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# PERSPECTIVES IN THE DEVELOPMENT AND CONSERVATION OF FRESHWATER FISHERIES RESOURCES OF THE CROSS RIVER, NIGERIA.

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## ABSTRACT

The aveilable commercially important freshwater fisheries resources (fin and shell fishes) of the Cross River, their potential yield, production and state of exploitation are appraised. Emphasis is placed on fishing gears and methods that have adverse impacts on the persistence and abundance of the fisheries resources. Possible strategies for fisheries development include the introduction of finfish cage culture in the lakes of the middle reaches and the establishment of Egeria radiata (clam), Pachymelania bryonensis (periwinkle), Etheria elliptica (oyster) and Atya gabonensis (shrimp) 'farms' in the main river channel. Fisheries conservation strategies advocated include, among others, the enforcement of laws regarding fishing season closures, mesh-size regulation and prohibition of the use of obnoxious fishing devices such as ichthyocides and explosives. The continuous monitoring of environmental perturbations that may arise from industrial effluents and riparian crop agriculture is necessary in order to enhance early detection of lethal levels of toxicants capable of causing mass mortality of the fisheries resources.

## INTRODUCTION

There has recently been a considerable exploitation pressure on the fisheries resources of the inland waters of Nigeria, this being accentuated in part, by the prevailing economic distress and increased demand for cheap and high quality animal protein source. In their attempt to maximize production from the wild, most fishermen have resorted to the use of obnoxious fishing devices such as ichthyocides and explosives to increase their levels of exploitation. These can result in the extirpation of some fish species and disruption of the biotic integrity of freshwater aquatic ecosystems.

If fisheries resources are to be exploited for sustained fish

output to meet the food and occupational requirements of the people, it is imperative that urgent steps be taken to conserve these resources through rational fishing strategies. This paper examines the status and resources potential of the various fisheries of the Cross River (Nigeria). Attempts are made to put in perspectives, the strategies for an integrated development and conservation of the fisheries resources.

## THE CROSS RIVER SYSTEM

The Cross River ($7^{o}30'$ - $10^{o}00'$E, $4^{o}15'$ - $7^{o}20'$N) is the principal drainage system of southeastern Nigeria. It lies mainly in the equatorial forest zone although north of latitude $7^{o}00'$N, the tributaries traverse derived savanna which alternates with forested areas. The river basin covers an area of 54,000km$^2$ with 40,000km$^2$ lying within Nigeria and 14,000km$^2$ in Cameroon. The soil of the floodplain consists of alluvium developed from sediments deposited by the river (ENPLAN, 1974). Presumably, this feature, together with the meandering middle reaches and associated natural lakes and the braided channel of the lower reaches (see Moses, 1987) determine the productivity of the river, which according to Moses (1987) is one of the highest (in terms of fish catch) of the medium size tropical African rivers.

An important hydrological feature of the Cross River is its flooding regime which synchronizes with the rainfall pattern. The river is subject to seasonal annual flooding during heavy rains in July - October, with 8,303km$^2$ of the basin area being liable to inundation (Moses, 1981). This hydrometeorological regime positively correlates with the biomass of fish caught (Moses, 1987).

## FISHERIES RESOURCES

The freshwater fisheries resources of the Cross River comprise finfishes (teleosts) and shellfishes (molluscs and macrocrustaceans). The dominant species of finfishes exploited by artisanal fisheries are presented in Table 1. The commercially important molluscan species are: Egeria radiata (clam), Etheria elliptica (oyster) and Pachymelania bryonensis (periwinkle). Among the macrocrustaceans,

Table 1. The commercially important freshwater fishes of the Cross River.

| Family | Species |
|---|---|
| Notopteridae | Papyroccranus afer |
| Mormyridae | Mormyrops deliciosus |
| | Mormyrus hasselquistii |
| | Mormyrus rume |
| Hepsetidae | Hepsetus odoe |
| Characidae | Brycinus imberi |
| | Brycinus macrolepidotus |
| | Hydrocynus forskalii |
| Citharinidae | Citharinus citharus |
| Cyprinidae | Labeo coubie |
| Bagridae | Chrysichthys nigrodigitatus |
| Schilbeidae | Parailia pellucida |
| | Schilbe mystus |
| Clariidae | Clarias gariepinus |
| | Clarias macromystax |
| | Heterobranchus longifilis |
| Malapteruridae | Malapterurus electricus |
| Mochokidae | Synodontis schall |
| Channidae | Parachanna obscura |
| Cichlidae | Tilapia zillii |
| Clupeidae | Cynothrissa mento |

Atya gabonensis and Machrobrachium vollenhovenii are the major species commercially exploited in the river.

## RESOURCES POTENTIAL AND PRODUCTION

Based on fish catch-basin area relationship, Moses (1981) estimated the potential yield of freshwater finfishes from the Cross River at 8,266t.yr$^{-1}$. The lake complexes of the middle reaches have a mean potential yield of 57.4kg.ha$^{-1}$ (range 53.2 – 64.6kg.ha$^{-1}$) according to estimates based on morphoedaphic index (Moses, 1987). These figures indicate that the river supports a considerable stock of finfishes which according to Moses (1980) has not yet been exploited at the maximum sustainable yield level. The annual production from the Nigerian portion of the river is c.8,000t.yr$^{-1}$ (Moses, 1979).

Moses (1990) has noted that the Egeria fishery yields about 1970t.yr$^{-1}$ (total weight) equivalent of 700t.yr$^{-1}$ (flesh weight); these represent 82% of the maximum sustainable yield (398.4kg.ha$^{-1}$ total weight; 112.2kg.ha$^{-1}$ flesh weight). The expansion of this fishery by increasing fishing effort will be unrealistic since any indiscriminate increase in exploitation rate above the present yield would lead to over fishing and a rapid decline in the standing stock. Although there are no estimates of the potential yields and production of E. elliptica and P. bryonensis, the several tonnes of their empty shells in the riparian villages throughout their ranges of occurrence, attest to the considerable stocks of these molluscs in the river.

No records are available on the standing stocks and production of freshwater shrimp resources of the Cross River.

## STATUS OF THE FISHERIES

### Finfish fisheries

The number of artisanal fishermen in the Cross River basin is uncertain. Moses (1979) recorded that they were c.4000. This number must have increased over the years due to school leavers going into fishing because of unemployment in offices. It is possible that they currently number c.6,000. Less than 40% of these

are full-time fishermen while the majority fish on part-time basis. The fishing crafts, gears and methods used in the river are described by Moses (1979, 1980) and Etcheri and Lebo (1983).

The tilapiines are the dominant fishes, forming 23% of total catch; they are caught mostly in November-December with valved basket traps; other commercially important fishes include mormyrids (16.1%), clariids (20%) and bagrids (12.2%); the composite of other species form 22% of total catch (Moses, 1980). Clariids constitute the dominant element of swamp fishery, being caught after bailing water from flood ponds. The bagrids, particularly Chrysichthys nigrodigitatus, are known to migrate from the estuary upstream to their breeding and nursery grounds in the floodplains during early rains when the river level is rising. This is evidenced by the fact that most of them caught during this period have ripe gonads.

The migrating fish are most abundantly caught in May-June by the use of gill-nets and long-lines. Juveniles that leave the floodplains with the receeding flood in November-December are also caught with small-meshed nets. The reproductive success of this fish (in terms of offspring) and future recruitment into the fishery are dependent on the number of spawners that arrive and spawn in the floodplains. Thus the mass-capture of potential spawners has an adverse effect on the number recruited into the fishery in subsequent seasons. The interception of returning juveniles also reduces the size of fishable stock of the species. It is essential to exploit Chrysichthys in a way that the population can be resilient, responding to normal increases in fishing effort with increased survival and growth rate. The clupeids, schilbeids and juveniles of other fishes are caught mainly with atalla lift-net.

The use of ichthyocides and explosives as fishing devices in the Cross River system has been reported by Moses (1980), Etcheri and Lebo (1983) and Udolisa and Lebo (1986). Commonly used ichthyocides include Gammalin 20 and narcotic extracts from macrophytes such as Derres elliptica, Acacia pennata and Tephrosia vogali. These fishing devices are non-selective, destroying target and non-target fish species, eggs, fry, fingerlings and other biotic components (e.g. plankton, amphibians, macroinvertebrates) of the ecosystem. These chemicals also pollute the water, impairing its use for domestic purposes.

## Shellfish fisheries

*E. radiata* is fished by men of 18–30 yr of age and they number c.250. Almost all the *Egeria* fishermen fish on part-time basis. The main fishing vessels are dug-out canoes. The clam is fished in November–May, with peak in January–February. The fishermen fish in groups of 2–3 persons; fishing involves diving and locating the partially or fully burried clams with the feet and hands before picking them up into baskets which are emptied into the canoe when full. There is no size selection during fishing since juveniles of less than 4cm total length have been found among clams displayed for sale at Itu bridge-head market. The catch/fisherman/fishing hour is 67–133 clams during peak fishing season but may be as low as 33–50 clams for the few fishermen that fish during the rains.

*P. bryonensis* is fished from the shores of the river in a way analogous to that of *E. radiata*. Fishing is almost all year-round but with higher intensity in November–February. There are no catch statistics but field observations indicate that the catch is quite substantial with increasing proportion of juveniles in recent years. The large number of juveniles caught is an index of over-exploitation and declining fishery. However, further investigation is needed before this assertion can be upheld.

*E. elliptica* is fished by chipping off the encrusted shells from rocks using blunt knives. The valves are pried open with a knife and the flesh removed for consumption. Detailed quantitative information regarding the standing crop and rate of exploitation are non-existent.

There are no records of the standing crop of available stocks of freshwater shrimps in the Cross River. *A. gabonensis* is fished by means of brush traps (Etcheri and Lebo, 1983) and by diving and catching the shrimps with bare hands. The latter method is most effective in the dry season when water transparency is high. According to Lebo (pers. comm), the rate of exploitation of this shrimp has dramatically increased in recent years *vis-a-vis* a decade ago when they were fished and eaten by only children. *M. vollenhovenii* is caught mainly with valved basket traps.

FISHERIES DEVELOPMENT

The development of the fisheries of the Cross River is necessary to alleviate the prevailing socio-economic problems of protein defficiency, poverty and unemployment.

Most artisanal fishermen operate as individuals or in small groups of 2 - 3 persons. With the present cost of dug-out canoes (₦3,000 - 10,000) and fishing gears, it is difficult for them to procure these implements. If the fishermen could be encouraged to cooperate by pooling their meagre resources (e.g. funds, fishing crafts, gears and operational bases), the catch would improve.

The production of teleosts from the river can be boosted by introduction of cage culture in the lakes of the middle reaches. These lakes are comparable to those in the Niger Delta which Otobo and Clidoro (1981) considered suitable for cage culture. Details of cage construction with cheap and locally available materials as well as management procedures are given by these authors. The tilapiines (e.g. Sarotherodon galilaeus, Tilapia mariae and Tilapia zillii) and clariids (e.g. Heterobranchus and Clarias species) which naturally occur in the river basin, have high potentials for cage culture; they are known for their hardiness, rapid growth and resistance to high population densities. These species spawn in the floodplains from where their fry and fingerlings can be obtained for cage stocking.

Egeria, Pachymelania and Etheria fisheries can be developed to increase their yields. Egeria 'farms' can be established at suitable sites where juvenile clams are 'transplanted' and allowed to grow to marketable sizes before being fished as is done in the lower reaches of the Volta River, Ghana (Whyte, 1981). Pachymelania 'farms' analogous to those of Egeria can also be established to supplement periwinkle production. Consideration should also be given to the cultivation of E. elliptica by providing suitable artificial substrates for the spat to settle and grow as is done for the mangrove oyster, Crassostrea gasar in the Niger Delta (Afinowi, 1985). As noted by Powell (1983), the yield from shrimp fishery can be increased by providing suitable artificial shelters (e.g. rock crevices, root masses and holes) for A. gabonensis from where the fully grown shrimps

can be harvested. Moreover, there are considerable unexploited stocks of Machrobrachium dux, Desmocaris trispinosa and Caridina africana in small streams and ponds in the Cross River basin. Shrimp production from the wild can be improved by tapping from these unexploited stocks.

## FISHERIES CONSERVATION

The Government should consider declaring the period of upstream migration of C. nigrodigitatus, a closed season for fishing; this would enable the potential spawners reach their breeding grounds. The period when the juveniles are returning should also be closed to fishing since this would facilitate their safe arrival at the estuary where they would feed, grow, mature and be recruited into the fishable stocks. The enforcement of laws against the use of small mesh sizes of gill-nets and gears like atalla lift-net which catch large proportions of juvenile fish should be given a priority to ensure the continued survival of juveniles of commercially important teleost fish resources.

Laws prohibiting the wanton destruction of fisheries resources by the use of ichthyocides and explosives should be enforced. The Nigerian Newsprint Manufacturing Company at Oku Iboku is known to release large amounts of effluents into the Cross River. The floodplain crop cultivation during the dry season (Moses, 1987) may involve the use of fertilizers and pesticides in some areas of the river basin; these can easily enter into the river through surface runoff. It is thus important to continuously monitor the levels of toxic chemicals in the river so that efforts can be made to avert their rising to concentrations capable of destroying the various fisheries of the river.

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