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THE ABIOTIC ECOLOGY OF BREEDING GROUND OF PALAEMONID PRAWNS IN THE ILAJE ESTUARY, ONDO STATE, NIGERIA.

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ABSTRACT
In situ ecological assessment of the breeding grounds of palaemonid prawns was conducted in some selected locations around Ondo state coastal area between the months of April and September. Data obtained were subjected to both descriptive and inferential statistics. Three species of Palaemonid prawns were identified in four different locations within the study area with relative abundance ratio of 4:3:1. *Macrobrachium macrobrachion, Nematopalaemon hastatus* and *Palaemon maculatus* respectively. Sex ratio of 1 male to 5 females for *M. macrobrachion*, and 1 male to 2 females for *N. hastatus* and *P. maculatus* were observed with result showing significant relationships ($P < 0.05$) in distribution patterns across collection sites. Population distribution within the water column showed that palaemons are sub-lithoral prawns inhabiting maximum mean depth of 0.67m ± 0.025. Surface macro-phytes such as *Eichhornia crassipies*, *Paspalum vaginatum*, and *Pistia stratiotes* are common providing hiding spots for the prawn at the breeding ground. The mean soil pH across the sites stands at 6.67± 0.399 with the soil textural class that range from silty-loam to silty-clay. Also, the water quality parameters of study areas suggest that captive culture and rearing of Palaemons may be feasible outside the breeding areas.

KEYWORDS: Palaemonid prawns, breeding grounds, *Macrobrachium macrobrachion, Nematopalaemon hastatus, Palaemon maculatus*, sub-lithoral.

INTRODUCTION
Prawns are important source of animal protein especially for the coastal rural dwellers. There are many varieties of prawns which are found across the various water bodies in Nigeria belonging to family Atyidae, Alphedae, Hippolytidae, and Palaemonidae, which include good candidates for aquaculture (Powel, 1982). However, the most common prawns species found in Nigerian rivers are *Macrobrachium species* (Bello-Olusoji *et.al*, 2004). There are small numbers of prawns fishermen in Nigeria (Amos, 2007). Basically, the major domestic producers of prawns in Nigeria are fishermen in the Niger-Delta, who solely depend on the wild catches with low economic yield subject to higher pressure of industrial shrimpers operating export market (Moses, 2006). Also, aquaculture operations involving prawn/shrimp culture (shell fish) does not exist (Bello-Olusoji *et.al*, 2004). Hence, local consumption of prawns in diets is limited. This is because most available research information on fresh and brackish water prawns is scarce and has been basically on taxonomy (Powel, 1982).

However, researches into the reproductive and growth characteristics of native species of prawns are on-going, though in its infancy (Arimoro and Meye, 2007); to encourage its involvement in aquaculture. Consequently, this research is focused on the documentation of scientific information on the abiotic ecology of the breeding ground of some native palaemonid species for subsequent acquisition of technical knowledge and eventual development of prawn aquaculture in Nigeria.

Description of the Study Area
The study area lies within Lat. 50 50'N - 60 09'N and Longitude 40 45'E - 50 05’E as shown in Figure 1. This area falls within the oil prospecting states in Nigeria called Niger Delta region. It consists of rivers and streams which traverse different settlements and discharge into the coastal ocean (Bight of Benin, Atlantic Ocean). The adjoining waters at the deeper mouth of the tributaries extend to form a vast area of brackish water which serves as a major fishing spot for fishermen. This brackish water is bounded by thick riparian vegetation with low occurrence of rhizoid plants and a higher profile of salt marshes and surface macrophytes such as *Eichhornia*

crassipies, *Paspalum vaginatum*, and *Pistia stratiotes* that extend into the tributaries and mark the breeding grounds of the prawns. However, four breeding spots across four villages were selected for the study.

METHODOLOGY

Study locations were selected based on the earlier information for prawn fishing around the study area. Prawn samples were collected with baited local traps on daily basis throughout the study period. Prawns in the sites were identified by taxa to species levels, using taxonomic keys from the FAO, (1981) and Powel, (1982). Morphomeric features (coloration, pleura arrangement, shape of rostrum, number of spines on the rostrum) of each species were used for identification to species level (Bello-Olusoji *et.al*, 2004). The prawn samples were then preserved in 10% formaldehyde solution. The relative abundance of the various identified prawn species were estimated from the record of the daily collection and the data were evaluated bi-weekly for twenty weeks. Catch assessment was evaluated on weight measurement to the nearest 0.01g unit using sensitive weighing balance (model pl200w). Sex distribution pattern amongst the prawn species' were assessed from sites *A* to *D* and the ratio of male to female distribution for each species was mathematically deduced. The sex variations across the selected sampling sites were further analyzed using the Students' T-test followed by a test of homogeneity of variance using Bartlett's F-test. The analysis of water quality parameters such as temperature (^{0}c), pH, conductivity (mΩ/cm), dissolved oxygen (ppm), salinity ($^0/_0$), total dissolved solids (ppm), total hardness (mg/l) and alkalinity (mg/l) were determined *in situ* by using Hydro-lab water quality meter (Electronic Probe, Hanna HI98106 model). Water samples were collected in stopper bottles enclosed in black polythene bags containing ice and were immediately transported to the limnology laboratory of the Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure, for chemical analysis of Carbonate (mg/l), and BOD (mg/l) following APHA, 2005 analytical method. Water depth measurements were also taken with a calibrated string tape with a lead weight attached to the zero end of the string to allow easy sink through the water column. Floating macrophytes were collected and taken to herbarium for taxonomic identification. Soil texture and pH were determined using standard methods (ISO 11277. 1998 and ISO 10390. 1994). All values recorded on water quality assessments and depth measurements across the study sites were described by mean ± standard deviation.

RESULTS

Three species of palaemonid prawns were identified across the four selected breeding locations (Table 1), with overall percentage relative abundance ratio of 40.88 : 45.63 : 13.38 for species of *M. Macrobrachion*, *P. maculatus and N.hastatus* (figure 2). Results showed that *M. Macrobrachion* exhibited a sex ratio of 1 male : 5females, while *N. hastatus* and *P. maculatus* exhibited a ratio of 1 male : 2 females respectively. Significant relationship exist ($P < 0.05$) in sex distribution ratio for each of the three species across the four sites.

Water depth measurements showed that palaemons prefer shallow water depths during their breeding exercise (Table 2). Analysis of water quality parameters showed that water temperature at the breeding spots range between 27.55^{0}C to 28.60^{0}C which is synonymous with room temperature. Water pH and salinity also ranged from 6.66 to 7.24 and 0.29 to 1.39 respectively (Table 3). The soil pH observed across the study sites range from 6.24 in site A; 7.11 in site B; 6.44 in site C; and 6.89 in site D, with the textural class of soil that range from silty-loam to silty-clay.

DISCUSSION

Seasonal breeding has been reported in tropical prawns, (Inyang, 1981; Marioghae, 1982; Hla *et al.*, 2005). Subject to this information, this study was carried out during the first peak (April to September) of the breeding season of prawns in the tropics (Nwosu and Wolfi, 2006). It is thus observed that populations of the female prawns out-numbered the males in all catches for the three species. Most female prawns identified during the study are ovigerous. However, deductions on sex distribution pattern observed *in-situ* for the three species of prawns, revealed a possible pairing ratio of 1male to 5females for *M. macrobrachion*, 1male to 2females for *P. maculatus* and 1male to 2females for *N. hastat*us. This shows a clear departure from the expected sex ratio of 1male to 1female as been reported for some fish species (Atz, 1964; Harrington, 1967). Howbeit, palaemonid prawns could be paired in ratio of 1 male : 2 females based on the above findings for trial induced breeding in the hatchery environment.

The physico-chemical properties of the water sample across the study sites (figure 3) showed conformity with the findings of Arimoro and Meye (2007) which were documented for the *M. dux* along river Orogodo, Niger Delta, Nigeria. However, from these results, it is clear that trial breeding operations should observe a condition of room temperature (range between 27^0C -28.60^0C) with a water pH range of 6.66 to 7.24 and the dissolved oxygen tolerance of 6.8mg/l which also conformed to the findings of Crocos (1985) and Marioghae (1987).

Indications from depth measurements of the study sites showed that Palaemons are sub-lithoral animals and do not inhabit great depths especially during breeding, though prefers dark hiding spots within the water body. The maximum mean depth recorded across the study sites was 0.67m ± 0.025, while the minimum mean depth encountered was 0.49m ± 0.026. The shallow depth and the high nutrient profile of the water body across the study sites enhance the growth of surface macro-phytes which provide major hidings for the Palaemons especially during breeding activities. Surface macro-phytes such as *Eichhornia crassipies, Paspalum vaginatum*, and *Pistia stratiotes* are mainly encountered. These help in conditioning the temperature and the pH profile within the breeding sites and support the proliferation of plankton. The soil pH observed across the study sites range from 6.24 to 7.11 with the textural class of soil which range from silty-loam to silty-clay. These findings make it visibly clear that the three identified species of palaemons may do well as aquaculture species as earlier observed by Powel (1982) because the water quality parameters and other edaphic indices could easily be attained by simulation in culture environment.

CONCLUSION

Indications from the findings of this study showed that palaemonid prawns in this estuary may adapt to and survive in fresh water environment, and that captive breeding and culture of the identified species (in an artificial culture environment) may be feasible by consciously simulating an abiotic model, after the results of this research. Also, further research into survival, feeding techniques and actual breeding and culture of these identified prawns in an artificial environment is recommended.

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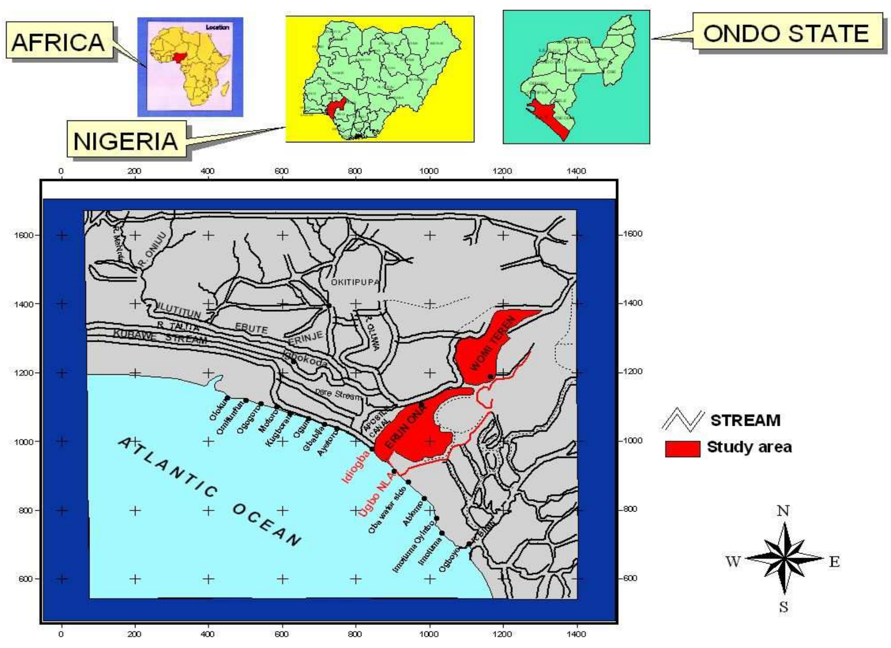

Figure 1: Map of the study area.

Species Identification

Table 1: Species identification across study sites.

SITE NAME(S)	SITE AREA OF COVERAGE (MTRS)	IDENTIFIED SPECIES	COMMON NAME(S)	RELATIVE ABUNDANCE (%)
A. UGBONLA	200	*Macrobrachium macrobrachion*	Brackish River Prawn	40
		Palaemon maculatus	Zaire Prawn	16.5
		Nematopalaemon hastatus	Estuarine Prawn	43.5
B. IDI-OGBA	150	*Macrobrachium macrobrachion*	Brackish River Prawn	48
		Nematopalaemon hastatus	Estuarine Prawn	52
C. ERUN-ONA	120	*Macrobrachium macrobrachion*	Brackish River Prawn	29
		Palaemon maculatus	Zaire Prawn	37
		Nematopalaemon hastatus	Estuarine Prawn	34
D. WOMITEREN	85	*Macrobrachium macrobrachion*	Brackish River Prawn	65.5
		Nematopalaemon hastatus	Estuarine Prawn	34.5

Overall Species Relative Abundance Ratio

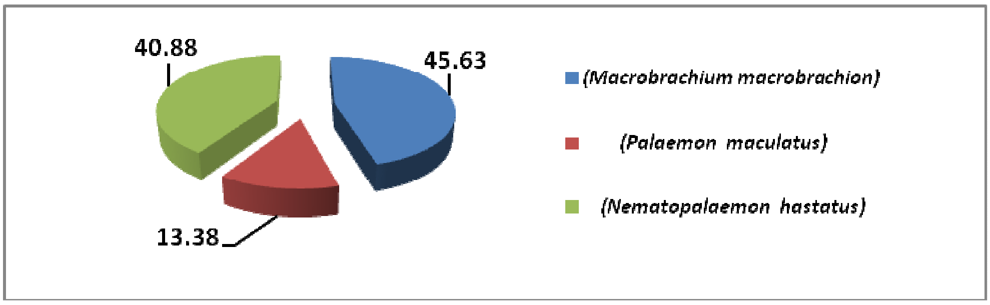

Figure 2: Relative abundance ratio of sampled prawns across the study sites.

Water Depth

Table 2: Water depth measurements across the study sites.

SITE INDEX	Water Depth at 1st Point of Measurement (mtrs)	Water Depth at 2ND Point of Measurement (mtrs)	Water Depth at 3RD Point of Measurement (mtrs)	RANGE	MEAN DEPTH(S) ± S.D
UGBONLA	0.70	0.68	0.65	0.65-0.70	0.67 ± 0.025
IDI-OGBA	0.58	0.56	0.54	0.54-0.58	0.56 ± 0.020
ERUN-ONA	0.62	0.59	0.56	0.56-0.62	0.59 ± 0.030
WOMITEREN	0.52	0.48	0.47	0.47-0.52	0.49 ± 0.026

Water Quality

Table 3: Analytical results of water quality parameters

STUDIED PARAMETERS	SITE A UGBONLA	SITE B IDI-OGBA	SITE C ERUN-ONA	SITE D WOMITEREN	RANGE	MEAN ± S.D
Temprature (^{0}C)	27.55	27.73	27.82	28.60	27.55 -28.60	27.925 ± 0.463
pH	7.24	6.83	6.68	6.66	6.66-7.24	6.8525 ± 0.269
Conductivity (mΩ/cm)	0.0017	0.0014	0.004	0.0008	0.0008-0.004	0.00198 ± 0.0014
Dissolved Oxygen (ppm)	6.80	7.52	8.83	8.06	6.80 -8.83	7.802 ± 0.857
Total Dissolved Solid (ppm)	301	371	1361	633	301-1361	666.5 ± 484.548
Salinity (%)	0.29	0.37	1.39	0.65	0.29-1.39	0.675 ± 0.501
Alkalinity(mg/l)	50.0	80.0	120.0	70.0	50-120	80 ± 29.439
Carbonate(mg/l)	3.0	4.8	7.2	4.2	3.0-7.2	4.8 ± 1.766
Biological Oxygen Demand (mg/l)	3.27	2.07	3.67	2.98	2.07-3.67	2.997 ± 0.679
Hardness (mg/l)	94.0	120.0	240.0	156.0	94-240	152.5 ± 63.631

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