The Zoologist Vol. 6: 55-60 (2008)

RECRUITMENT PATTERN OF *MACROBRACHIUM VOLLENHOVENII* IN THE LAGOS – LEKKI LAGOON SYSTEM, NIGERIA

ABOHWEYERE, P. O.[1]; ANYANWU, A. O.[2] and WILLIAMS, A. B.[1]

[1] *Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos State, Nigeria.*

[2] *Nigeria – SAO Tome and Principe Jiont Development Authority, Wuse II, Abuja, Nigeria*
**Corresponding Author*

Abstract
Recruitment pattern of *Macrobrachium vollenhovenii* in the Lagos – Lekki Lagoon System was estimated from a time series length-frequency data of two years (April 2002 – May 2004). The annual recruitment pattern was estimate through back-projection, along a trajectory defined by the von Bertalanffy Growth Formula (VBGF) of the restructured data onto the time axis. *M. vollenhovenii* from the Lagos Lagoon exhibited two peaks of unequal pulse strength. The peaks of the smaller sized prawn for *M. vollenhovenii* were noted in September to November and in February. The recruitment pattern exhibited, revealed that for sustainability of this resource exploitation should be avoided in the months of September to November and also in February, as this would allow the young recruits to grow and reproduce thereby ensuring resource sustainability.

Key words: Recruitment Pattern, Pulse Strength, *Macrobrachium vollenhovenii*, Resource Sustainability, Lagos – Lekki Lagoon System.

Introduction
The Lagos – Lekki Lagoon artisanal fisheries is dependent on the lagoon fisheries resources of which *Macrobrachium vollenhovenii* is a major resource. The livelihood of the artisanal fishermen therefore depends on the continual availability of the lagoon resources. *Macrobrachium* species are important both in ecological and economical terms, playing salient role in determining the dynamics and structure of aquatic ecosystem and are valued as food for man. *M. vollenhovenii* is bigger in size compared to the other *Macrobrachium* species.

Many workers have studied their ecology, biology and fisheries. Marioghae (1982, 1990) investigated the fishery, distribution and salinity tolerance of *M. macrobrachion* and *M. vollenhovenii* in the Lagos Lagoon. Enin (1995) gave estimates of growth, mortality rates and recruitment patterns of *M. macrobrachion* in the Cross River Estuary, while Gabche and Hockey (1995) studied the growth and mortality of *M. vollenhovenii* in Lobe River, Cameroun. Nwosu and Wolfi (2006) studied the population dynamics of *M. vollenhovenii* in the Cross River Estuary; and Etim and Sankare (1998) reported on the growth, mortality and recruitment of *M. vollenhovenii* in Fahe Reservoir, Cote d'Ivore.

Recruitment is the process by which young fish enter the exploited area and become liable to capture with fishing gear. This may involve an actual movement in which the young prawns move from

*Author for correspondence

shallow nursery area into the main fishing ground. In prawns recruitment involve a change in habit; the young larvae are pelagic while the recruiting to the exploited phase are demersal (Mueter *et. al*., 2007).

Mathematically, the important quantity is t_r = mean age at recruitment. Recruitment is by nature much less easy to express in quantitative terms than mesh selection. As the main interest is in the combined effect of recruitment and selection – i.e the pattern of entry into the catch – the recruitment pattern is very important when it is above, or overlaps the range of gear selection, but not when it is complete before gear selection starts. Where important the general curve may be determined by a proper knowledge of the biology of the species and possibly estimated with greater accuracy by surveys (Pauly, 1982). Normally the recruitments are over a range of size.
Recruitment is a very crucial phenomenon in fisheries as it determines the magnitude of catch that can be taken from year to year from a fish stock. Since it is the pulsed nature of recruitment into a population that determines the structure of a set of length-frequency data, the converse also applies that one should be able to recover some information on the seasonality of recruitment from length frequencies (Pauly, 1982).

The abundance and productivity of commercial fish stocks varies on interannual and interdecadal time scale as a result of environmental variations, species interactions, and fishing (Mueter *et al*., 2007). Variability in recruitment of many demersal stocks is characterized by synchronous strong year classes. Field and Ralston (2005) documented substantial spatial synchrony in recruitment within each of three rockfish species. Recruitment pattern allows the identification of the number of recruitment pulses per year and evaluating the relative importance of these pulses when compared to each other.

This study investigated the recruitment pattern of *M. vollenhovenii* with the purpose of providing vital scientific information that the management of this stock in the Lagos – Lekki Lagoon will be based.

Materials and Methods

The monthly length-frequency samples analyzed in this study were collected from eighteen (18) stations on the Lagos – Lekki lagoon system, longitude 3°22.5' to 4° 13' E and latitude 6°24' to 6° 38'N (Fig. 1) by the artisanal gear, shrimp trap locally known as igun. The gear consisted of a conical shaped cane trap of 44 - 47cm length and a mouth opening of 17 - 19cm diameter. The sampling period was from April 2002 to May 2004.

Total length (TL), of the prawn from the orbital notch to the tip of the telson, of individual specimen was recorded. These measurements were made to the nearest 0.5cm, as described by FAO Species Identification Sheets for Fishery Purposes (FAO, 1981).

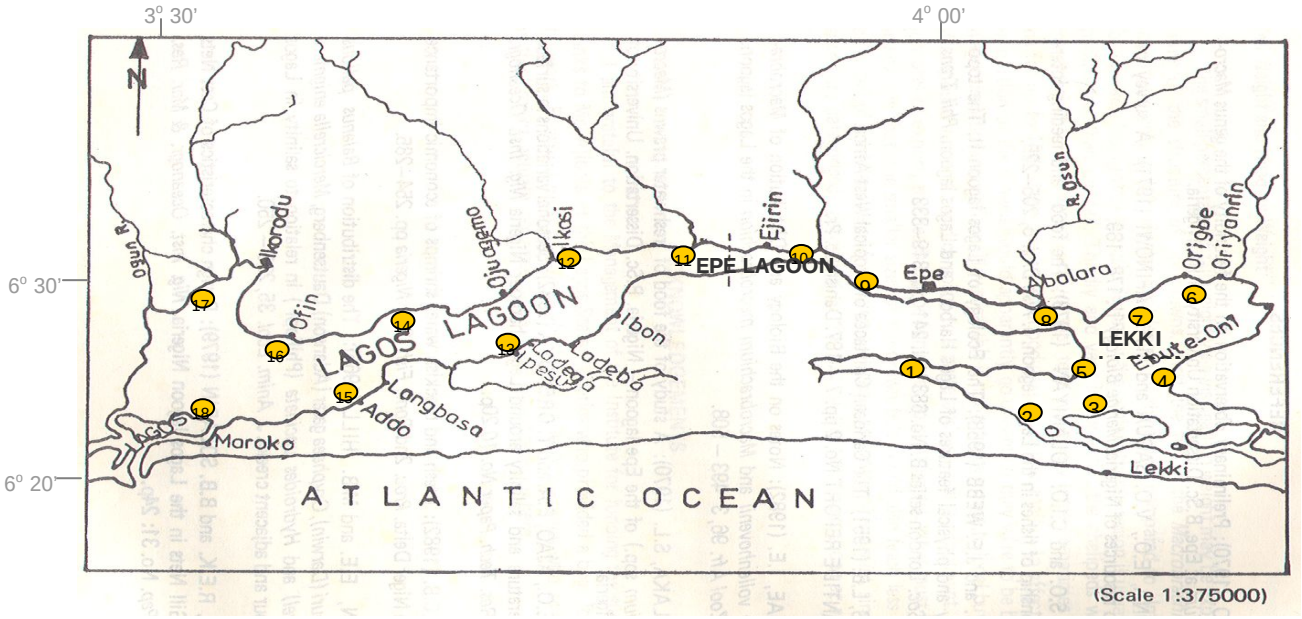

Fig 1: Map of Lagos – Lekki Lagoon system showing sampling sites

FAO-ICLARM Stock Assessment Tools (FiSAT) (Gayanilo *et al.*, 1996; Gayanilo and Pauly, 1997) was used to estimate the annual recruitment pattern following Moreau and Cuende (1991), through reverse projection of the restructured data onto the time axis. This entails back-projecting, along a trajectory defined by the von Bertalanffy Growth Formula (VBGF) all the length-frequency onto a one-year time scale (Pauly, 1987).The parameters used were asymptotic length (L∞), growth coefficient (K), growth performance index (ø') and slowest growth period or Winter Point (WP). The pattern was decomposed using NORMSEP and fitted with Guassian distribution. Recruitment pulses were reconstructed from the time series of length frequency data to determine the number of pulses per year and the relative strength of each pulse. Due to the inability to calculate the parameter t_0 of the von Bertalanffy growth model using length frequency data alone (Pauly, 1987), the absolute position of the recruitment peak (period of high juvenile – specimens of ≤4.5cm - preponderance) in terms of month of year could not be calculated. However, the position of the peak were inferred approximately by examining the length frequency data used.

Results

Values of L∞, K, ø' and WP were 18.8cm, 0.55, 2.50 and 0.75 respectively. Figure 2 shows the backward projection, along a trajectory defined by VBGF for *M. vollenhovenii* and Figure 3 is the recruitment pattern decomposed into pulses. *M. vollenhovenii* from the Lagos Lagoon exhibited two peaks of unequal pulse strength. The relative recruitment values (in percentages) for the various months are presented in Table 1. The highest percentage recruitment was observed in month 6 of the relative time and no recruitment was observed in relative time month 12. The peaks of the smaller sized *M. vollenhovenii* (≤4.5cm) were noted in September to November and February.

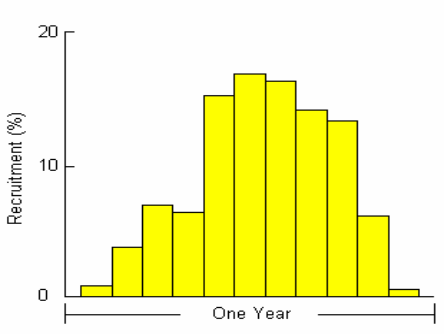

Fig. 2: Backward projection, along a trajectory defined by the VBGF, of the restructured length frequency data onto an arbitrary one-year timescale for *M voltenhovenii*. The months on the X axis cannot be located exactly hence the abscissa is an arbitrary year) because of the location parameter (t_0) of the VBGF.

`

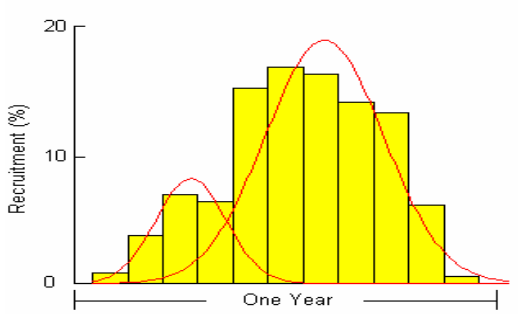

Fig. 3: Recruitment pattern decomposed into pulses exhibiting two peaks of unequal pulse strength for *M. vollenhovenii*. Decomposition using 2 and 6 months for groups 1 and 2 gave values of 2.80 and 6.60 respectively.

Table 1: Relative Recruitment Values for *M. vollenhovenii*

Relative Time	Percent Recruitment
Month 1	0.75
Month 2	3.69
Month 3	7.05
Month 4	6.35
Month 5	15.14
Month 6	16.73
Month 7	16.22
Month 8	14.08
Month 9	13.46
Month 10	6.08
Month 11	0.45
Month 12	0.00

Discussion

Recruitment has been described as a year round phenomenon for tropical fish and shrimps species (Qasim, 1973; Weber, 1976). Two recruitment peaks, one major and the other minor were exhibited by *M. vollenhovenii* from the Lagos – Lekki Lagoon System. This observation is at variance with the concept of continuous recruitment phenomenon of Qasim (1973) and Weber (1976); however it conforms with Pauly (1982) assertion of double recruitment pulses per year as nearly a general feature of tropical fish species, and for short-lived species (Pauly and Navaluna,1983; and Dwiponggo *et al*., 1986). The presence of one major peak and one minor peak probably earlier in the year for *M. vollenhovenii* appears similar to the patterns observed for *Penaeus notialis* off Cote d'Ivoire (Garcia and Le Reste, 1981), *Penaeus duoraum* from Tortugas, Florida (Pauly *et al*., 1984), *Nematopalaemon hastatus* off the Southeast coast of Nigeria (Enin *et al*., 1996) and for *M. vollenhovenii* from Cross River Estuary (Nwosu and Wolfi, 2006).

Etim and Sankare (1998) observed this same peak period (September - November) as recorded in the present study for this species in Fahe Reservoir, Cote d'Ivoire however while there was only one peak of recruitment in Fahe Reservoir, there was another peak (February) in the Lagos – Lekki Lagoon System. The observed peaks could probably be due to high water level occasioned by heavy rains that characterizes this period.

Conclusion

The recruitment pattern exhibited by *M. vollenhovenii* in the Lagos – Lekki Lagoon System from the present study revealed that there are two peak periods of recruitment. For sustainability of this resource, exploitation should be avoided in the months of September to November and also in February. This would allow the young recruits to grow and reproduce thereby ensuring resource sustainability. The fishery for *Macrobrachium* in the Lagos-Lekki lagoon is a wet season fishery. Though the major recruitment pulse could be adjudged to have fallen within the wet season, it is the end of the wet season and the recruitment continues till November that clearly falls within the dry season. The minor pulse that can be said occurs in February is in the peak of the dry season. It is therefore of great importance that the fishery not be extended into the dry season to ensure resource sustainability.

References

Dwiponggo, A, T. Hariati, S. Banon, M.L. Palomares and D. Pauly (1986). Growth, mortality and recruitment of commercially important fishes and Penaeid shrimps in Indonesian waters. *ICLARM Tech. Rep*. 17: 91pp.

Enin, U.I. (1995). First estimates of growth, mortality and recruitment parameters of *Macrobrachium macrobrachion* Herklots 1851, in the Cross River Estuary, Nigeria. *Dana* 11: 29 38.

Enin, U.I., U.Lowenberg and T.Kunzel (1996). Population dynamics of the estuarine prawn (*Nematopalaemon hastatus* Aurivillius 1898) off the southeast coast of Nigeria. *Fish. Res*. 26: 17 – 35.

Etim, L. and Y. Sankare (1998). Growth and mortality, recruitment and yield of the freshwater shrimps *Macrobrachium vollenhovenii* Herklot, 1857 (Crustacea, Palaemonidae) in Fahe Reservoir, Cote d'Ivoire, *West Africa. Fish. Res*. 38: 211 223

FAO (1981). FAO Species Identification Sheets for Fishery Purposes. Eastern Central Atlantic fishing area. W. Fisher, G. Bianchi and W. B. Scott. Ed. Vol. VI, 284p

Field, J. C., and S. Ralston (2005). Spatial variability in rockfish (Sebastes sp.) recruitment events in California Current

System. *Can. J. Fish. Aquat. Sci.* 62: 2199 – 2210.

Gabche, C.E and H.U.P. Hockey (1995). Growth and mortality of the giant African prawn *Macrobrachium vollenhovenii* (Herklots: Crustacea: Palaemonidae) in Lobe River, Cameroun: A preliminary evaluation. *J. Shellfish. Res.* 14 (1): 185 – 190.

Garcia, S. and L. Le Reste (1981). Life cycles, dynamics, exploitation and management of coastal penaeid shrimp stocks. *FAO Fisheries Technical Paper* No. 203, 215p

Gayanilo Jr. F.C., P. P. Sparre. and D. Pauly (1996): *FAO-ICLARM Stock Assessment Tools* (FiSAT). Rome, 126pp (+3 diskettes).

Gayanilo Jr. F.C.J. and D. Pauly (ed.) (1997). FAO-ICLARM Stock Assessment Tools (FiSAT). Reference Manual. *FAO Computerized Information Series (Fisheries)*, No. 8. Rome, FAO. 262pp.

Marioghae, I.E. (1982). Notes on the biology and distribution of *Macrobrachium vollenhovenii* and *Macrobrachium macrobrachion* in Lagos Lagoon (Crustacea, Decapoda, Palaemonidae) *Rev. Zool. Afr.* 96 (3): 493 – 508

Marioghae, I.E (1990). Studies on fishing methods, gear and marketing of *Macrobrachium* in the Lagos area. *Nigerian Institute for Oceanography and Marine Research. Tech. Paper* 53. 20pp.

Moreau, J. and F. Cuende (1991). On improving the resolution of the recruitment patterns of fish. *ICLARM Fishbyte* 9 (1): 45 – 6.

Mueter, F.J., Boldt, J.L., Megrey, B.A. and Peterman, R.M. (2007). Recruitment and survival of Northeast Pacific Ocean fish stocks: temporal trends, covariation, and regime shifts. *Can. J. Fish. Aquat. Sci.* 64: 911 – 927 (2007)

Nwosu, F.M. and M. Wolfi (2006). Population Dynamics of the Giant African River Prawn *Macrobrachium vollenhovenii* Herklot 1857 (Crustacea, Palaemonidae) in the Cross River Estuary, Nigeria. *West Africa Journal of Applied Ecology*. 9:78- 92.

Pauly, D. (1982). Studying single-species dynamics in a tropical multispecies context. In Pauly, D and G.I. Murphy (Editors), *Theory and Management of Tropical Fisheries.* ICLARM Conf. Proc., Vol. 9, pp. 33 – 70

Pauly, D. (1987). A review of the ELEFAN system for analysis of length-frequency data in fish and aquatic invertebrates. In Pauly, D and G.G. Morgan (Editors), *Length-Based Methods in Fisheries Research.* ICLARM Conf. Proc., Vol. 13, pp. 7-34.

Pauly, D., J. Ingles and R. Neal (1984). Application to shrimp stocks of objective methods for the estimation of growth, mortality and recruitment-related parameters from length-frequency data (ELEFAN 1 and 2). In Gulland, J.A. and B.J. Rothschid (eds): *Penaeid shrimps – their biology and management*. Fishing News (Books) Ltd., Surrey. pp. 220 – 234.

Pauly, D. and N.A. Navaluna (1983). Monsoon-induced seasonality recruitment of Philippine fishes. *FAO. Fish. Rep.* 3 (291): 823 – 833.

Qasim, S.Z. (1973). Some implication of the problem of age and growth in marine fishes from Indian waters. *Indian J. Fish.* , 20 (3): 351 – 371.

Weber, W. (1976). The influence of hydrographic factors on the spawning time of tropical fish. In K. Tiews (Editor), *Fisheries Resources and their Management in Southeast Asia.* Pp. 269 – 281.