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Exploitation of Fishes from the Andoni River System, Niger Delta, Nigeria and Conservation Strategies

[1]A. Francis, [1]F.D. Sikoki and [2]E.J. Ansa
[1]Department of Animal Science and Fisheries, Faculty of Agriculture,
University of Port Harcourt, P. M. B. 5323 Port Harcourt, Nigeria
[2]Department of Animal and Environmental Biology,
African Regional Aquaculture Centre, Aluu, Port-Harcourt

Abstract: One year (January, December, 1999) length-frequency data sampled from catches of five randomly selected artisanal fishers that use unmotorized canoe were analyzed using FiSAT (FAO-ICLARM Fish Stock Assessment Tool) to obtain exploitation ratio of eleven fish species. Under exploitation was evident in 27.30% cases (3fish species) viz, Galeoides decadactylus: E (exploitation ratio) was O. 2000; Chrysichthys nigrodigitatus (E = O.2500) and Sarotherodon melanotheron (E = 0.5240). In 63.70% cases i.e. seven species namely Ethmalosa fimbriata (E = 0.5240); Eucinostomus melanopterus (E = 0.4589); Ilisha africana (E = 0.5540) Liza grandisquamis (E = 0.4560), Lutjanus goreensis (E = 0.740), Pomadasys jubelini (E = 0.5290) and Tilapia guinensis (E = 0.4820) the fishery can be described as being under optimum exploitation. Only Pseudotolithus elongatus (9%) is overfished. Conservation strategies include establishment of grow out brackish water fish ponds, propagation by natural seeds, control of pollution and environmental degradation.

Key words: Unmotorized, exploitation, chysichthys, pollution

INTRODUCTION

The intensity of fishery resource exploitation within the West African coastal area, a major occupation for millions (made up of man, women and children), is an age long occupation. This intensity has increased over the years with increasing human population especially within the rural and sub-urban settlements. About 50-74% of Nigeria's 500,000 MT of fish come from the artisanal fishery sub-sector while commercial trawling contributed less than 10% of the total marine catch, riverine and lake fishery. In the West African sub-region artisanal fishery accounts for over 80% of domestic landings (FAO, 1989).

Exploitation ratio gives picture of the status of a fish stock as to whether it is over fished or not on the assumption of an exploitation optimum E(opt) of 0.5, which in turn rests on the basis that sustainable yield is optimized when fishing mortality coefficient is equal to natural mortality coefficient. Studies on the exploitation level of fisheries in Nigeria is scarce. Since fish stock assessment is in its embryonic stage in Nigeria, there is need for accumulation of data, which will form the basis for management of the coastal fisheries. This study aims at showing the fisheries status within the Andoni river brackish water system since the river is representative of the state of the artisanal capture fishery in the coastal states of Nigeria and most of West Africa.

MATERIALS AND METHODS

Data for this study were procured from five randomly selected catches of artisanal fishers that use dug-out canoe and paddle. The fishers land their catches at Kaa waterfront, one of the two main landing sites for the Andoni fishers. The second landing site is at Oyorokoto. (Fig. 1).

The Andoni river system is known for its numerous creeks, rivulets, swamps and exposed mud flats at ebb tide. Red and white mangrove trees (*Rhizophora* and *Avicenia* sp.) border the creek and river channels providing breeding and nursery grounds through their stilt root and pneumatophores respectively, for fingerlings of fishes like the mullets and tilapias.

Nympa fructicans (Nympa palm) is rapidly replacing the mangrove trees along most of the creeks.

The Andoni river system located within latitudes 4 28, to 4° 45, North and longitude 7° 45, East, together with other rivers form the Niger Delta and also drains the River Niger into the Atlantic ocean. The Niger Delta is rich both economically and in biodiversity (Francis, 2003). The climate and other features of the River system have been described in (Francis, 2003; Francis and Sikoki, 2003; 2004).

Corresponding Author: A. Francis, Department of Animal Science and Fisheries, Faculty of Agriculture, University of Port Harcourt, P. M. B. 5323 Port Harcourt, Nigeria

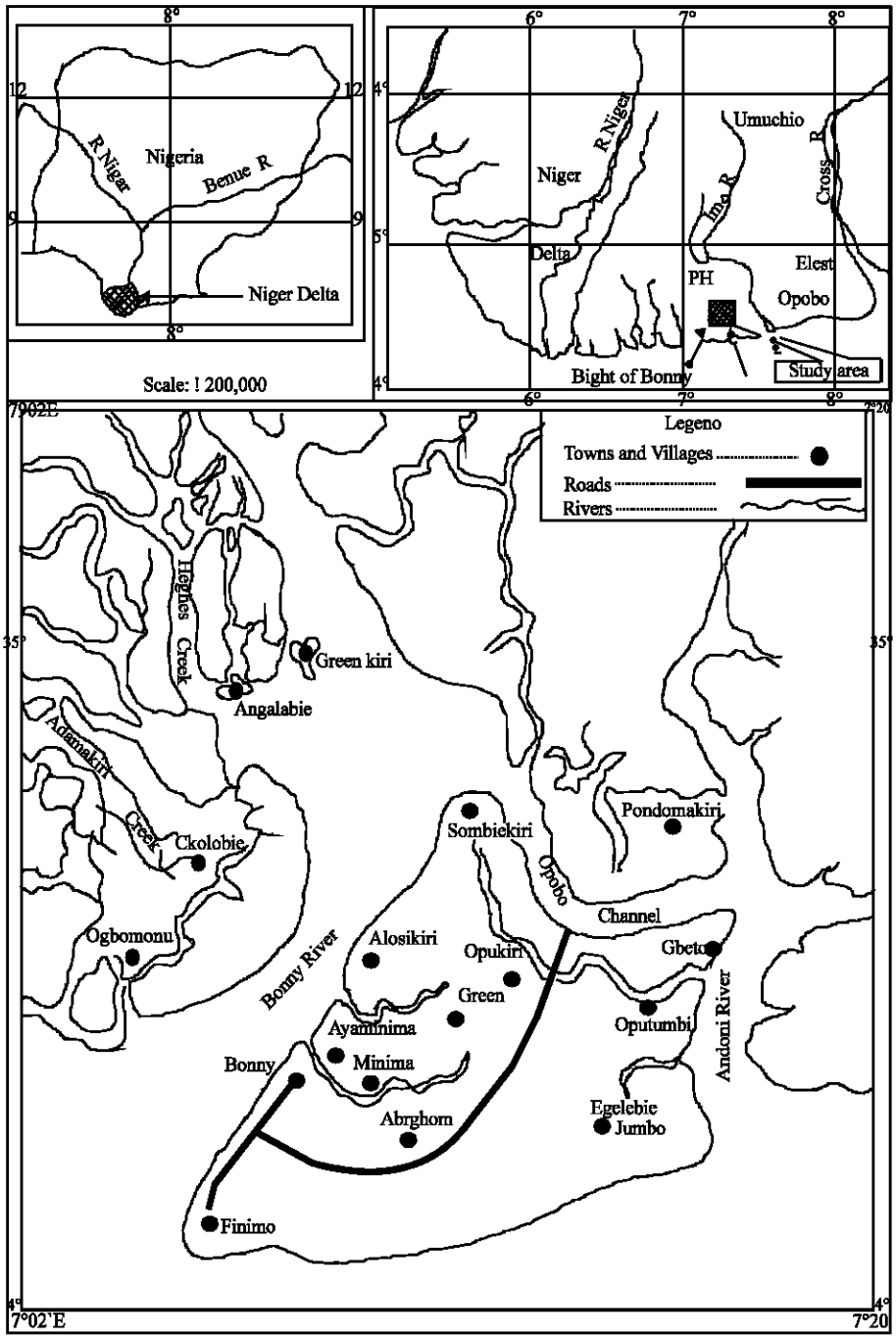

Fig. 1: Part of Niger delta showing bonny and andoni riners

Fish identification and measurement: Identification of fish to species level was made possible through the keys of (Reed *et al.*, 1967; Tobor, 1968; Blaches *et al.*, 1970; Schneider, 1990). Bi-weekly length-frequency data consisting of all the Total Length (TL) measurements in centimetres were obtained from the artisanal catches using the procedure out lined in Pauly in which all fishes in a catch were singly measured if the catch assemblage was about 5 kg. For catches exceeding 5 kg and of different cohort sizes, bigger fishes were picked and measured while the remainder of the catch was sorted into subgroups. Each subgroup was measured as a sub-sample and multiplied by the number of subgroups to obtain over all catch data. Total length of the fish was the measurement from the anterior-most part of the snout to its caudal fin using transparent plastic ruler.

Table 1: Exploitation ratio of fish species from the andoni river system, niger delta, nigeria (1999 data)

S/N	Fish species	Exploitation ratio	Exploitation as %	M/k
1	Chrysichthys nigrodigitatus	0.2500	25.00	2.22
2	Ethmalosa fimbriata	0.5240	52.40	1.66
3	Eucinostomus melanopterus	0.4589	46.00	2.23
4	Galeoides decadactylus	0.2000	20.00	2.11
5	Ilisha africana	0.5540	55.40	2.25
6	Liza grandisquamis	0.4560	46.00	2.23
7	Lutjanus goreensis	0.5140	51.40	2.23
8	Pomadasys jubelini	0.5290	52.90	2.21
9	Pseudotolithus elongatus	0.6814	68.14	1.77
10	Sarotherodon melanotheron	0.3150	32.00	1.72
11	Tilapia guinensis	0.4820	48.20	1.95

Statistics: The total length measurements were converted into length frequencies having constant class interval of 1 cm and analysed for mortalities using FiSAT Software package (Gayarilo and Pauly, 1995). The out put from the mortalities routine in FiSAT was employed in the manual calculation of exploitation ratio using the formula:

E = F/Z where
E = Exploitation ratio
F = Fishing mortality coefficient, and
Z = Total mortality coefficient.

The exploitation ratio was calculated for 11 commercially important fish species.

RESULTS

The result of the exploitation ratio of 11 commercially important fish species from the Andoni River system is in Table 1. The result can be divided naturally into two groups of high and low values of exploitation ratios. The high value group ranged between 0.4560 (*L. grandisquamis*) and 0.6814 (*P.elongatus*) i.e. eight fish species altogether while the remaining 3 fish species had low value exploitation ratios ranging between 0.2000 (*G. decadactylus*) and 0.3150 for *S. melanotheron.* Expressed as percentage, death due to fishing activity ranged between 46-68% (8 fishes) while in 3 fishes 20-30% of death was due to fishing activities.

DISCUSSION

The exploitation ratios reported in this study are valid for scientific interpretation due to the employment of M/K (Natural mortality to growth coefficient ratio). As a validity tool values of M/K usually range between 1.00 and 2.5 Beverton and (Holt, 1959) and is supposed to be constant for a group of closely related families or taxa. The M/K values in Table 1 as product of the mortality estimations from FiSAT prove that the mortality values themselves, the input for the calculation of these exploitation ratios were valid.

Hart (1997) obtained exploitation ratio of E = .4048 for *Mugil cephalus*, a species closely related to *L. grandisquamis* from the Bonny River, an adjoining river to the Andoni River. The closeness of the exploitation ratios of .4048 and .4560 for the two mullets seems to indicate that capture fishery within the Niger Delta brackish water system may be at the same level of exploitation and impact impinging upon it from the Niger Delta environmental factors discussed below.

The above calculated exploitation ratios are acting as guide to the dynamics within the Andoni River ichthyofauna. Generally, it can be seen that the multispecies fishery of the river system seems, relatively, to be at the same level of exploitation. The reason for this statement stems from the fact that the exploitation ratios of fish species within the high value group represent 72.73% of cases while the remaining 27.27% case for the low value group mathematically, can be deemed significantly different from the first group and thus ignored.

However, because fishery management deals with discrete organisms, these exploitation ratios can now be used to delineate the fisheries into various exploitation status. Thus, going by the report of Tobor (1991) for an exploitation optimum of Eopt= 0.5, *P. elongatus* can be classed as over exploited with an E of 0.6814. In the same vain; the species *I. africana* (E = 0.5540), *P. jubelini* (E = 0.5290); *E. fimbriata* (E = 0.5240), *L. goreensis* (E = 0.5140), *T. guinensis* (E = 0.4820), *E. melanopterus* (E = 0.4589), *L. grandisquamis* (E= 0.4560) can be described as being in a state of optimum exploitation (i.e., 63.63%) of the fishery. The remaining 27.27% of the multiple fishery (consisting of *G. decadactylus, C. nigrodigitatus* and *S. melanotheron* are underexploited. As these exploitation ratios have indicated that only 9% of the multiple fishery is over fished yet depletion of fish stock has set in since the 80^s Abohweyere (1989), it follows that causes of fish death other than over fishing is exerting much impact on the fishery. Besides over fishing other factors aiding rapid depletion of fish stock within the coastal states in Nigeria as a whole include oil pollution (Ezenwa *et al*., 1987); mismanagement (WCS, 2006);environmental stress caused by oil exploratory and exploitatory activities (Hart,1997) and fish predation (King,1984). Other contributory factors to the high natural mortality observed within this river include the report of Francis (2003) that habitat degradation, pollution, obnoxious and illegal fishing activities were threatening extinction of fish species like S. melanotheron. Within the Andoni River brackish water system, environmental degradation such as the felling of the Rhizophora and *Avicenia species* as fuel wood is also an occupation for

the rural dwellers who sell the wood products as firewood (fuel wood) for fish mongers who; un turn use them for smoking of fish before marketing. Encroachment, and replacement of the mangrove trees with *Nympa fructicans* is also posing a serious environmental issue since the shades formed by the pneumatophores and stilt root of the *Avicenia* and *Rhizophora* respectively, form breeding and nursery grounds for brackish water fish fingerlings within coastal creeks (Ezenwa *et al*., 1987,1990). Fixed fence trap whose practice as fishing method has reduced drastically within the Andoni River system, also exerts deleterious effects on the fish fauna since the size of fish to be entrapped are not selected. Destructive influence on the coastal ichthyofauna as a whole also include activities of fishing trawlers that use code end stretch mesh sizes smaller than 44mm (1 3/4inches) when shrimping within the approved area or less than 76 mm (3inches) when trawling for fish within the inshore waters which is against the stipulation in the Sea Fisheries Decree of 1992 (CEDA, 1998).

Defiant activities of motorized fishing boat to fish within the first five nautical miles of the waters of the Nigerian continental shelf (CEDA 1998) also has its toll on the artisanal fishery to deplete stock faster than expected.

Conservation strategies: To avert a more rapid depletion and eventual destruction of the potentially viable fishery industry within the coastal states in Nigeria and West Africa as a whole, the following conservation strategies have been put forward:

- Public enlightenment: This would involve the use of various communication systems to intimate beneficiaries and fisherfolks of the adverse effects of uncontrolled use and destructive harvesting of fishery resources including the effects of environmental degradation on the coastal fishery resource.
- Establishment of brackish water grow-out ponds. By this strategy specified quantity of fingerlings from the wild can be introduced into brackish water fish ponds, cages and pens; and reared to table size since most of the brackish water fish species, for now do not reproduce in captivity.
- Propagation by natural seed. In this method, milt and eggs from ripened males and females captured during the breeding season can be collected for external fertilization and the embryos reared in enclosures up to table size. The essence of the second and third strategies above is to provide alternate source of employments, income and food security for the artisanal fishers thereby reducing the pressure on the natural ecosystem and allowing the fishery to renew itself for sustainable use and conservation of biodiversity.
- Provision of smoking kilns at reduced price for the fish mongers thereby discouraging environmental degradation.
- Creation of marine protected areas that would also check environmental degradation.
- Establishment and enforcement of operational standards for oil exploratory and exploitatory activities, and other industries located close to fishing environment so as to control pollution of the aquatic ecosystem to the detriment of the ichthyofauna.

RECOMMENDATION

- Management of the coastal fisheries can only be feasible through availability of statistics from fish stock assessment therefore, there should be large scale fish stock assessment of the coastal fish stock in Nigeria and West Africa.
- Stipulations in the Sea Fisheries Decree of 1992, regulations in the code of conduct for responsible fishery and all fishery related international regulations and guidelines should be enforced in the coastal states of Nigeria, and closely monitored.

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APPENDIX 1

Total mortality of fish species from the andoni river artisanal fishery(1999 data)

S/N	Species name	Total mortality (Z)
1	*C. nigrodigitatus*	0.88
2	*E. fimbriata*	1.64
3	*E. melanopterus*	2.92
4	*G. decadactylus*	2.45
5	*I. africana*	2.42
6	*L. grandisquamis*	1.60
7	*L. goreensis*	1.79
8	*P. jubelini*	1.57
9	*P. elongatus*	3.83
10	*S. melanotheron*	3.27
11	*T. guinensis*	2.78

Source :(Francis, 2003)

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