rich folk lore and provides an important source of livelihood for the people of Lagos and Ogun State. It is the most important common property aquatic resources and the largest source of freshwater fish production in the states. The main livelihood activity of the people around the lagoon is fishing. The lagoon fishing activities is dominated by a unique age-old method involving aggregation and capture of fishes from man made floating islands of aquatic grass and needs locally called Iken. The Lekki lagoon has supported decades of small scale fisheries which have shown signs of over-exploitation. There is therefore the urgent need to combine the bi-objectives of conservation and yield optimization to improve the fish production in the lagoon.

Fagade (1969) and Ikusemiju (1973) described the acadja fish shelter in Lagos and Lekki lagoon, respectively. Solarin and Udolisa (1993) investigated brush park fishing in Lagos lagoon. Solarin (1998) observed that the fish shelters accounted for 25% of the total fish produced in the Lagos Lagoon. Welcomme and Batley (1998) listed fish shelter as one of the techniques for stock enhancement. Suresh (2000) described fish aggregating devices (FADS) as natural or artificial objects or structures placed at the bottom, suspended in the water column or repot a float on the surface of aquatic bodies to attract aggregate and regenerate demersal, pelagic, resident and migratory fishes. Fish are attracted to these objects for the shade, food and breeding grounds they provide (Solarin, 1998; Suresh, 2000; Emmanuel and Kusemiju, 2005). The probable problems associated with floating island as reported by Suresh (2000) are that it caused considerable pressure on untouched floating island grounds. It was further reported that the environmental consequences of the booming floating island fishery, the number of floating islands in the lagoon can sustain as well as stock and recruitment of fishes in the lagoon are yet unknown. The performance of the old but unique fish shelter was compared with the open lagoon water. The management measure involving the active participation

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of the local fishermen are also indicated for resources conservation and the realization of the sustainable fisheries potentials of the lagoon.

MATERIALS AND METHODS

Description of study area

The Lekki lagoon is one of the largest lagoons in West Africa and it supports a major fishery. The lagoon is located between Lagos and Ogun States of Nigeria and lies between longitude 4° 00 and 4° 15 E and between latitude 6° 25 and 6° 37 N (Figure 1). According to Kusemiju (1973), the lagoon has a surface area of about 247 km^2 and it is mostly shallow (less than 3.0 m deep) the maximum depth being 6.4 m. Lekki lagoon is a freshwater environment fed by the river Oni in the North eastern part and by Rivers Oshun and Saga in the north western parts of the lagoon. It opens into the sea via the Lagos lagoon and Lagos harbour. The lagoon is transitional in that it connects three south western states (Ondo, Ogun and Lagos). The lagoon is part of an intricate system of waterways made of lagoons and creeks that are found along the coast of South-western Nigeria from the Dahomey border to the Niger Delta (Emmanuel, 2009).

The two distinct seasons (dry and rainy) are observable in the lagoon which is typical of the southern part of Nigeria. The fisheries techniques obtained in the lagoon are mostly small scale based. Thus little capital is required to set up fishing business. The lagoon serves as the fish basket of the protein source of the surrounding settlements. The vegetation around the Lekki lagoon consists mainly of stilt rooted trees, a dense undergrowth of shrub and raphia palms (*Raphia sudanica*) and oil palms (*Elaeis guineensis*). The floating grass (*Saccarum sp*) occurred on the periphery of the lagoon while coconut palms (*Cocos nucifera*) are widely distributed in the surrounding villages. Some parts of the lagoon are covered by floating plants like the water lettuce, *Pistia stratiotes*, duck weed, *Lemna* sp and the water hyacinth, *Eichhornia crassipes* are always found in the periphery and are distributed all over the lagoon during the dry season more especially December, January, February and early March of the year.

Floating island fishing operation

The artificial floating islands 'Iken' were investigated as fishing enhancement techniques. The floating island consisted of floating aquatic weeds like luxuriant water hyacinth, *Eichhornia crassipes, Pistia stratiotes, Vossia* spp, *Cyperus* sp and other aquatic plants slatted into stationary position and prevented from drifting with the water movement.

Comparative harvesting of the floating island and the open water was done with traps (size range 70 - 90 cm length overall) and gillnet (50 mm mesh size). The weight (kg) of fish caught by selected traps in both the floating island and the open water were also inspected. The fishermen were also interviewed orally concerning the materials used in the floating island construction details, longevity and causes of losses. Fish species were identified with the aid of available literature (Tobor and Ajayi, 1979; Schneider, 1990; Olaosebikan and Raji, 1998; Paugy et al., 2004). Fish total length and weight in centimeter and kilogram respectively were recorded.

RESULTS

Floating islands are composed primarily of *Echhornia crasspies, Cyperus* spp or *Vossia* spp. The submerged parts of this vegetation comprise a complex framework of closely spaced densely tangled roots, providing many crevices in which small fishes can hide from large and predatory fishes. The roots also provide substrata or shelter for edible organisms. Epiphytic algae were noted, dragonfly and damsel fly larvae water scorpions and post larval fishes were collected beneath floating islands. The dimensions and dominant plant types for floating island experimental trial are given in Table 1. The performance of the floating island depends on the size and the thickness. Table 2 shows the fish species composition by weight in the floating island. *Chrysichthys nigrodigutatus* contributed 25.51, 23.42 and 25.19% of the total weight of floating island 1, 2 and 3 respectively. *Tilapia guineensis* contributed 17.0, 21.55 and 23.18% for floating island 1, 2 and 3 respectively.

Normally giant basket trap with fence are used for floating island harness in Lekki lagoon. In the experiment, gillnet (50 mm) was also used to sample one of the island (40 x 30 m) Table 3 and Figure 2 shows the comparison of fish caught with gillnet (50 m mesh size) in the floating island (installed for 12 weeks) and open water. The fishing operation with the use of acoustic yielded the highest catch by weight of 47.22% followed by fishing without acoustic (33.33%) and the least catch was recorded in the open lagoon (19.44%).

DISCUSSION

More fish by weight was caught in the shelters than the open water. The shelters provided shade and hiding places as well as food for fish. Although modern FAD according to Suresh (2000) include huge structures made of concrete modules, vehicles lines etc, the artisan fisheries in Lekki Lagoon use this old fishing method they have evolved utilizing the natural weed as FAD in the form of floating islands. The organic matter release by dead and decaying plant and animal materials in the Iken enrich the surrounding water, supporting a host of aquatic organisms. Solarin (1998) and Solarin and Kusemiju (2003) jointly observed positive correlations between the fish caught in the brush park and the period of installation as well as the density of implantation. This fish aggregating device is peculiar to Lekki Lagoon due to its environmental factors like the salinity which allow the growth of macrophytes. It was noted in this study that aquatic macrophytes contributed to an increase in fish abundance when compared with areas or water bodies devoid of macrophytes. This agreed with Borawa et al., (1979) who found that in the Currituck Sound (USA) fish density increased from approximately 1,000 to more than 15,000 fish ha^{-1} after *Mynophylum spicatum* became established. Killgore et al (1989) in their study of fish in the Potomac River (Virginia, USA) found densities of 17,000 - 98,000 fish ha^{-1} in areas with plants and the catch per unit effort (CPUE) was two to seven times higher in areas with plants than without plant. They added that

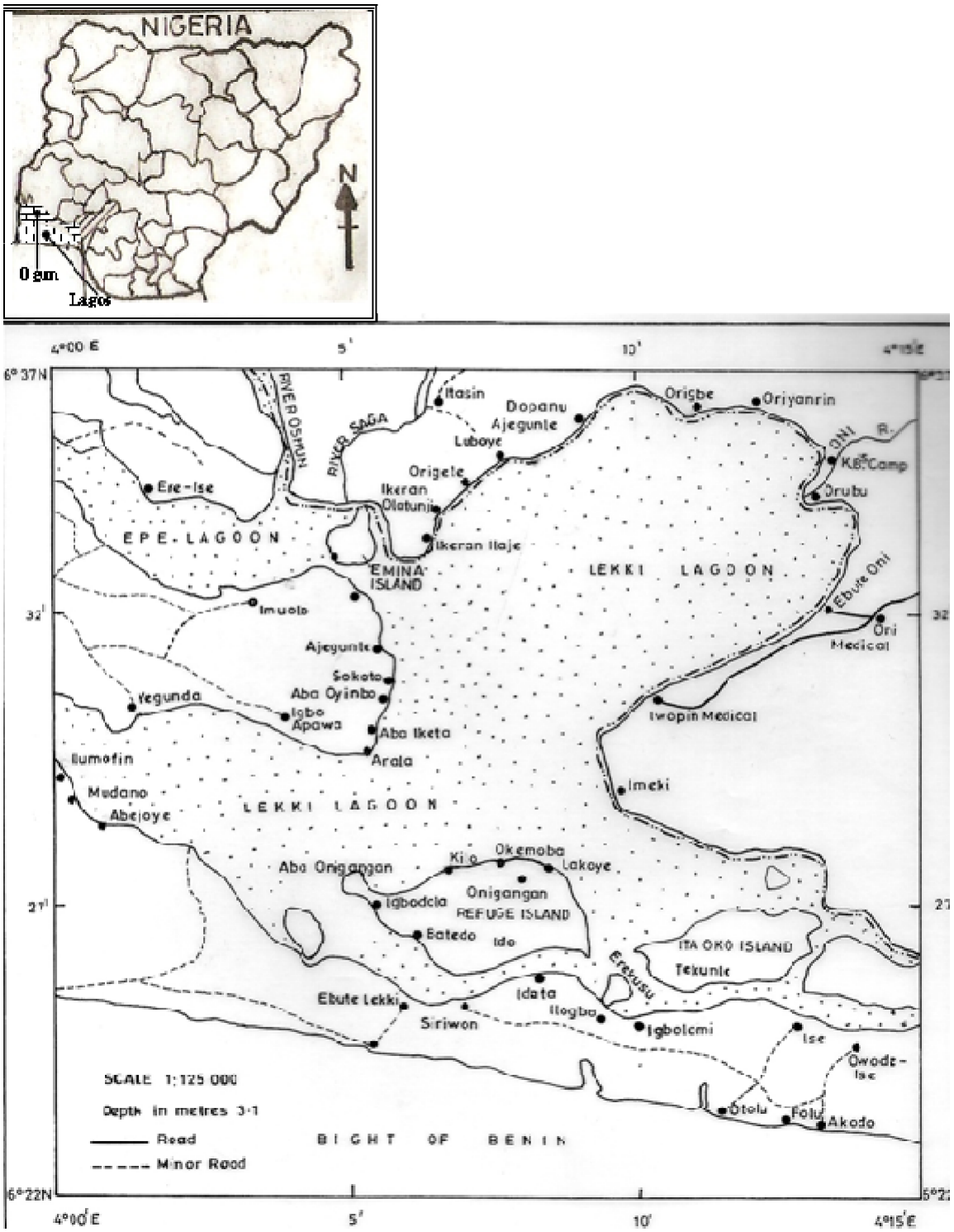

Figure 1. Map of Lekki Lagoon and its environs.

seasonal changes in density and species composition of aquatic plants cause a transition in the spatial and temporal distribution of fish. Egborge (1988) described the water hyacinth as a biological museum containing a wide array of organism like the algae, rotifers, nematodes, annelids, molluscs, cladocerans, copepods, isopods and amphipods which served as food for crabs and fishes. The mechanism of fish aggregation started with the colonization of the shelter with plankton and other micro-organisms which in turn promoted the growth of a large

Table 1. Dimensions and dominant plant type for floating islands in Lekki lagoon.

Dimensions	Floating Island		
	1	2	3
Length x width (cm)	30 x 20	40 x 30	50 x 30
Circumference at waterline (m)	264.2	448.5	565.7
Maximum height above water (m)	2.7	3.1	3.7
Maximum depth below water (m)	2.10	2.50	1.78
Dominant Plant	Water hyacinth	*Vossia sp*	*Cyperus sp*

Table 2. Composition of fish collected beneath floating islands in Lekki Lagoon (Percentage weight).

Species	Floating Island		
	1 (kg)	2 (kg)	3 (kg)
Cichlidae			
Tilapia guineensis	20(17.00)	36.8(21.55)	46.2(23.18)
Tilapia mariae	10(8.50)	15.0(8.78)	20(10.04)
Hemichromis fasciatus	6.2(5.27)	7.6(4.45)	8.2(4.11)
Elapidae			
Elops lacerta	2.1(1.79)	1.6(0.94)	3.2(1.61)
Hepsetidae			
Hepsetus odoe	3.1(2.64)	1.1(0.64)	3.2(1.61)
Palaenonidae			
Macrobrachium vollenhoeveni	10.5(8.93)	10.2(5.97)	11.2(5.62)
Macrabrachium macrobrachion	5.6(4.76)	6.2(3.63)	8.70(4.37)
Portunidae			
Callinectes amnicola	10.1(8.59)	12.6(7.38)	13.2(6.62)
Total	117.6	170.8	199.3

Table 3. Comparison of fish caught with gillnet (50 mm mesh size) in the floating island (installed for 12 weeks) (40 x 30 m) and the open lagoon.

Operational type	Weight of fish caught (kg)	Percentage
Floating Island fishing (without acoustic)	60.0	33.33
Floating Island fishing with acoustic	85.0	47.22
Open water	35.0	19.44
Total	180.0	100.0

number of small planktophagus animals and fishes which fed on them (Solarin 1998).

This study identified the use of giant basket trap and gillnet in floating island fish harvest in the lagoon. This has yielded value and has increased the living standard of the fisher folks. Dibble et al. (1996) gave the list of methods used in floating island harvest as electro-shocker, divers, seine, rotenone, gillnet, drop or throw-nets, pop-nets, light trap, explosives, belt transect, rote-none and block-net, modified traps. They categorically stated that pop-nets, drop-nets and throw-nets seem to be most effective in sampling fish in aquatic macrophytes.

As the demand and price of fish increased, the number of floating island multiplied and this causes considerable

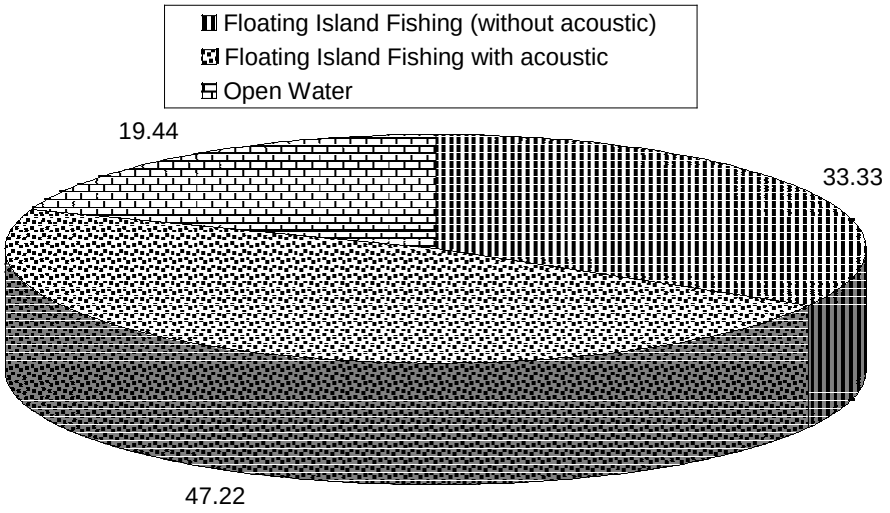

Figure 2. Percentage by weight of fish caught in floating island and open lagoon.

pressure on untouched fishing ground in the lagoon. The environmental consequences of the booming Iken fishery, the number of floating islands the lagoon can sustain, as well as the stock and recruitment of fishes in the lagoon are not known. During the dry season the floating island caused great nuisance in the lagoon by hindering fishing activities and transportation in the lagoon by covering the lagoon expanse. This was also reported by Suresh (2000) in Loktak Lake (India).

Virtuall free fishing is counter productive in terms of conservation and yield optimization. A fisherman takes care and harvests the installed Iken and temporarily owns the area of installation without dispute by other fisherman in the community. The fish shelters are traditional community based management system for the enhancement of the resources should be encouraged and refined (Solarin and Kusemiju, 2003).

Management measures to maintain optimal production from Iken fishery should include the use of luxuriant water hyacinth. This will reduce deforestation and erosion of the mangrove belt. This will additionally protects the nursery and breeding grounds of the commercially important fish species as well as the fish biodiversity and maintained fish production for sustainability. Communal or joint ownership of the Iken fishes should be encouraged to minimize conflicts which may arise from multiple ownership claims, more especially during heavy storm which displaces some of the floating island. Solarin and Kusemiju (2003) suggested two set should be for harvesting and the other set for recruitment of the juvenile life stages. The number of fish shelter should be controlled in order to optimize fish production and also to remove conflicts with other users of the lagoon (transportation and logging). The community based management demands full participation of the local community in the management process.

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