(RESEARCH ARTICLE)

The recruitment pattern of *Macrobrachium* species from Igbedi Creek, Bayelsa State, Niger Delta, Nigeria

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Abstract

The recruitment pattern of *Macrobrachium* species at Igbedi Creek, Bayelsa State, Nigeria, were investigated to show if it can support optimum shrimp catch in the year 2020. The riparian settlements of Ogoubiri, Toruibeni, Amassoma and Otuan were chosen for this research. The result showed that there are three species in the Creek which were *Macrobrachium macrobrachion*, *Macrobrachium vollenhovenii* and *Macrobrachium felicinum*. Juveniles and ovigerous females were observed for all three species. The recruitment model in FiSAT II was utilized and the result showed that the percentage recruitment peak for *Macrobrachium macrobrachion* was 23.78% in the month of June while *Macrobrachium vollenhovenii* was 17.40% in the month of July. Recruitment peaks were recorded for both sexes in the months of March to September in all four locations and there was year-round recruitment for the both species. The species *Macrobrachium felicinum* was captured in the month of November with few catches. Male domination of females for *Macrobrachium vollenhovenii* and *Macrobrachium felicinum* were recorded. Therefore, this study recommend that optimum catch can be attained through closed season policies and further research on *Macrobrachium* species at Igbedi Creek.

Keywords: Recruitment pattern; Macrobrachium; Igbedi Creek; Niger Delta; Optimum catch

1 Introduction

The freshwater prawns, *Macrobrachium* species belong to the family Palaemonidae and are widely distributed in various inland water bodies of the Niger Delta in Nigeria. Powell [1], described 20 inland shrimp species of economic importance which includes 12 Palaemonidae of which 5 are *Macrobrachium* species which include: *Macrobrachium dux, Macrobrachium felicinum, Macrobrachium macrobrachion, Macrobrachium species A* and *Macrobrachium vollenhovenii.* These species are consumed and sold by shrimpers from the riparian communities along the freshwater and Brackish water ways. Prawn species in Nigeria have good candidates for culture, they are species of great value as their exoskeletal parts are utilized as fish and livestock feed ingredients [1,2,3].

As species of economic importance, the dwindling fish and shrimp catch [4], had not deterred fishers from exploiting the shrimp's species of Nigerian inland waters which includes the species at Igbedi Creek. The need to investigate population parameters such as the recruitment of the species is important for decision/policy making. Recruitment is defined as the addition of new members to the fishing ground under investigation [5]. It is the stage a fish or prawn growth had reached where it can be caught [6], and counted in a fishing gear. Normally, spawners and recruits are not

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observed directly and must be inferred from models that use other sources of data, such as the age or size structure of fishery catches [7]. Fecundity studies are useful for providing estimates for possible recruitment or juveniles available for culture [8]. The propagative capacity of a population is a function of the fecundity of the females [2].

A recruitment curve can be obtained from percentage of fish population derived from fishers catch [9]. Knowledge of the size caught by gears are of note for management purposes. To the fisheries manager, the spawning stock of the adult fish is important [10] including shrimps. Some factors identified affecting recruitment includes size of the spawning stock, environmental factors, predation and competition. The challenges of recruitment in fisheries management is investigating the fish larvae in one season that will survive and become juvenile fish in the next season [11]. This can also be applied in aquatic invertebrates such as the *Macrobrachium* species*.* The average age of a fish or shrimp species at recruitment depend on the kind of species and the gear utilized. Generally, assessment of the recruitment pattern is often obtained by comparing the size composition of definite catches with known gear [12]. This study provides information on the recruitment pattern of *Macrobrachium* species at Igbedi Creek, Bayelsa State, Niger Delta, Nigeria, that can support optimum shrimp catch.

2 Material and methods

2.1 The Study Area

The study was carried out at Igbedi Creek which is a tributary in Bayelsa State. Bayelsa State is one of the nine States of the Niger Delta. Bayelsa State lies at latitude 4° 39' 50" North and longitude 6° 2' 13.15" East. The Igbedi Creek was selected because the species are caught by fishers in the region. The stations which were purposively selected as described in [13], were Ogoubiri, Toruibeni, Amassoma and Otuan and were sampled for the *Macrobrachium* species.

Ogoubiri (Station 1) is located within latitude 4° 59' 43"N and longitude 6° 06' 56"E. Toruibeni (Station 2) is located within latitude 4° 58' 31"N and longitude 6° 4' 25"E. Amassoma (Station 3) is located within latitude 4° 58' 15" N and longitude 6° 06' 32.94" E. Otuan (Station 4) is located at latitude 4^0 52' 27" N and longitude 6^0 07' 18" E downstream from Amassoma as described by [13].

2.2 The Gear used and Catch Composition

The gear utilized and the catch composition of each was investigated and identified at each location of Ogoubiri, Toru-Ebeni, Amassoma and Otuan.

2.3 Collection of Shrimp Samples and identification of species

Fresh live specimens of *Macrobrachium* species were obtained from fishers for twelve calendar months biweekly at the chosen sampling stations at Igbedi Creek. Specimens were kept and preserved in 10% formalin and taken to the Laboratory. Samples were pooled into monthly data, sorted into sexes, and then length-frequency data was obtained by measuring individual shrimps by sizes (standard length-from tip of rostrum to tip of telson) to the nearest 0.1 mm and their weight to the nearest 0.1g.

2.4 Identification of Species

The species of prawns were identified using appropriate tools [1,14,15] as described by [13]. Morphological features were used including the colour differentiation.

2.5 Recruitment pattern

The species were harvested using traps: non-return valve traps, non-return net traps and hand-push nets by fishers. The pattern of catch was not determined by mesh size of gears as the gears have entrance hole or opening by which the shrimp crawl into the valve traps or hauled into the hand-push nets, therefore mesh size selectivity was not applied in this research but asymptotic length L∞ and the growth coefficient K derived from the length-frequency data were subjected to the recruitment procedure of FISAT II - FAO-ICLARM Stock Assessment Tool, developed by Pauly [16], Moreau and Cuende [17], and Gayanilo and Pauly [18] and employed extensively by fisheries managers and reseachers. It is a tool based on the assumptions that all fish in a given data set grows as described by a single set of growth parameters; and that one month out of twelve always has zero recruitment.

3 Results and discussion

3.1 Recruitment Pattern

Three species of the genus *Macrobrachium* were identified; *Macrobrachium felicinum, Macrobrachium macrobrachion* and *Macrobrachium vollenhovenii. Macrobrachium felicinum* were caught in a single month of November therefore cannot be analyzed in the FiSAT II recruitment pattern statistical tool. The recruitment patterns were analyzed using the FiSAT II recruitment pattern method. These estimates are shown on Figure 1 to 8 and the highest peak for each species is shown on Table 1. The peak of the recruitments was taken from the graphs. The alphabets: J, F M, A, M, J, J, A, S, O, N represents the months of the year from January to November.

Juveniles and ovigerous females were also observed in the creek during the study period for all three species. *Macrobrachium macrobrachion* recorded more females than male while *Macrobrachium felicinum* and *Macrobrachium vollenhovenii* recorded more males than female.
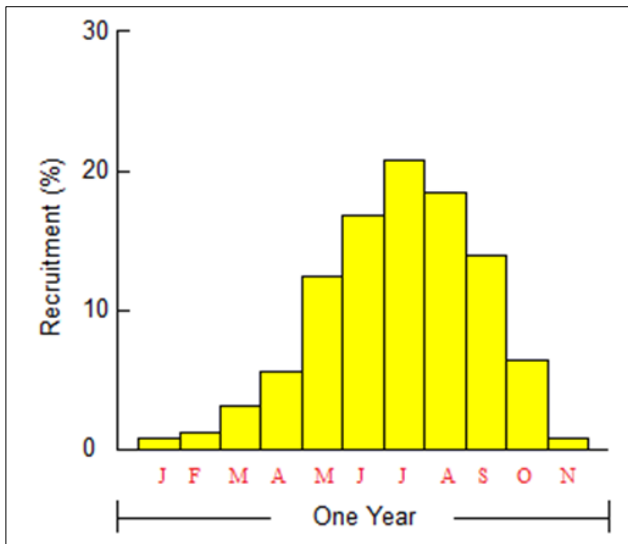

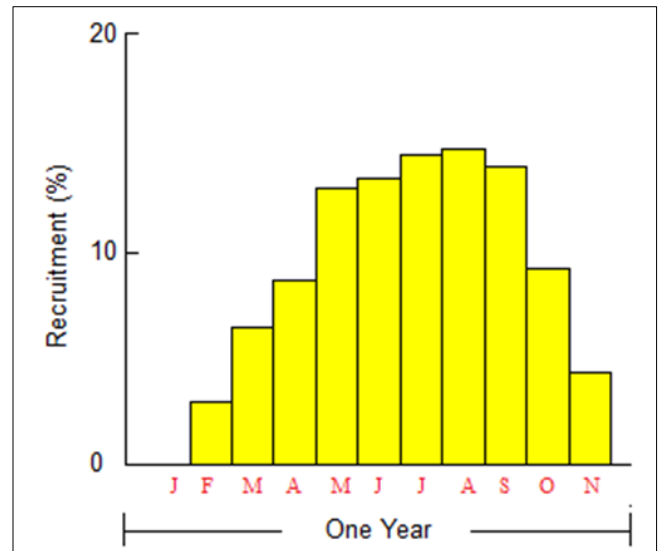**Figure 1** Recruitment pattern of total M. *macrobrachion of Amassoma*

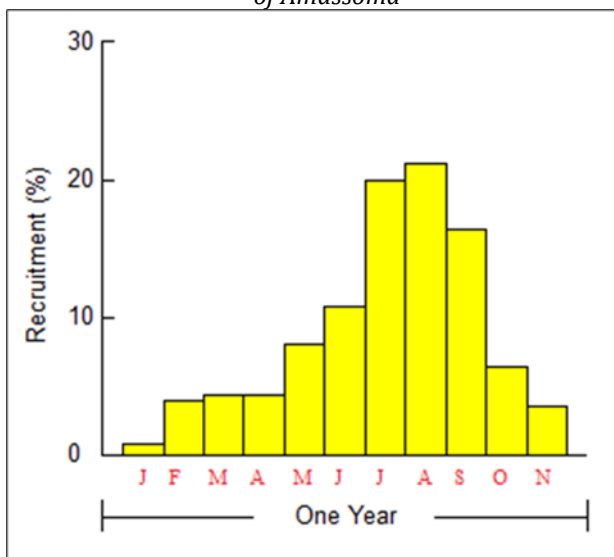**Figure 2** Recruitment pattern of total M. *vollenhovenii of Amassoma*

Figure 3 Recruitment pattern of total M. *macrobrachion of Ogoubiri*
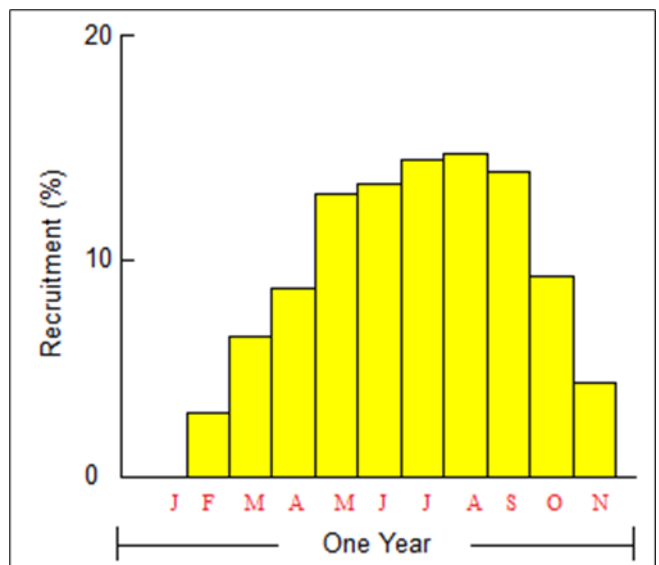

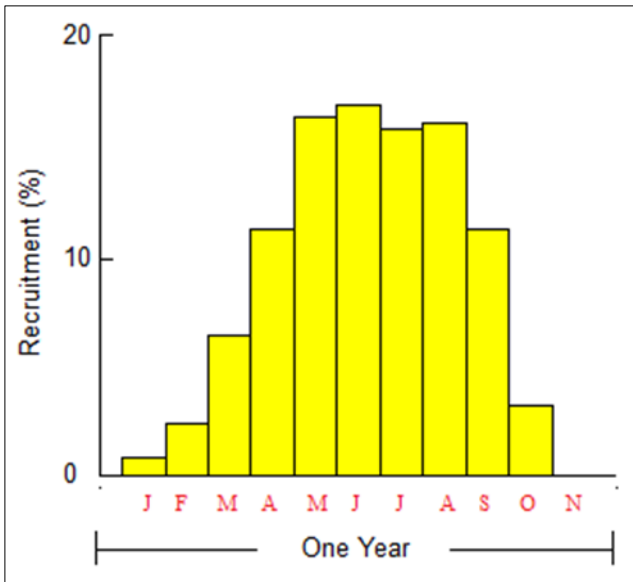**Figure 4** Recruitment pattern of total M. *vollenhovenii of Ogoubiri*

Figure 5 Recruitment pattern of total M. *vollenhovenii of Otuan*
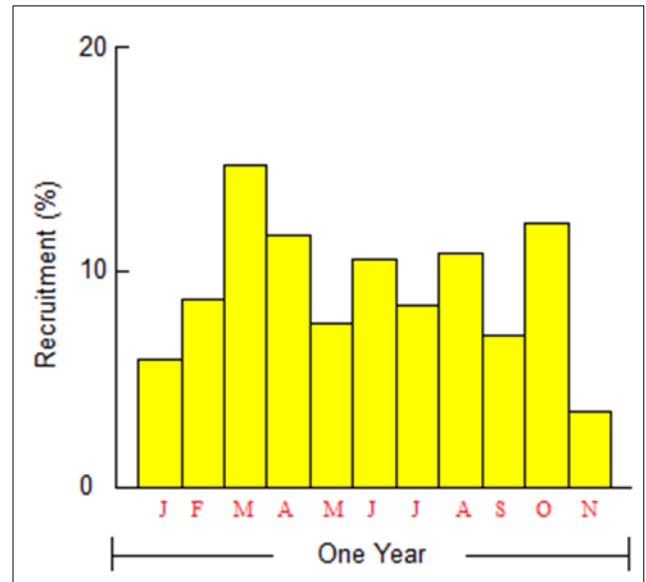

Figure 6 Recruitment pattern of total *M. macrobrachion of Otuan*
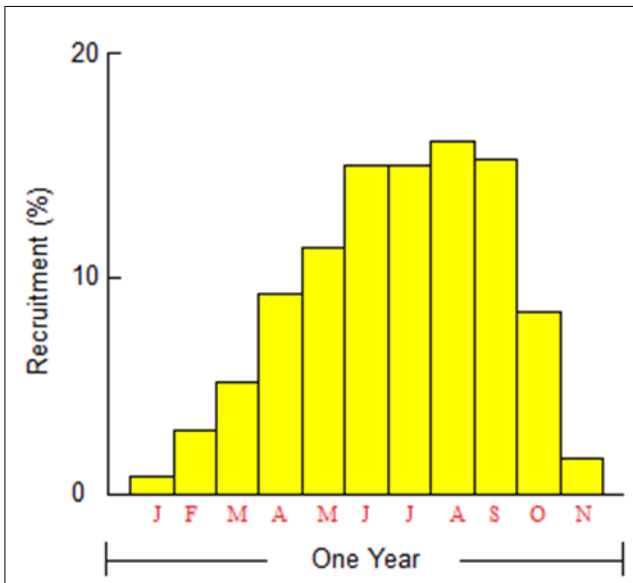

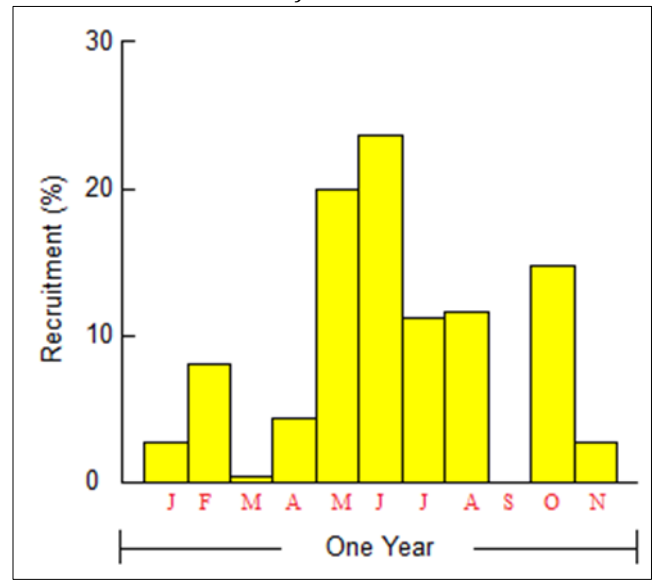**Figure 7** Recruitment pattern of total *M. vollenhovenii of Toru-Eben*

Figure 8 Recruitment pattern of total *M. macrobrachion of Toru-Ebeni*

Table 1 Recruitment pattern of *Macrobrachion* at Igbedi creek for 2020

Location	Species	Sex	Recruitment	
			Month	**Peak(%)**
Ogoubiri	*M.m*	M	June	22.51
Toru-Ebeni	*M.m*	M	June	15.82
Amassoma	*M.m*	M	June	14.68
Otuan	*M.m*	M	May	15.95
Ogoubiri	*M.m*	F	June	18.06
Toru-Ebeni	*M.m*	F	Aug.	14.54
Amassoma	*M.m*	F	July	17.21
Otuan	*M.m*	F	June	17.82
Ogoubiri	*M.v*	M	Aug.	14.79
Toru-Ebeni	*M.v*	M	Aug.	15.13
Amassoma	*M.v*	M	Sept.	17.23
Otuan	*M.v*	M	Aug.	14.87
Ogoubiri	*M.v*	F	Aug.	13.85
Toru-Ebeni	*M.v*	F	Sept.	16.80
Amassoma	*M.v*	F	Aug.	14.58
Otuan	*M.v*	F	July	18.45
Ogoubiri	*M.m*	MF	Aug.	21.38
Toru-Ebeni	*M.m*	MF	June	23.78
Amassoma	*M.m*	MF	July	20.75
Otuan	*M.m*	MF	March	14.58
Ogoubiri	*M.v*	MF	June	15.93
Toru-Ebeni	*M.v*	MF	Aug.	15.90
Amassoma	*M.v*	MF	Aug.	16.83
Otuan	*M.v*	MF	July	17.40

M. v: *Macrobrachium vollenhovenii*; M.m: *Macrobrachium macrobrachion*; M.f : *Macrobrachium felicinum*; M:male; F:female

4 Discussion

4.1 Recruitment pattern

From this study recruitment pattern was all year round as shown in (Figures 1 to 8). The highest peaks and their percentages are shown on Table 1. Tropical fish and shrimps are described to show year-round recruitment [19, 20, 21]. *M. vollenhovenii* showed this recruitment pattern with a major peak at the Cross River Estuary [22]. Pauly and Navaluna [23], reported a year-round recruitment pattern for shrimps and *Penaeus* species in Indonesian waters [24]. Deekae and Abowei [9] reported year-round recruitment for *M. macrobrachion* at Luubara Creek, Ogoni Land, Niger Delta, Nigeria. Silva *et al.* [25], reported a year-round recruitment for *Macrobrachium amazonicum* at the Amazon River mouth, Amapá State, Brazil. From this study the recruitment pattern of *Macrobrachium* species showed peaks from the months of March to September for both sexes at Igbedi Creek. Understanding the recruitment pattern of a fish or shrimp species will help fisheries managers and policy maker to determine the closed season for fish exploitation. *Macrobrachium* species at Igbedi Creek apart from *Macrobrachium felicinum* which was caught in a single month of

November show recruitment peaks. Abohweyere *et al.,* [26], reported two peaks within the year in *M. vollenhovenii* recruitment pattern from September to November and then February and therefore encouraged avoidance of fishing during this period.

The catch showed that there were more males than female for *Macrobrachium felicinum* and *M. vollenhovenii* this might be due to random catch from the gears utilized and also species migration as the species were observed to be more abundant during the wet season than in the dry season at Igbedi Creek. *Macrobrachium macrobrachion* recorded more females than male and probably this allowed for continuous replacement of population which is in agreement with Deekae and Abowei [9], which reported more females than male for *Macrobrachium macrobrachion* at Luubara Creek in Rivers State Nigeria.

5 Conclusion

Igbedi Creek which is a water-way with human activities such as fishing, sand-mining, transportation, waste disposal, etc. was investigated for the recruitment pattern of *Macrobrachium* species and four riparian communities of Ogoubiri, Toru-Ebeni, Amassoma and Otuan were sampled. The gear utilized were efficient for the capture of *Macrobrachium* species and all year-round recruitment pattern for *Macrobrachium vollenhovenii* and *Macrobrachium macrobrachion* were recorded, but recruitment pattern for *Macrobrachium felicinum* cannot be established as this species was successfully exploited in a single month of November throughout the year 2020. Year-round recruitment indicates availability of the prawns for exploitation, and research. Therefore, this study recommend that the closed season should be encouraged to increase awareness among fishers for shrimp species sustainability as recruitment peaks were recorded in the months of March to September. Male domination of females for *Macrobrachium vollenhovenii and Macrobrachium felicinum* calls for further research and catch control policies should be adopted to reduce the pressure on the catch.

Compliance with ethical standards

Disclosure of conflict of interest

 There was no conflict of interest.

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