

**INFLUENCE OF RAINFALL AND SALINITY ON THE SPAWNING CYCLE OF
Nematopalaemon hastatus IN RIVER NUN ESTUARY,
BAYELSA STATE, NIGER DELTA.**

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ABSTRACT

Spawning pattern of *Nematopalaemon hastatus* in River Nun Estuary, Bayelsa State in the Niger Delta was studied for one year. Samples were collected from artisanal shrimpers operating along the estuary on a monthly basis and stored in 9% formalin for laboratory analysis. The *N. hastatus* in each monthly sample were observed for gravity, using a hand lens. There was a colour change in the eggs from light orange to dark brown with maturation. Eggs in different stages of maturation from light orange to dark brown were observed in the samples all year round, comprising both rainy and dry seasons. Main spawning observed was between July and September. The peak spawning activity occurred in September while the lowest was between November and December. Largest *satus* with eggs measured 14mmCL (carapace length) and the smallest 7mmCL. Statistical analysis to test the level significance of gravid *N. hastatus* between seasons showed that more spawners were landed during the rainy season than the dry season. Spawners are usually caught before they have the chance to lay their eggs and this could lead to a reduction in the reproductive process, resulting in a decrease in biomass. It is therefore pertinent to introduce management strategies involving, fisheries scientist, fisheries managers and the shrimpers.

Keywords: *Eggs, Estuary, Mature, Season, Shrimps, Spawners,*

INTRODUCTION

River Nun Estuary is one of the numerous estuaries in the Niger Delta that discharge into the Atlantic Ocean on the Bight of Benin and Bonny and is known to be rich in Palaemon shrimps. Shrimps, which are locally known as "crayfish" are crustacean decapods that consist of a mixture of penaeid and caridea shrimps; and post larval stages of other Crustacean. The fishery is mostly composed of *Palaemon maculatus* and *Nematopalaemon hastatus* and they occur in the ratio of 2:3. Palaemon shrimps constitute valuable seafood for both the local community and Nigeria in general. Shrimps are highly cherished by the people of the Niger Delta. They are used for the preparation of food because of their high protein value which are considered very cheap and important source of livelihood for the coastal communities (Sotolu, 2010). They are highly priced and in high demand in Nigerian market (Deekae and Abowei, 2010) and are either sold fresh or smoked dry before selling to commercial shrimp buyers from the eastern part of Nigeria.

The shrimps are found between Senegal in West Africa to Angola in Central Africa. In Nigeria, they are found in areas from Forcados to Bonny along the Atlantic coast in the rich Niger Delta. Distribution of shrimps is greatly influenced by the presence or absence of fine sediments, high organic content and temperature variations. Salinity is also an important factor in the distribution of shrimps (Marighae 1985 and Abowei *et al.*, 2008).

Most shrimps reproduce all year round. Penaeid shrimps live and spawn at sea, while the post-larvae migrate to the creeks, grow and migrate back to sea as late juveniles or young adults. *Nematopalaemon hastatus* spawn every two weeks (Marioghae 1980 and Powell 1980) and the spawning is influenced by the two-weekly tidal cycle, but the second spawning do not take place soon after hatching of eggs because female bearing eyed eggs do not have well developed ovaries.

The *Palaemon* fishery is an important industry in Akassa that sustains the rural populace in the River Nun estuary. It has been observed to be the major source of livelihood where the people depend on sales from the fishery for provision of their daily need. Most people irrespective of age and sex are involved in this all throughout the year, especially during the raining season when is perceived to be the main shrimping season. Due to the importance of *Nematopalaemon hastatus* (crayfish) fishery to the Akassa community in particular and Nigeria in general a

study was conducted to report the spawning pattern of the shrimp in the River Nun Estuary, Bayelsa State, Niger Delta with a view of suggesting possible measures to manage the fishery.

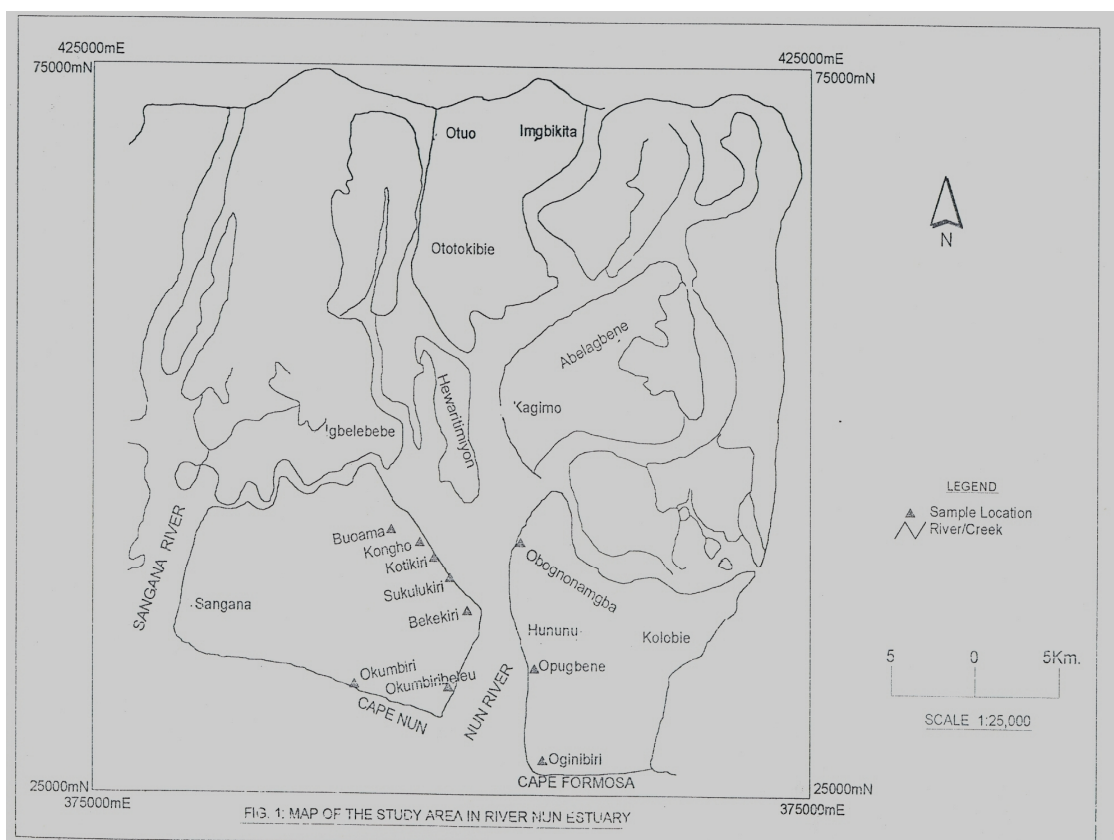
MATERIALS AND METHODS

The data and samples for this study were collected between May 2004 and April 2005 from artisanal shrimpers in Akassa communities operating along the lower River Nun within the Niger Delta. These communities include Kotikiri, Sukukiri, Bekekiri, and Okumbiribeleu on the West and Obognonamgba, Opugbene and Ogninibiri on the East.

The area extends from Akassa at the river mouth to about 12.5km North and lies between longitude 5°55' and latitude 4°20'. It is one of the many rivers that discharge into the Atlantic Ocean through the Niger Delta on the Bight of Benin and Bonny (Fig 1). Samples were collected monthly and then stored in 9% formalin and taken to the laboratory for further analysis. In the laboratory, 2kg of samples were taken and the different species were identified according to identification keys by Holthius (1980), Powell (1983) and Fisher *et al.*, (1981). The *Nematopalaemon hastatus* in each sample was examined with a hand lens for gravity. The carapace length (CL) and the weight of *Nematopalaemon hastatus* in each sample were recorded. The gravid *N. hastatus* were weighed and the weight expressed as a percentage of the total weight of *N. hastatus*. Student-t-test was used to ascertain the level significance of gravid *N. hastatus* between seasons.

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Temperature values were taken from a mercury-in-glass thermometer graduated in °C. The thermometer was immersed into the water to a depth of 2cm for 5minutes, until the mercury stabilized. Salinity was measured by using hand Refractometer (Atago Japan). The bag-net or stow net is the gear employed in the fishery. It is a conical nylon bag net measuring between 40 and 50m. The mouth of the net is about 2.5m wide and 2m high and oriented to filter the on-coming currents.

Dug -out canoes measuring between 8-10m and powered by 8HP are employed in the coastal fishery, while the dug-out canoes employed in the estuary are powered manually and measure between 4-7m. It takes an average of 90minutes for coastal shrimpers to get to their fishing ground, while estuarine shrimpers spend 10 minutes to get to the fishing ground. Estuarine shrimpers; age between 10and 60yr employ between 2-10 bag-nets with landing ranging between 0.2kg-40/boat/day and shrimp mostly for household consumption . Coastal shrimpers fish mostly for

commercial purpose with landing ranging between of 0.4k- 220kk/canoe/day employs between 20-24 gear and their age range is between 27-45years.

Rainfall pattern was collected from the meteorological department of Port-Harcourt International Airport (fig 2).

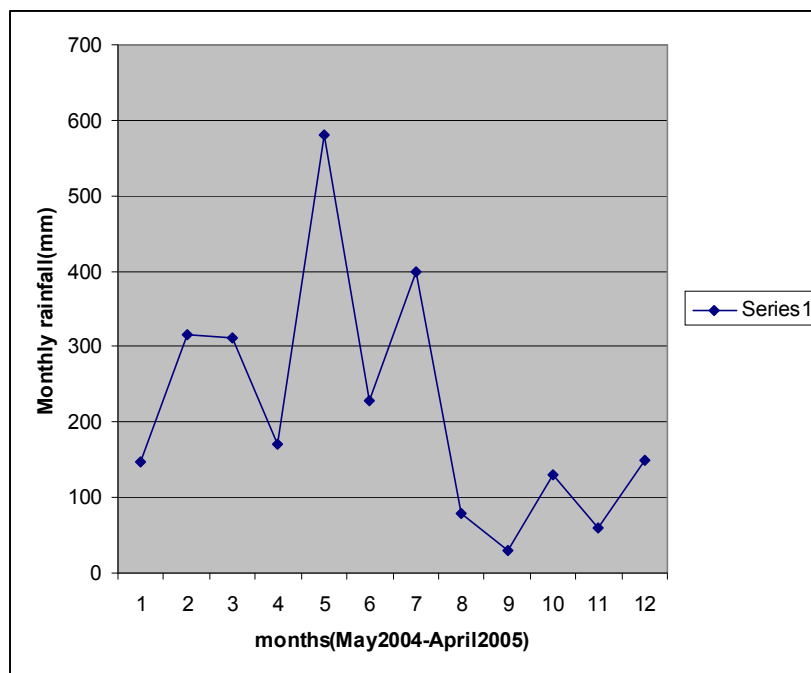


Fig. 2: Monthly rainfall

RESULTS

The monthly mean rainfall is shown in fig 2. Rainfall was highest in September and lowest in January. During the rainy season, rainfall was highest in September and lowest in May. Rainfall was highest in November and lowest in January during the dry season.

Monthly mean salinity ranged between 9psu and 21.3psu. Water salinity was highest during the dry season and lowest during the rainy season. The highest salinity value was recorded in February and the lowest mean salinity value was recorded in July (Table 1).

Monthly mean surface water temperature readings recorded between May2004 to April 2005 ranged between 24°C and 27°C. The lowest monthly mean temperature

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was recorded between July and September and the highest monthly mean temperature of 27°C was recorded in March.

Table 1: Monthly Mean Temperature and Salinity Measurements

| Months | Monthly Mean Water Temperature (°C) | Monthly Mean Salinity (psu) |
|--------------|-------------------------------------|-----------------------------|
| May | 26 | 13.5 |
| June | 25 | 13.05 |
| July | 24 | 9.0 |
| August | 24 | 12.6 |
| September | 24 | 12.9 |
| October | 25 | 13.5 |
| November | 26 | 10.1 |
| December | 25 | 17.3 |
| January | 26 | 21.3 |
| February | 26 | 11.3 |
| March | 27 | 16.1 |
| April | 27 | 10.5 |
| Total | 305 | 161.15 |
| Mean | 25.5 | 13.43 |

Gravid females with different stages of maturation were observed in the samples all year round. The eggs in the formalin-fixed samples were found to change from light orange to dark-brown with maturation. Seasonal spawning activity observed indicates that spawning occurred all year round. The main season of spawning was between July and September (fig. 3). The peak spawning activity occurred in September while the lowest was between November and December. Smallest size *N. hastatus* with eggs measured 7mm CL (carapace length) and the largest 14mmCL. Statistical analysis the level significance of gravid *N. hastatus* between seasons showed that more spawners were landed during the rainy season than the dry season. Statistical analysis showed significant difference in gravid shrimps landed in rainy season and dry season. More gravid shrimps where landed in the rainy season than the dry season.

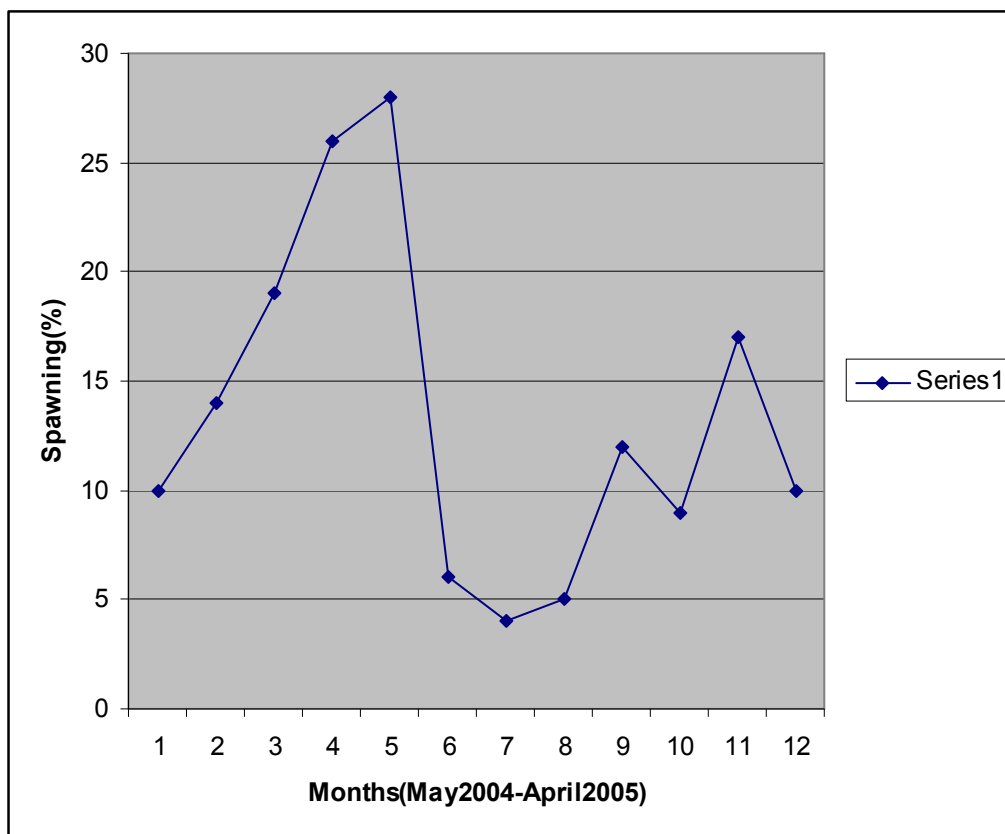


Fig 3: Monthly Spawning Activity of *Nematopalaemon hastatus* in River Nun Estuary, Bayelsa State, Niger Delta

DISCUSSION

The salinity observed in the area ranged between 9 and 21.3psu. This finding corroborates with those of Abowei *et al.*, (2006) Salinity was low during the rainy season. This may be due to the fact that the rains might have lowered the salinity, through high river discharge that might have lowered the salinities of estuaries in the Niger Delta and introduced silt and plant from the land to the water. The relative stability of the salinity regime may have accounted for the continued presence of *Nematopalaemon hastatus* throughout the year, though, the salinity regime is usually influenced by the quantity and pattern of discharge from the river. From the foregoing, it seems *N. hastatus* can tolerate polyamine conditions, but may not endure salinity lower than 9psu.

Presences of gravid females at different stages of maturation suggest spawning was all year round. The high percentage of spawners in September could be due to the fact that palaemonid shrimps move upstream during the rainy season to spawn

which coincide with the period of heavy shrimping activities (Waribugo and Alfred-Ockiya, 2000). Restriction of *Nematopalaemon hastatus* to the lower estuaries could be due to the fact that shrimps are essentially pelagic and have high oxygen demand. The high oxygen demand is met only by near saturation condition of the lower estuary. Increase in artisanal shrimping operations during the rainy season may interfere with spawning activities, since spwaners are caught before they have the chance to lay their eggs, during which eggs and larvas are destroyed. This could lead to a reduction in the reproductive process, resulting in a decrease in shrimp biomass.

High rate of spwaners landed in September and March may imply that spawning could be occurring during theses months, supporting the fact that shrimps spawn twice a year. The high percentage of adult shrimps in the months of August and September is probably due to the fact that their food materials are abundant during that period. The peak of abundance of mystid *Rhophalophthalmus africana*. This food item is the principal food material for adult *Nematopalaemon hastatus*.

CONCLUSION

Monthly Palaemon shrimps landed during the study period were observed to be shrimps with eggs at different percentage, suggesting that they spawn all year round with two peaks in September and March. The two peaks recorded in September and March implied that Palaemon shrimp spawn twice a year. The higher percentage of gravid shrimps landed during the rainy season happens to coincide with the period of active shrimping activities resulting in harvest of spwaners. The fact that spwaners are caught before they have the chance to lay their eggs could interfere with the reproductive process and reduction in biomass. This might contribute to high rate of exploitation of the *Nematopalaemon hastatus* fishery in the River Nun Estuary. It is therefore, important to introduce management measures to check this trend.

The management team should involve fisheries scientist, fisheries managers and the shrimpers. The shrimpers should make the ultimate decision because they are more involved in the *Nematopalaemon hastatus* fishery in the River Nun Estuary, Bayelsa State in the Niger Delta.

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REFERENCES

- Abowei, J.F.N; Deekae, S.N; Allison, M.E; Tawari; C.C and Ngodigha, S.A. (2006), A Review of Shrimp Fisheries in Nigeria. Publ. Preo-Joe. Port Harcourt.
- Abowei, J.F.N; Davies, D.O and Ngodigha, S.A. (2008), The Recruitment Pattern of Two Palaemon Shrimps and Some Physio-chemical Characteristics in the River Nun Estuary, Nigeria. Int. J. Nat. Appl. Sci. ISSN:0794-4713
- APHA, (2005), American Public Health Association: Standard Methods for the Examination of Water and Wastewater 22nd Edn.
- Deekae, S.N and Abowei, J.F.N. (2010), The Recruitment Pattern of *Macrobrachium macrobrachion* (Herklots, 1851) from Luubara Creek, Ogoni Land, Niger Delta, Nigeria. Res. J. Appl. Sci. Eng. Tech. 2(6):566-573. ISSN: 2040-7467.
- Enin, U.I. (2004), Influence of rainfall on the dynamics of two prawn populations in the Cross River Estuary, Nigeria. *Glob. J. Appl. Sci.* 10(4) : 525 - 533
- Fischer, W; Bianchi, G; Scott, W.B. (1981), FAO Species Identification Sheets for Fishery Purposes: Eastern Central Atlantic, Fishing Area 34, 47(in part). Canada-Fund-in-Trust and Food and Agriculture Organization of United Nations.Vol 6.
- Holthuis (1980), FAO Species Catalogue Vol.1 Shrimps and Prawns of the World. An Annotated Catalogue of Species of Interest to Fisheries. FAO Fish Synop. 125, Vol. 271.

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- Marioghae, I.E. (1985), Review of Research on Panaeid Shrimps in Nigeria. In The Mangrove Ecosystem of Niger Delta. Proceedings of a Workshop. Uni. of Port Harcourt. B.H.R Wilcox and C.B Powell (Ed) 212-225.
- Powell, C.B. (1983), Fresh and Brackish Water Shrimps of Economic Importance in Niger Delta. Proceedings of 2nd Annual Conference of Fisheries Society of Nigeria, Calabar, 25-27th January 1982. 254-285.
- Sotolu, A.O. (2010), Sustainable Fisheries Management through Efficient Fisheries Resources Data Statistics. *J. Fish. Aqua. Sci.* 6:202-211.
DOI:10.3923/JFAS.2011.202.211
- Waribugo, S.A and Alfred-Ockiya, J.F. (2000), Contribution of Artisanal Fisher Folk to the Exploitation of Shrimps in the River Nun Estuary, Niger Delta. 14/15th annual Conference/International Workshop of Nigerian Association for Aquatic Science.25-28th October 2000, Awka. Book of Abstracts.

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