LUNAR AND SEASONAL VARIATIONS IN THE CATCHES OF MACROBRACHIUM FISHERIES OF THE CROSS RIVER ESTUARY, SE NIGERIA

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ABSTRACT
Monthly catches of the Macrobrachium fisheries were recorded at a commercial shrimp landing site on the coasts of Calabar, from April 1997 to August 1998. Catches fluctuated over an annual cycle, with two peaks occurring from May - July and November - December.
These peaks represented periods of major activities, reproduction, recruitment or migration. Also, mean catches decreased in the months of February and August, corresponding to the peak of dry season and the so-called 'August break', respectively. Catches from active gears (seine, push net) varied among the moon phases too, with a main peak during Full Moon, and the mininum catch during first quarter. However, the catch from passive gear (trap) depicted an inverse relationship, showing a peak during the first quarter. Variation in catches at different months and moon phases were significant at P 0.05.
Recognizing these variations and trends would help in management decisions such as defining closed seasons without adversely affecting the economy of the fishers.

INTRODUCTION

The Macrobrachium fishery sustains a year-round fishery in the Cross river Estuary, Surveys by Enin, *et al.* (1997) revealed a total number of 768 fishermen operating with 301 boats are engaged in active fishing. The fishing crafts are non-motorized canoes driven with paddles and sails, each craft is about 6.7m long, with a maximum of (3) three fishermen. The fishery is exploited by three gears: beach seine, push net (active) and trap (passive). Three Macrobrachium species, and Penaeus nuptials form the bulk of the catch (Nwosu, 2002). Most of the fishers land their catches at Akpan's beach on the coast of the Calabar River (Fig 1). The catch is sold fresh to local consumers in the surrounding markets. It is a relatively cheap source of protein to the residents in the Calabar metropolis and its suburbs.
Earlier works on the fishery include, essentially those of Enin (1995, 1997) who estimated the initial growth parameters and formulated management strategies for the fishery. Elsewhere in the Lagos lagoon, Marioghae (1982) studied the biology of M. Macrobrachion and M. Vollenhovenii, while Powerll (1983) described the species in his work in the Niger Delta area.
The aspect of catch variations has not been reported in available literature. Hence, the present work is to bridge this gap in knowledge by providing information on the catch variations by months, moon phases and at different seasons.

Material and Methods

The study area, Cross river Estuary, is located in the Southeast of Nigeria between latitudes 40 and 80 N, and longitudes 7°30 and 10°E (Fig 1) Catches from artisanal fishermen were taken weekly at the landing site, Akpan's beach, in Calabar representing the moon phases, and by gears. Total Catch per canoe per trip was recorded at the site using a 25kg spring balance to the nearest 0.5kg. Weekly samples from the gears (seine, pushnet, trap) were later pooled to form the monthly and moon pooled to form the monthly and moon phases data. Sampling lasted from April 1997 to August 1998.
Significance tests were carried out using analysis of variance (ANOVA) at the level of 0.05, while least Significant Difference (LSD) was used to separate means where Anova showed significant difference (Sokal and Rohlf, 1995).

Results

Fig. 2 shows the catch variations among thymine phases. Maximum catches were recorded during Full moon and New moon, while the minimum catches were recorded during the Quarters of the moon. Differences among the phases were significant at P:0.05 (Anova) However, only the catch at Full moon was significantly higher than the other moon phases (LSD).
The active gears (beach seine and pushnet) also showed a similar pattern for catches during the moon phases, being higher during New moon and \full moon. The passive gear (trap) showed an opposite relationship, with a peak during the First quarter (Fig 3) Catches by months fluctuated during the study period, with two maximum May-July and November-December (Fig 4).

these variations were statistically significant (Anova, P 0.05). Two minima were recorded in January - February, and August period. Fig. 5 presents the rainfall over Calabar from 1996 - 1998.

Discussion

Variations in catch during the lunar periods reflect the behaviour of the shrimps and the response of the fishery to the different moon phases. The higher catches recorded from active gears (seine and pushnet) at New and Full moon, and the passive gear (trap) at first quarter in this study, agree with findings of Garcia and Le Reste (1981), who report similar behaviour for penaeid shrimps. These could be due to the fact that catches by passive gears depend solely on the behaviour of the shrimps (e.g feeding) which may become more pronounced at 'low water moon phases' (First and Last quarter). Though high catch of shrimps at New and Full moon could also be behaviour - related, active gears need additionally, external factors such as age and experience of the fisher to make good catches.

The two peaks observed for the catches of the fishery May-July and November-December, correspond to the peak of reproduction and recruitment / upstream migration in response to incursion of highly saline sea water into the freshwater and less saline estuarine areas, respectively (New and Singholka 1985; Akpan and Offem 1993; Nwosu 2000). Incidentally, these peaks fell into the two tropical seasons, rainy and dry seasons, respectively. Gamba *1997) found abundance of M. Amazonicum in Venezuela to correspond with peak of spawning of the species (May - October). The minimum catches recorded in August and much of the dry season periods are environmentally related, in agreement with Garcia et al. (1989). These periods are marked with low rainfall and high temperature, respectively. Moses (1979) reported this so-called "August break" in his work on rainfall patterns in the area. Marioghae (1982) observed that the Macrobrachium fishery in the Lagos lagoon was largely dormant during the dry season. In the present study, low catches were recorded at the peak of dry season. What is responsible for the constricting findings?.

For the management of this fishery, therefore, closed periods, instead of closed seasons or closed areas could be adopted. in that case, 5 - 10 days within two adjacent moon phases could be used. Bowen and Hancock (1985) applied this management strategy successfully to the penaeid shrimp fishery of Western Australis.

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REFERENCES

Akpan, E. R and J. O. Offem, 1993, Seasonal variation in water quality of the cross river, Nigeria, Revue Hydrobiologuq Tropicale, 26 (2); 95 - 103.

Bowen, B. k and D. A. Hancock, 1985. review of Penaeid prawn fishery management regimes in Australia. in P. C. Rothlisberg, B J. Hill and D. J Staples (eds), proceedings of the Second Australian National Prawn Seminar. Simpson, Halligan, Brishane, Australia, pp. 247 - 265.

Enin, U I. 1995. First estimates of growth, mortality and recruitment parameters of Macrobrachium macrobrachion Herklots, 185 in the Cross River Estuary, Nigeria Dana, 11 (1); 29 - 38.

Enin. U. I 1997. Formulation of management strategies for two exploited West African prawn populations. Fisheries Management and Ecology, 4: 301 - 309.

Enin, U. I. S. Holzlohner and F. M. Nwosu, 1997. Survey of the fishing villages of the inner Cross River Estuary, Nigeria. Paper presented at the Seminar on "Cross river Basin - Nature and Culture" Calabar May 19 - 20. 19p.

Gamba, A. L.1997 Reproductive biology of Macrobrachium Jelsjkii (Miers, 1877) and Macrobrachium amazonicum (Heller, 1862) in Venezuela (Crustacea, Decapoda, Palaemondae) ACTA CIENT VENEZUELA, 48 (1) 19 - 26.

Garcia, S. and L le Reste, 1981. Life cycles, dynamics, exploitation and management of coastal penaeid shrimp stocks. FAO Fish. Tech Pap. 203 215p.

Garcia, S. P Sparre and J. Esirke, 1989, 1989. Estimting surplus production and maximum sustainable yield from biomass data when catch and effort time series are not available. Fisheries research, 8 13-23.

Marioghae, I. E, 1982. Notes on the biology anc distribution of Macrobrachium vollenhovenii and Macrobrachium macrorachion in the Laos lagoon (Crustaces, decapoda, Palaemonidae) revue Zoologie Afrique, 96 (3): 493 - 508.

Moses B. S. 1979. The Cross River, 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. pp. 355 - 371.

New, M. B and S. Singholka, 1985. Freshwater prawn farming. A manual for culture of Macrobrachium Rosenbergii. FAO Fish Tech. Pap., Rev. 1 (225): 118p.

Nwosu, F. m 2000. Studies on the biology, ecology and fishery impact on the Macrobrachium species of the Cross rive Estuary, Nigeria. Ph. D Thesis, University of Calabar, Nigeria 224 p.

Powell, C. B 1983. Fresh and brackish water shrimps of economic importance in the Niger Delta. In Proceedings of second Annual Conference of the fisheries Society of Nigeria, 25 - 27 January, 1982. Calaber pp. 254 - 285.

Sokal, R. R and F. J. Rohlf, 1995. Biometry 3rd Edition, new York W. N. Freeman and Com. 887p.

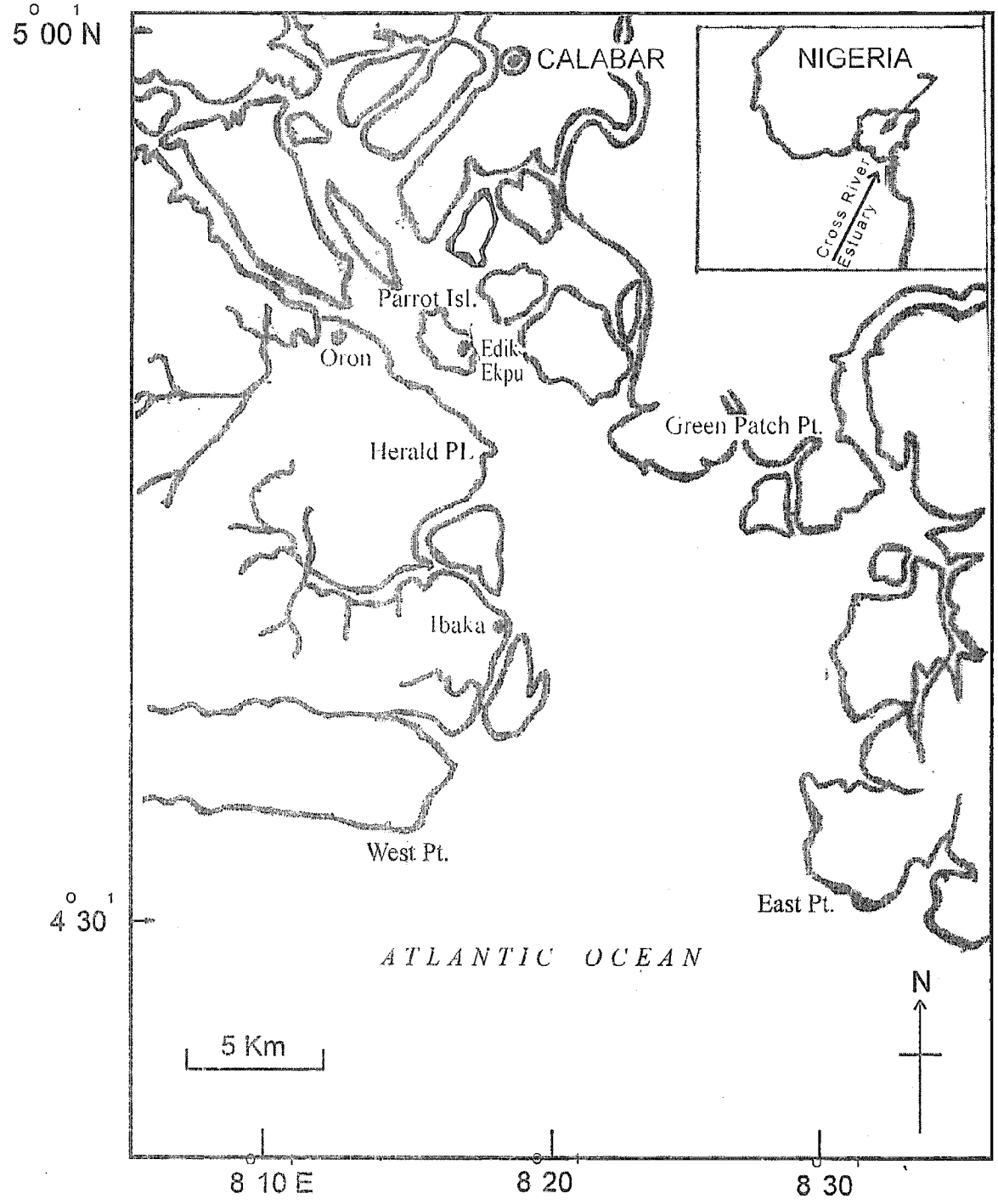


Fig. 1: The Cross River Estuary showing Calabar the sampling site.

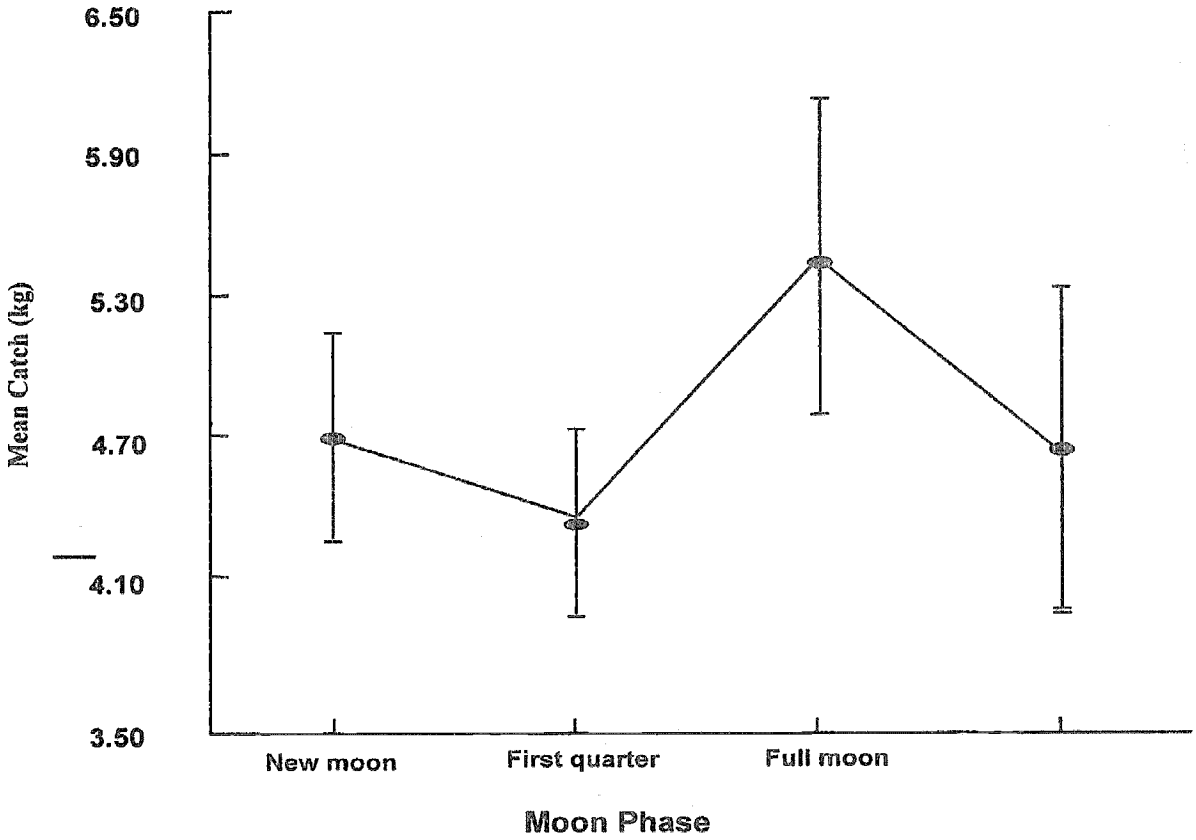
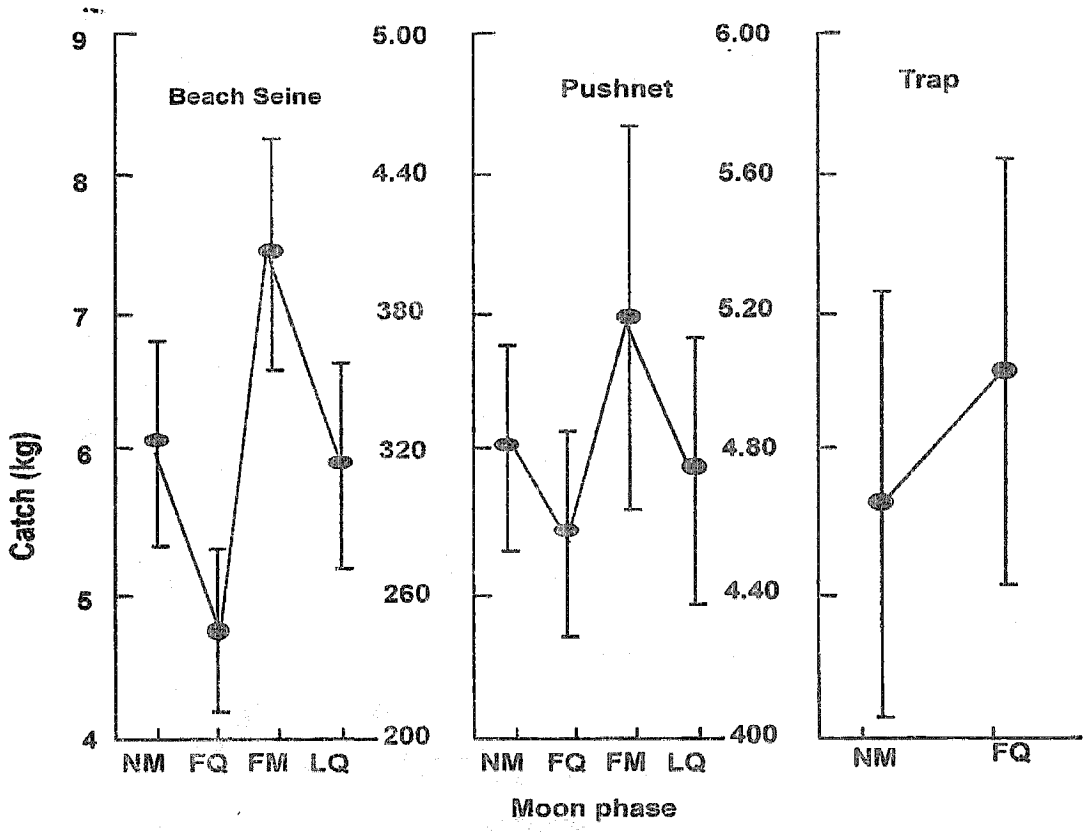


Fig. 2: Catch per Canoe day-1 with 95% confidence interval (Vertical lines) for Macrobrachium fishery of the Cross River Estuary by moon phases. Pooled data from Seine, Pushnet, and Trap catches April 1997 to March 1998



NM = Newmoon, FQ = First quarter,
FM = Full moon, LQ = Last quarter

Fig. 3: Catch (kg) per gear type of the Macrobrachium fishery by moon phases with 95% confidence interval as vertical lines. April 1997 to June 1998.

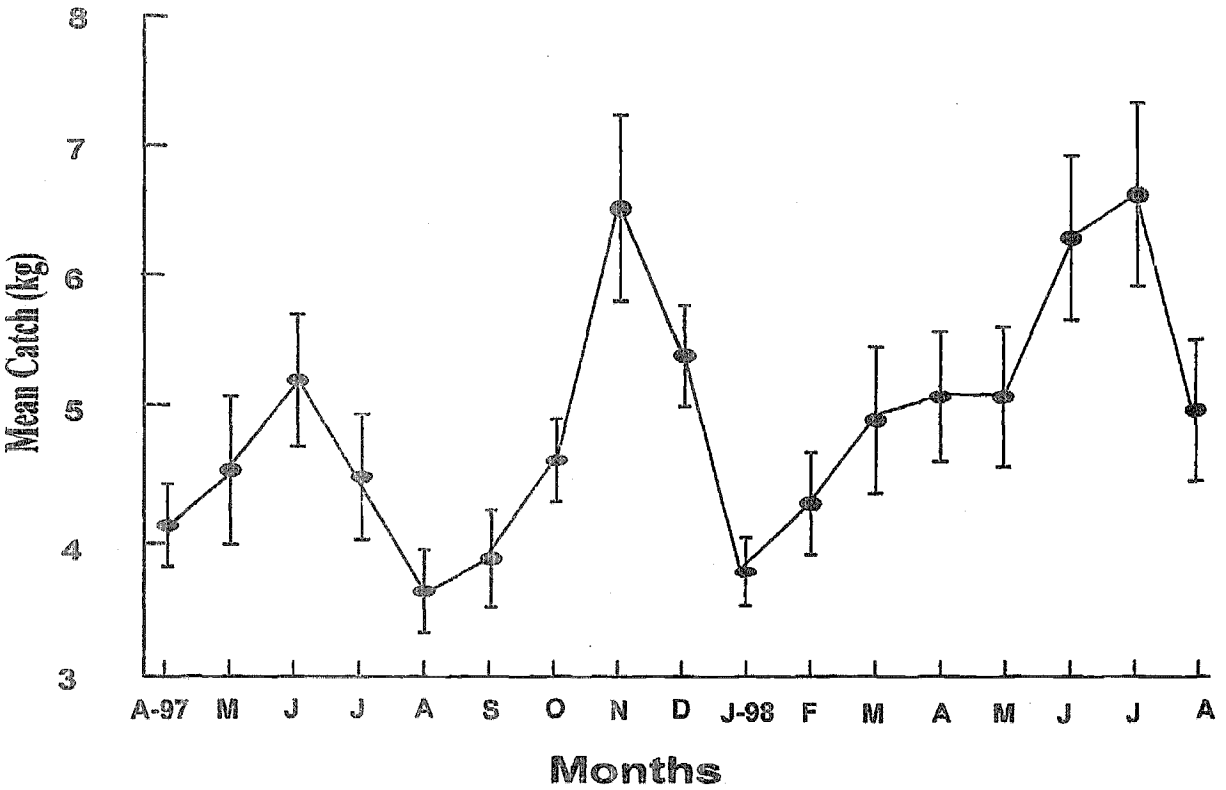


Fig. 4: Mean monthly carch per canoe day-1 with standard error for the Macrobrachium fishery April 1997 to August 1998

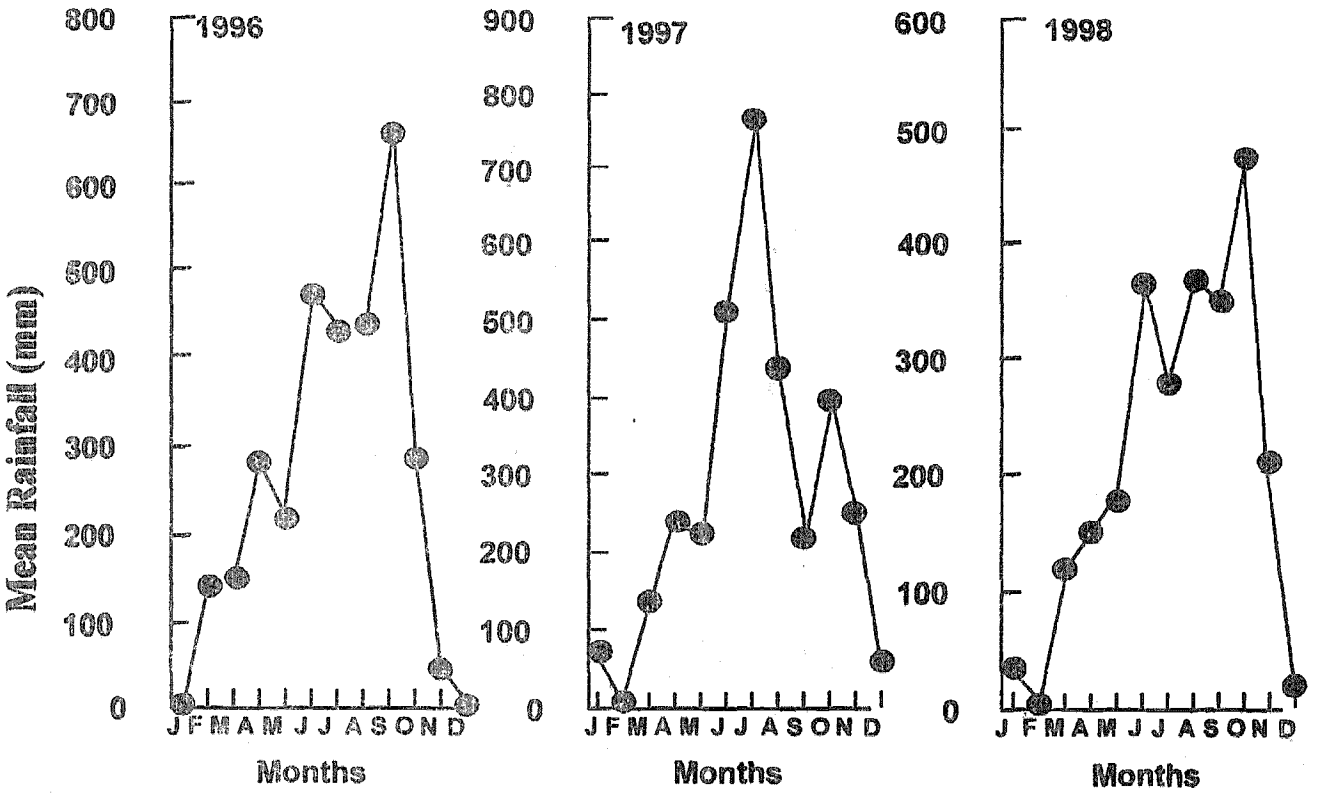


Fig. 5: Rainfall over Calabar 1996 to 1998