GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 10, NO. 2, MARCH 2004: 249 - 256
COPYRIGHT(C) BACHUDO SCIENCE CO. LTD. PRINTED IN NIGERIA. ISSN 1118-0579

FISHING EFFORT STATISTICS OF THE ARTISANAL FISHERIES OF THE CROSS RIVER ESTUARY, NIGERIA.

S. HOLZLÖHNER, F.M. NWOSU and U. I. ENIN

(Received 9 December 2002; Revision accepted 22 December 2003)

ABSTRACT

Frame surveys were carried out in 1997 and 1998 to assess the effort statistics of the artisanal fisheries of the Cross River Estuary. These surveys covered the inner Estuary and the West coast of the outer Estuary. Fishing effort was taken as number of fishers, number of canoes, and types of fishing gears. A total of 64 fishing villages were surveyed (51 in inner and 13 in outer Estuary), and brought on map. The total number of fishers was 87,990 (39,090 in the inner and 48,900 in the outer Estuary). The mean number of fishermen per settlement was 1,294 (782 in the inner and 3,762 in the outer Estuary). The total number of canoes was 19,023 (10,303 in the inner and 8,720 in the outer Estuary). The mean number of canoes per settlement was 280 (206 in the inner and 671 in the outer Estuary). About 12 different fishing gears are in use in the area, with gillnets, long line, beach seine, traps, anchor (stow) net and purse seine being the most widely used. The fishing crafts were mainly non-motorized dugout canoes with the exception of the purse seine and anchor net canoes in the outer Estuary.

KEYWORD: *effort*; fisheries; artisanal; estuary; Nigeria

INTRODUCTION

Excessive fishing effort has been recognized as one of the prime problems in many cases where resource over-exploitation occurs (ACMRR, 1983). Regulations of fishing effort (e.g. reduction of number of boats, number and type of gears), time of fishing, mesh size regulation, etc.) is an important management approach. However, lack of comprehensive effort data is an obstacle to management of fisheries resources. In addition, it is important to know how much fishing effort have been used to catch a given quantity of fish. This enables an index of abundance to be calculated (Holden and Raitt, 1974). An effective method for assessing the fishing effort in an area or for a given fishery is by undertaking an inventory, usually through a 'frame survey' (FAO, 1980).

In the Cross River Estuary, only a baseline survey of the fishing settlements by Antai *et al.* (1993) on behalf of the International Fund for Agricultural Development (IFAD) was available. This survey that was mainly socio-economic in nature, provided some fishery information for the five Local Government Areas (L.G.As.) bounding the Cross River Estuary (Mbo and Oron in Akwa Ibom State; Akpabuyo, Calabar and Odukpani in Cross River State). A total of 129 fishing settlements, 22,757 fishermen and 7,147 canoes were reported in the five L.G.As.

The present report is a result of 'frame survey' conducted in the inner and West coast of the outer Estuary. The survey consisted of a fishery part which is here presented, and a demographic/socio-cultural part (Holzlöhner, Enin and Nwosu, 1997; Holzlöhner et al., 1998). The target of the fishery part was identifying the fishing settlements (landing sites), fishing units (canoes and fishers), as well as obtaining information on fishing gear types and fishing techniques of the area. These form the effort statistics of the different fisheries of the Cross River Estuary.

MATERIALS AND METHODS

This survey spanned through 1997 and 1998. FAO (1980) 'ground survey' method was employed. An existing map of the Cross River Estuary, Nigeria, was obtained from the Department of Geography and Regional Planning, University of Calabar. This map was converted into a study-working map. For purposes of convenience, the study area (Cross River Estuary) was divided into two sections (inner and outer) with an imaginary border at latitude 04°45'N. The survey was conducted upstream in the arms of the Cross River and the Calabar River to the limits of the occurrence of mangrove vegetation (see indications in Fig 2). The border of the survey downstream was Westpoint (Fig. 1).

S. HOLZLÖHNER, Department of Biological Oceanography, Institute of Oceanography, University of Calabar, Calabar, Nigeria.
F. M. NWOSU, Department of Biological Oceanography, Institute of Oceanography, University of Calabar, Calabar, Nigeria.
U. I. ENIN, Department of Biological Oceanography, Institute of Oceanography, University of Calabar, Calabar, Nigeria.

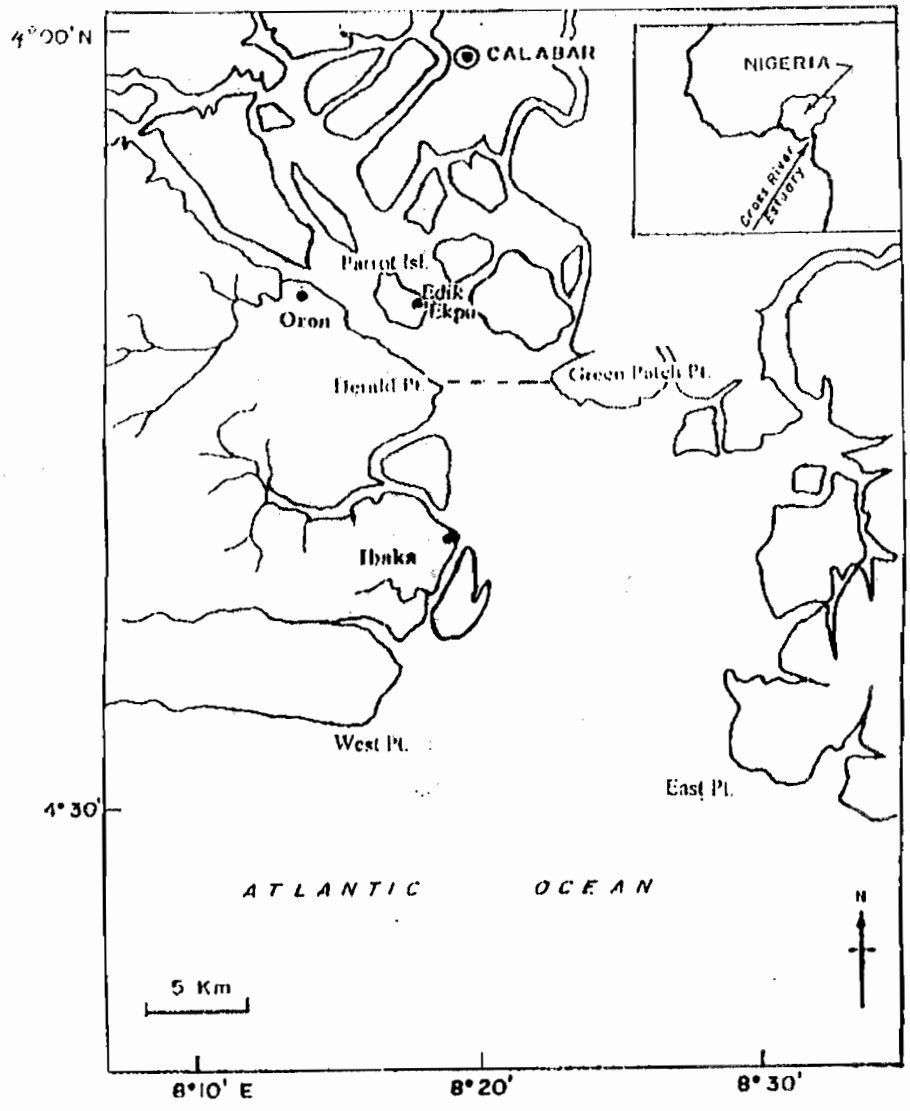

Fig. 1: Cross River Estuary

The Estuary was visited with the research boat of the Institute of Oceanography 'Planktonfisher'. Each fishing village/settlement brought on map with its proper coordinates using the Global Positioning System (GPS). Two to three villages were checked each day during the study period. Altogether were performed 26 boat's trips of one day duration each. Information was sought and obtained using the questionnaire-interaction method and observation on site. Questions included the number of fishers, number and types of canoes, and types of gear. Elementary techniques of descriptive statistics (mean, percentage) were employed.

The survey team consisted usually of two scientists and one technician. It was ensured that at least one member of the team had command of the main languages of the survey region (Effik/Ibibio). Biased answers – intended or caused by misunderstanding – were prevented by asking the same question in several ways or asking different groups of fishers in the same settlement.

RESULTS

A total of 64 fishing villages/settlements were found in the study region (51 in the inner, 13 on the West coast of the outer Estuary (Tables 1 and 2, Figures 2 and 3)). Tables 1 and 2 also include number of canoes, number of fishers and type and occurrence/distribution of fishing gears/methods in the surveyed villages/settlements.

The number of fishers in the entire survey area was 87,990 (39,090 in the inner, 48,900 in the outer Estuary). The mean per settlement was 1,294 fishers (782 in the inner and 3,762 in the outer Estuary). A total of 19,023 canoes were operative in the area (10,303 in the inner, 8,720 in the outer Estuary). The mean per settlement was 280 canoes (206 in the inner and 671 in the outer Estuary). The canoes in the inner Estuary were non-motorized, but the bigger ones in the outer Estuary, especially for purse seine and anchor net fishery, were equipped with outboard engine.

Table 1. Fishing settlement and fishing gears in the inner Cross River Estuary

Name settlement	Position	No. Boats	No. Fishers	Gill-net	Boat seine	Beach seine	Push net	Cast net	Trap	Weir trap	Hand line	Long line	Har-poon	Hand picking
Ine Anakpa Uruan	4°52.36N 8°15.32E	300	2,000?	+	-	-	-	+	+	-	-	+	+	-
Ine Etak Ukom	4°54.94N 8°15.68E	120	360	+	-	-	-	-	-	-	-	+	-	-
Ine Ekot Inyang Idung Ine Mbak	4°52.66N 8°15.12E 4°52.24N 8°14.41E	20	80	+	-	-	-	-	-	-	-	+	-	-
Ine Inua Akpa	4°53.85N 8°15.98E	9	27	+	-	-	+	+	-	-	-	+	-	-
Ine Udo Okobo	4°52.44N 8°17.01E	200	800	+	-	-	-	-	-	-	-	+	-	+
Ine Udo Akpa Efut	4°52.27N 8°17.01E	100	300	+	-	+	+	+	+	-	-	+	-	-
Ine Nung Ikono Ufok (Ine Akpan Ndo)	4°50.95N 8°18.72E	300	1,300	+	-	-	-	+	-	-	-	+	-	-
Ine Akpan Ufak	4°51.25N 8°18.88E	100	400	+	-	-	-	+	-	-	-	-	-	-
Ebisuo Kiri	4°51.58N 8°18.84E	16	48	+	-	+	+	-	+	-	-	+	-	-
Ine Nkanwaha	4°49.61N 8°20.06E	140	560	+	-	+	+	+	+	+	-	+	-	-
Edik Ukpa	4°52.19N 8°21.08E	60	240	+	-	+	+	+	+	+	-	+	-	-
Ine Ete Effiom (Edik Ikwa)	4°49.17N 8°21.49E	150	600	+	-	+	+	+	+	+	-	+	-	-
Ine Mbuk Anyanka	4°51.62N 8°21.84E	60	180	+	-	+	+	+	-	-	-	+	-	-
Ine Akpa Ndo Okobo	4°50.87N 8°18.63E	50	150	+	-	-	+	-	-	-	-	+	-	-
Ine Mkparawa (Nnung Ikono)	4°51.20N 8°13.92E	20	50	-	-	-	-	-	-	-	-	+	-	-
Esuk Mma	4°48.45N 8°15.57E	1,000	4,000	+	-	+	+	+	-	-	-	+	-	-
Ine Emoeei	4°48.12N 8°15.75E	20	80	+	-	-	-	-	-	-	-	+	-	-
Edik Ekpu (Obio Ufuro)	4°48.97N 8°17.95E	750	3,000	+	-	-	-	-	-	-	-	-	-	-
Edik Okon (Esuk Mbiam)	4°47.10N 8°16.41E	1,500	6,000	+	-	+	+	+	-	-	-	+	-	-
Ine Attah	4°51.87N 8°15.61E	30	90	+	-	-	-	-	-	-	-	-	-	-
Ine Esa Isiet	4°54.03N 8°14.12E	32	64	+	-	-	-	-	+	-	-	+	-	-
Ine Afa Uruting	4°47'22N 8°21.71E	600	2,400	+	-	-	-	+	+	-	-	+	-	-
Name settlement	Position	No. boats	No. fishers	Gill-net	Boat seine	Beach seine	Push net	Cast net	Trap	Weir-trap	Hand line	Long line	Har-poon	Hand picking
Ine Ibighi Edu	4°51.67N 8°13.02E	26	78	+	-	+	+	-	+	-	-	+	-	-
Ine Inua Edik	4°52.28N 8°11.49E	100	300	+	-	+	+	+	+	-	-	+	-	-
Ine Nnung Ikono	4°52.44N 8°13.92E	25	50	+	-	+	+	-	+	-	-	+	-	-
Ine Ekot Edung (Esit Iso Okpo)	4°53.15N 8°13.45E	300	1,200	+	-	+	+	+	+	-	+	+	-	+
Ine Eman Ukpa	4°53.47N 8°13.31E	500	2,000	+	-	-	-	+	+	-	+	+	-	+
Ine Barracks	4°54.72N 8°10.48E													
Ine Ndon Ebon (Akpa Ukim)	4°52.38N 8°12.98E	48	144	+	-	+	+	-	+	-	-	+	+	+

Ine Efik (Ine Ikot Nkim)	4°55'08N 8°15'78E	300	900	+	-	-	-	-	-	-	+	+	+	-	
Ine Nung Ikono Ufok	4°56'78N 8°17'24E	200	600	+	-	-	+	-	-	+	-	-	+	-	
Ine Etak Ukana II	4°57'16N 8°14'27E	25	50	+	-	-	-	+	-	-	-	+	-	-	
Ine Utan Udia	4°56'45N 8°12'40E	30	90	+	-	-	-	-	-	-	-	+	-	-	
Ine Afia Offiong	4°58'67N 8°11'13E	60	120	+	-	-	+	+	+	-	-	+	-	+	
Ine Ekot Inyang	4°57'76N 8°11'11E	35	105	+	-	-	-	-	+	-	-	+	-	+	
Ine Etak Ukana I	4°59'23N 8°10'46E	500	1,500	+	+	-	+	+	+	-	-	+	+	+	
Ine Ndoroffiom	4°59'53N 8°09'56E	30	90	+	-	-	-	-	-	-	-	+	-	-	
Akpatre Efe	5°01'75N 8°08'89E	214 ?	642 ?	+	-	-	-	+	+	+	+	+	-	+	
Ine Mkpong	4°59'61N 8°12'75E	15	30	+	-	-	-	-	-	-	-	-	+	-	
Ine Mkpe	4°55'10N 8°11'34E														
Ine Ama Odung	4°56'73N 8°08'59E	30	60	+	-	-	-	-	-	-	+	+	-	-	
Akwa Akpa Uruan	4°58'36N 8°08'03E	500	2,000	+	-	-	-	+	+	+	-	+	+	+	
Ine Edet Okon Effiom	4°57'98N 8°07'03E	60	180	+	-	-	-	+	+	+	+	+	+	+	
Ine Mparawa	4°57'51N 8°08'05E														
Ine Esin Ufot (Ine Owot)	4°57'16N 8°08'27E	80	240	+	-	-	-	-	+	+	+	+	-	+	
Esuk Itiat	5°09'36N 8°18'02E	11	21	+	-	-	+	-	+	-	+	+	+	+	
Esuk Mbat (Obio Akim Inwang)	5°08'15N 8°16'67E	50	150	+	-	-	-	+	+	-	-	+	-	+	
Esuk Mma Nsa Ekpo	5°08'01N 8°16'67E	20	120	+	-	-	+	+	+	-	-	+	-	+	
Adiabo Otukikang	5°04'25N 8°15'37E														
Adiabo Ikot Ukpa	5°05'38N 8°14'97E	60	180	+	-	-	+	+	+	-	-	+	-	-	

Altogether thirteen (13) types of gear or catch methods were widely distributed in the fishing villages/settlements viz: gillnet, beach seine, boat seine, push net, cast net, trap, weir trap, hand line, long line, harpoon, anchor (stow) net, purse seine, and hand picking.

88.2% of the surveyed villages used gillnet (usually operated as driftnet), 58.8% of the villages used cast net (but 100% usage was recorded in the outer Estuary), 48.8% used push net, while only 11.8% had anchor net (only in the outer Estuary). Beach seine, boat seine and purse seine (only present in one village, Ibaka) were used in 35.3%, 10.3% and 1.5% of the villages, respectively. Trap was used in 54.4% of the villages, and weir trap in 16.2%. Long line, hand line, harpoon and picking by hand were used in 83.8%, 19.1% and 42.7% of the villages, respectively. The significance of usage is also demonstrated in Fig. 4.

DISCUSSION

Frame surveys are one of the major ways of acquiring the basic fisheries statistics by inventorying the various components. As Gulland (1983) puts it, measures such as number of fishers or fishing units, recorded perhaps once a year, can be used as measure of fishing effort. This justifies the present study, which was aimed at obtaining information on the fishing effort in the study area. So far 64 fishing villages/settlements were identified and brought on map, most of them for the first time. As has been noted by Akegjejo-Samsons (1992), accessibility is a major problem when working in fishing settlements. This could have been one of the limitations of the survey by Antai et al. (1993). However, the use of a small research boat, coupled with the general objective, propelled the survey undertaken in this study to this extent.

Using number of boats in villages/settlements as an index of size, the two sections of the survey area showed marked differences. The inner part was characterized by mainly small but numerous settlements, including some temporary huts, a total of 51 (Table 1, Fig. 2), while the outer part was characterized by few but larger villages, a total of 13 (Table 2, Fig. 3). Size of the village was also indicative or reflective on the nature of fisheries the fishers embarked upon. Hence the large villages in the outer Estuary are engaged in the two most lucrative fisheries in the area – those on bonga (*Ethmalosa fimbriata*) and estuarine catfish (*Nematopalaemon hastatus*).

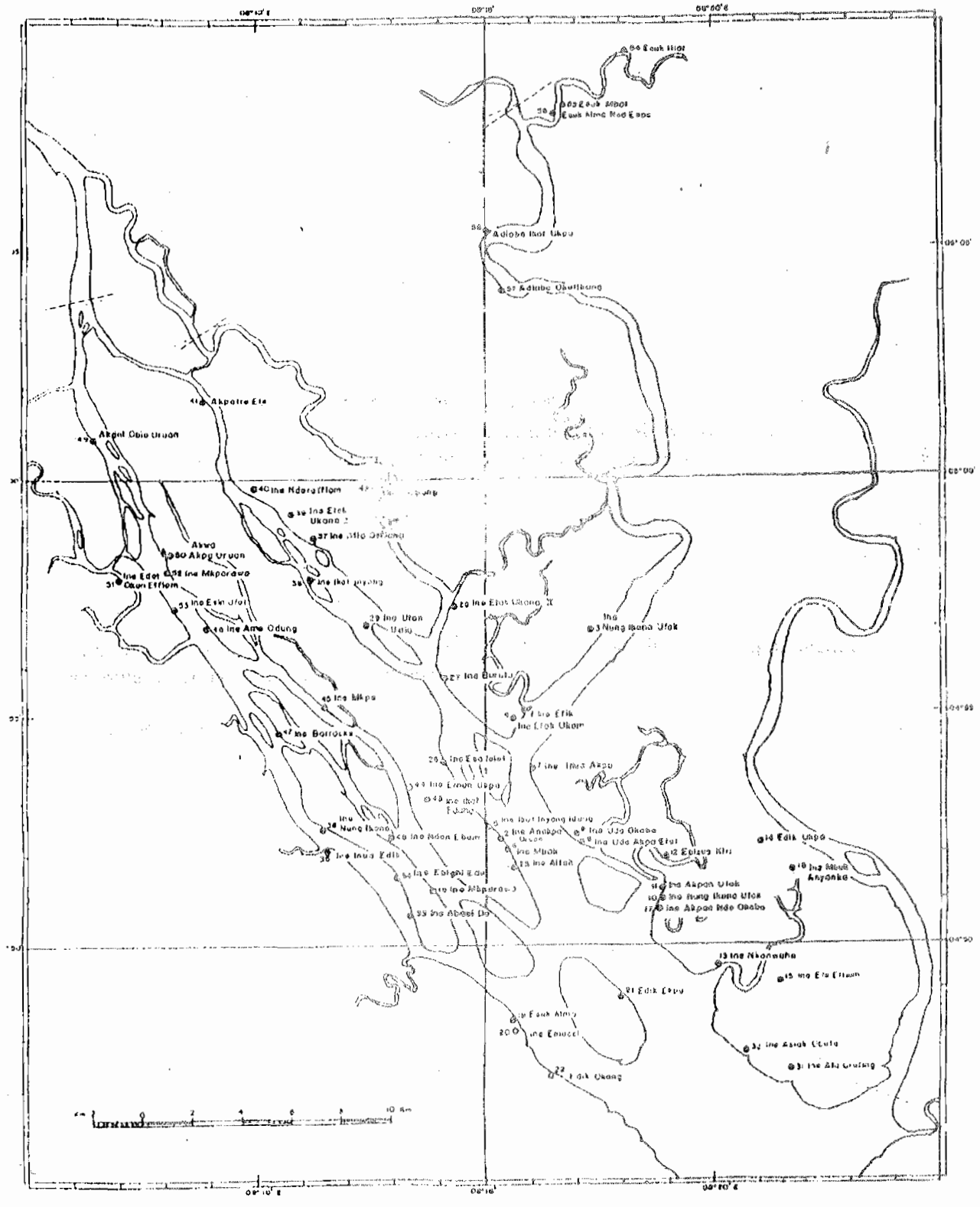

Fig. 2: Fishery survey of inner Cross River Estuary

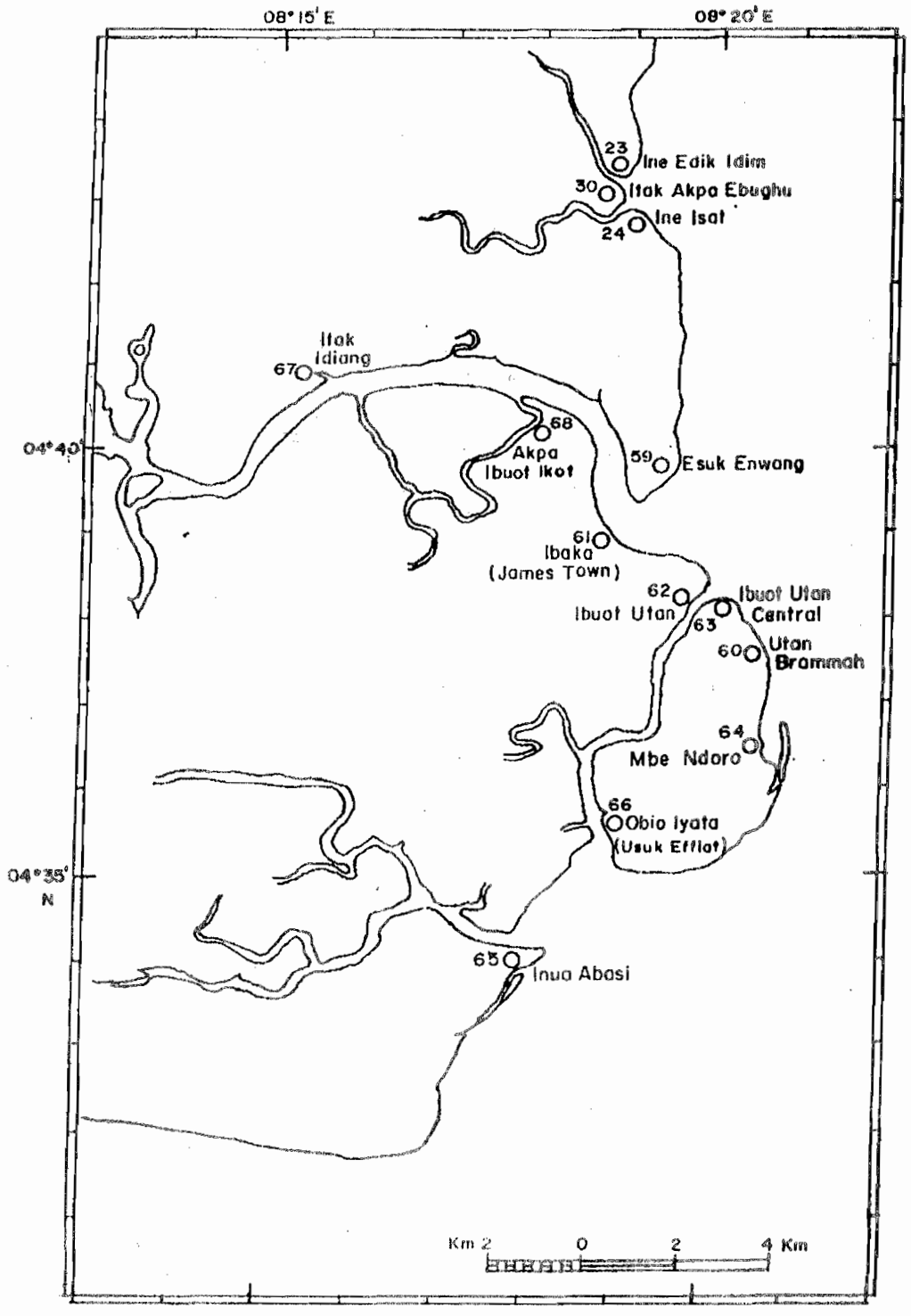

Fig. 3: Fishery survey of the West coast of the outer Cross River Estuary Distribution of villages

In the inner Estuary, the number of fishers per settlement ranged from 20 – 6,000 and the number of canoes from 9 – 1,500, while in the outer Estuary the range was 60 – 15,000 fishers and 20 – 3,000 boats. Furthermore, the total number of fishers (87,990) and fishing boats (19,023) indicate that heavy fishing activities are going on in the area. This effort level is here adjudged to be very high. It is of no doubt therefore, that most of the fisheries in the area so far studied showed indications of over-exploitation , e.g. freshwater shrimp - *Macrobrachium* sp., estuarine shrimp - *N. hastatus* or bonga - *E. fimbriata* (Enin, Löwenberg and Künzel, 1996; Nwosu 2000; Ama-Abasi and Holzlöhner, 2002).

A former survey (Antai *et al.*, 1993) obviously did not cover fully the intended survey region. The

Table 2: Fishing settlements and fishing gears in the outer Cross River Estuary

Name settlement	Position	No. boats	No. fishers	Gill net	Boat seine	Beach seine	Push net	Cast net	Trap	Weir trap	Hand line	Long line	Har-poon	Hand picking	An-chor net	Purse seine
Isuk Enwang	4°39'71N 8°19'24E	200	1,000	+	+	+	+	+	+	-	+	+	-	+	-	-
Utan Bramma	4°37'66N 8°20'28E	3,000	15,000	+	+	-	+	+	-	-	+	+	+	+	+	-
Ibaka	4°37'21N 8°08'82E	640	9,600	+	+	+	+	+	+	-	-	+	+	+	+	+
Ibuot Utan	4°38'25N 9°19'75E	200	1,000	+	+	+	+	+	+	-	-	+	+	+	+	-
Ibuot Utan Central	4°38'01N 8°20'12E	300	1,500	+	+	+	+	+	+	+	+	+	+	+	+	-
Mbe Ndoro	4°36'32N 8°20'66E	2,500	12,500	+	-	+	+	+	+	+	+	+	-	+	+	-
Inua Abasi	4°34'43N 8°17'60E	300	1,500	-	-	-	-	+	-	-	-	+	-	+	+	-
Esuk Effiat (Obio Iyata)	4°35'62N 8°18'73E	500	2,500	+	+	+	+	+	+	+	+	+	+	+	+	-
Edik Udonuko	4°43'40N 8°18'53E	100	400	+	-	+	+	+	+	-	-	+	-	+	-	-
Ine Isa	4°42'64N 8°19'08E	200	800	+	-	-	+	+	-	-	-	+	-	+	-	-
Ine Atak Akpa Ebughu	4°42'87N 8°18'61E	500	2,000	+	-	+	+	+	+	-	-	+	-	+	-	-
Attak Ediang	4°40'90N 8°15'40E	20	60	-	-	+	+	+	-	-	-	+	-	-	+	-
Akpa Ibuot Ikot	4°40'20N 8°17'00E	260	1,040	+	-	-	-	+	+	-	-	+	-	+	-	-

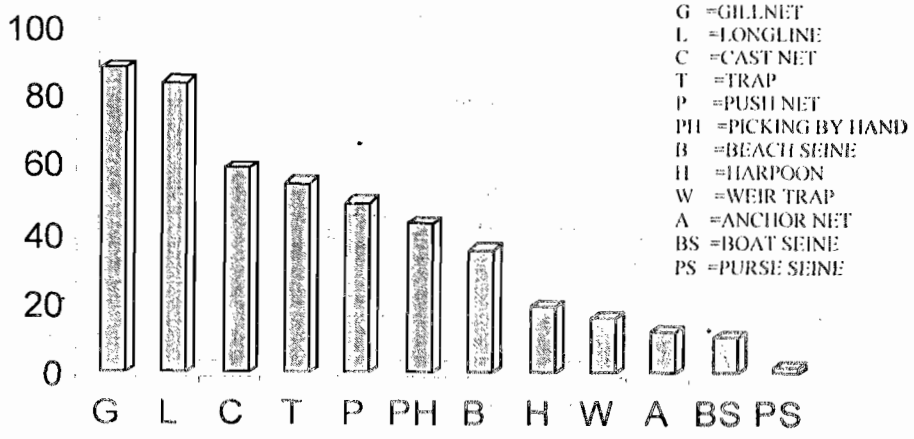

Fig. 4: Percentage of villages with occurrence of different fishing gears or methods in Cross River Estuary

survey presented here covers 70% more fishing settlements in the comparable region. This difference can hardly be explained by foundation of new villages. By the answers to our questions on the age of the settlements (Holzlöhner, Enin and Nwosu, 1997; Holzlöhner, 1998) nearly all found villages were already existent during the former survey.

We observed that gillnets (mainly used as driftnets) were most important in the survey area (used in 88.2% of the settlements).. Their wide usage may not be unconnected with the flexibility and suitability for all the seasons and species (pelagic, demersal). Solarin and Udolisa (1978) had estimated the proportion of gillnets to other gears in the Lagos Lagoon as 36% while Moses (1979) reported 33.7% in the freshwater section of the Cross River. Long line was used during our survey in 83.8% of the area, probably for the same reasons as gillnets. Castnet and trap were used in 58.8% and 54.4% of the villages, respectively.. Beach seines were mainly suitable for shrimps, especially *Macrobrachium* spp. and *Penaeus notialis*, while handpicking was used for mollusks (periwinkles). Purse seine was only found in one village (Ibaka) and its operation is concentrated on bonga fishery, while harpoons are important occasionally for hunting of large fishes.

In conclusion, the result of the survey presented here will be the first reference material for future studies. It has documented the variety of fishing gear operating in the area during the survey period. It has also recorded the number of fishers and fishing canoes/boats. However, it has to be noted that these statistics are subject to changes. Increase or decrease based on a number of factors including self-regulation due to high cost and low value in return, management measures, etc. Our additional demographic and socio-cultural data (Holzlöhner, Enin and Nwosu, 1997; Holzlöhner et al., 1998) suggest that the changes are rapid enough to warrant re-survey at five years interval. This will always bring an up-to-date record, among others, on the state of the fishing effort in the area.

REFERENCES

ACMRR, 1983. Working Party on the management of living resources in near-shore tropical waters. Report of the Advisory Committee on Marine Resources Research Working Party on the Management of Living Resources in Near- shore Tropical Waters. FAO Fish. Rep. (284): 78 pp.

Ama-Abasi, D.E. and Holzlöhner, S., 2002. Length Frequency distribution of *Ethmalosa fimbriata* (Bowdich) in Cross River Estuary and adjacent coastal waters. Global Journal of Pure and Applied Sciences 8 (3): 299-304

Akegjejo-Samsons, Y., 1992. Practical suggestions for the commercialization of fishery production in Ondo State. In: Eyo, A.A.C. Bologun, A.M. (eds.). Proceedings of the 10th Annual Conference of the Fisheries Society of Nigeria, Abeokuta, pp.207-212.

Antai, E. E, Obiekezie, A. I., Enin, U. I. and Enyenihi, E., 1993. Baseline survey of fishing settlements in Akwa Ibom, Cross River and Rivers States. Final Report. A study commissioned by International Fund of Agricultural Development (IFAD), 37 pp. and 3 Appendices.

Enin, U.I. Löwenberg, U.C. and Künzel, T., 1996. Population dynamics on the estarine prawn (*Nematopalaemon hastatus* Aurivillius 1898) off the southeast coast of Nigeria. Fish. Res. 26:17-35.

FAO, 1980. The collection of catch and effort statistics. FAO Fish.Circ.(730): 63 pp.

Gulland, J. A., 1983. Fish stock assessment: A manual of basis methods. FAO/Wiley Series on Food and Agriculture, vol. 1: Wiley Interscience, Chichester, U.K, 223 pp.

Holden, M. J. C. and Raitt, D. F. S., (Eds.) 1974. Manual of fisheries Science. Methods of resource investigation and their application. Part 2. FAO Fish. Tech. Pap. Rev. 1 (115): 214 pp.

Holzlöhner, S, Enin, U.E. and Nwosu, F. M., 1997. Stock assessment of fish and shellfish species in the Cross River Estuary. Annual Report for National Agricultural Research Project (NARP), 39 pp.

Holzlöhner, S., Enin, U. I., Nwosu, F. M. and Ama-Abasi, D. E. 1998. Stock assessment of fish and shellfish species in the Cross River Estuary. Annual Report for Nationally Coordinated Research programme (NCRP), 50 pp.

Moses, B. S., 1979. The Cross River, Nigeria: its ecology and fisheries. In: Proceedings of the International Conference on Kainji Lake and River Basin Development in Africa. Kainji Lake Research Institute, New Bussa. II: 355 - 371.

Nwosu, F. M., 2000. Studies on the biology, ecology and fishery impact on the *Macrobrachium* species of the Cross River Estuary, Nigeria. Ph.D Thesis, University of Calabar, 224 pp.

Solarin, B. B. C. and Udolisa, R. E. K., 1978. Survey of fishing gears in Lagos Lagoon. NIOMR Ann. Rep., pp. 35-38.