Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.4, No.14, 2014

Mortality and Recruitment of the West African Fiddler Crab (*Uca tangeri*) inMbo River of AkwaIbom State, Nigeria

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Abstract
Studies on the mortality and recruitment pattern of the crab *Ucatangeri*in Mbo river of AkwaIbom State, Nigeria, was conducted for 12 consecutive months (April, 2012 – March, 2013). Length-frequency data was analyzed using FISAT software. Using the Shepherd's method, asymptotic length (L∞) was 3.99cm, while the Von Bertalanffy Growth Function(VBGF) K was 0.10. Meanwhile, Powell-Wetheral plot estimated asymptotic length (L∞) was 3.58cm and Z/K was 0.72yr^{-1}. The natural mortality(M) of*Ucatangeri*was 0.71yr^{-1}. However, using length-converted catch curve, total mortality (Z) was estimated to be 0.27yr^{-1}. The instantaneous fishing mortality (F) was calculated to be -0.44yr^{-1}, indicating that it was not a highly fished species.
Keywords: Mortality, Recruitment and Crab.

1.0 Introduction

Freshwater crabs are a strangely neglected component of the world's inland aquatic ecosystems. Despite their wide distribution throughout the tropical and warm temperate zones of the world, and their great diversity, their role in the ecology of freshwaters is very poorly understood. This is nowhere more true than in Africa, where crabs occur in almost every freshwater system, yet even fundamentals such as their higher taxonomy are yet to be determined. In terms of basic morphology, freshwater crabs are similar to their marine counterparts, but they are taxonomically distinct. There is a large size range, with some species reaching adulthood with a carapace width (CW) of 20–30 mm, whereas others reach maturity at CW 50 mm or more. Older specimens of the larger species can have CWs in excess of 100 mm.(Cumberlidge, 1999).

Crabs are predated upon by a variety of organisms, particularly otters and, in central and West Africa, otter shrews, but also fish, young crocodiles, monitor lizards, mongooses, civets, drills and birds such as storks and kingfishers (Rathbun 1921; Voelker& Sachs 1977; Purves et. al., 1994; Butler & Marshall 1996). Turnbull-Kemp (1960) reported work from Zimbabwe that found that 13.1% of 1000 trouts had crabs in their stomachs, while crab remains were identified from 100% of otter (Aonyxcapensis) droppings examined, with a volumetric occurrence of 97.5%. There was a difference in the size of crabs eaten by these species, with trout feeding on the smaller individuals while otters (and other predators such as eels) catch larger individuals from the stream bed (Butler & Marshall 1996).

Little is known about the susceptibility of freshwater crabs to disease, or about parasitism. In many areas they may be infested with Simulium larvae and pupae, but there is no evidence that these have a detrimental influence on the crabs themselves. Similarly, Turnbull-Kemp (1960) reported large numbers of crabs in Zimbabwe carrying a small greenish leech (Hirudinea) up to 10 mm in length, but whether these were parasitising the crabs or simply using them as an attachment site is unclear. At least some crabs are subject to kleptoparasitism. In Lake BarombiMbo, they fall victim to prey stealing activities by cichlid fishes, with two species of fish that employ 'sit-and-wait' predatory tactics being especially suited to this activity (Dominey& Snyder 1988).

2.0 Materials and Method

2.1 The Study Area: Mbo River (Fig. 1) is a tributary of the Cross River. It lies between longitude 8º:00¹ – 8º:30¹E and latitude 4º:30¹-4º:45¹N, and falls within the tropical rainforest belt with equatorial climate regime. The location of the study area is just north of the Equator and within the humid tropics and its proximity to the sea makes the area generally humid. The crabs were collected with the assistance of fishers using artisanal baited pots, traps and hands (manual) to pick and dislodge them from their nest. They were placed in clean polythene bags and taken to the laboratory for analysis.

2.2 Determination of Mortality Rate and Recruitment Pattern:The catch curve method (Pauly, 1983) was used in estimating the total mortality (Z) of the crabs. This method involved plotting the natural logarithms of the crabs in various age groups (N) against their corresponding relative age t. Z will then be obtained from the slope (b) of the descending part of the curve after it has been fitted with a regression line. The equation of the line will be derived from the equation.

Log N = a+ bt…….(1)

where;

a = intercept

b = Slope
t = Relative age
N = Age

Only those values of log N which pertain to the age of the crabs that were identified as fully vulnerable to the gear were included in the calculation of the linear function. Fishing mortality co-efficient (F) was estimated as:

F = Z – M ……(2)

where;
Z = Total mortality
M = Natural mortality
F = Fishing mortality

Natural mortality (M) was estimated using Pauly's (1980) empirical formula that integrates mortality and size, using the mean temperature (29.2^{0}C) of Mboriver.

$Log_{10}M = 0.0066 - 0.279Log_{10}L_{\infty} + 0.6543Log_{10}K + 0.4634Log_{10}T$……(3)

Where
M = Natural mortality
L∞ =Asymptotic length (i.e., possible length)
K = Growth co-efficient
T = Mean temperature
Note that:
Z = F + M

The catch curve method has also been incorporated into the FiSAT computer programme (Gayanilo and Pauly, 1997) hence Z was obtained through the computer package.

The length –frequency data collected from samples of Ucatangeri were subjected to this recruitment procedure. The recruitment routine in FISAT estimated the recruitment pattern using the number of recruitment pulses per year and evaluating the importance of this pulses when compared to each other using length-frequency data.

The two assumptions on which the recruitment model is based are;

- That all fish in a given data grow as described by a single set of growth parameters.
- And that one month out of twelve always has zero recruitment.

The recruitment patterns were analyzed using NORMSEP (SEParation of the NORMally distributed components of length-frequency samples) to fit into Gaussian distribution on length-frequency data for the year pooled together (Pauly, 1983; Moreau and Cuende,1991; Gayanilo and Pauly, 1997).The significance of regression was assessed by analysis of variance (ANOVA).

3.0 Results and Discussion: Using the Shepherd's method, asymptotic length(L∞) was 3.99cm, while the Von Bertalanffy Growth Function(VBGF) K was 0.100(fig. 2). Meanwhile, Powell-Wetheral plot estimated asymptotic length(L∞) to be 3.58cm and Z/K was 0.721(fig. 3). From Pauly's equation where M is natural mortality with a mean habitat(Mbo river), temperature of 29.2^{0}C showed that natural mortality(M) of Ucatangeri was 0.70778 per year.

However, using length-converted catch curve (Fig. 4), total mortality(Z) was estimated to be 0.27yr^{-1}. Fishing mortality was calculated to be -0.43778, indicating that it was not a highly fished species. Natural mortality(M) being greater than total mortality(Z) suggest that, small animals have a higher mortality or the assumptions of catch curve are not met.

Asymptotic length is the maximum theoretical average length that a species could attain (granted it grows throughout life) in its habitat given the ecological peculiarities of the environment, and the K value of the VBGF constant is the parameter which indicates the speed at which the species grows towards this final size. Using the Shepherd's method, asymptotic length (L∞) was 3.99cm, while the Von Bertalanffy Growth Function(VBGF) K was 0.10. Meanwhile, Powell-Wetheral plot estimated asymptotic length (L∞) was 3.58cm and Z/K was 0.72yr $^{-1}$. The natural mortality(M) of *Ucatangeri* was 0.71 per year. However, using length-converted catch curve, total mortality (Z) was estimated to be 0.27yr $^{-1}$. Fishing mortality was calculated to be -0.44yr $^{-1}$, indicating that it was not a highly fished species. Natural mortality (M) being greater than total mortality (Z) suggest that, small animals have a higher mortality or the assumptions of catch curve are not met.

The recruitment pattern of*Ucatangeri* showed three major peaks; April, July and December(fig. 5). This implies that, the species will be abundant in those three months of peak recruitment. Months other than the peak recruitment months, can be used for breeding and growth of*Ucatangeri.*

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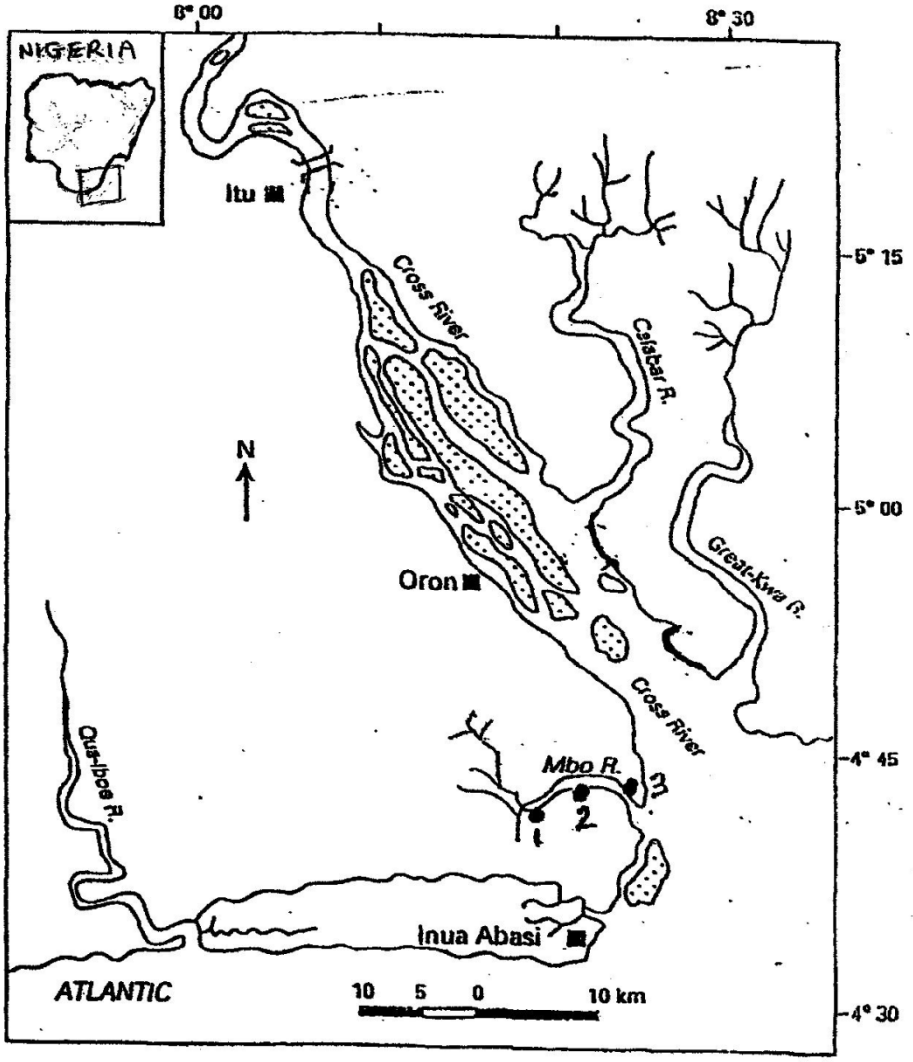

Fig. 1: Map of Mbo River showing the proposed sampling station

(Insert: Map of Nigeria showing the location of the study area)

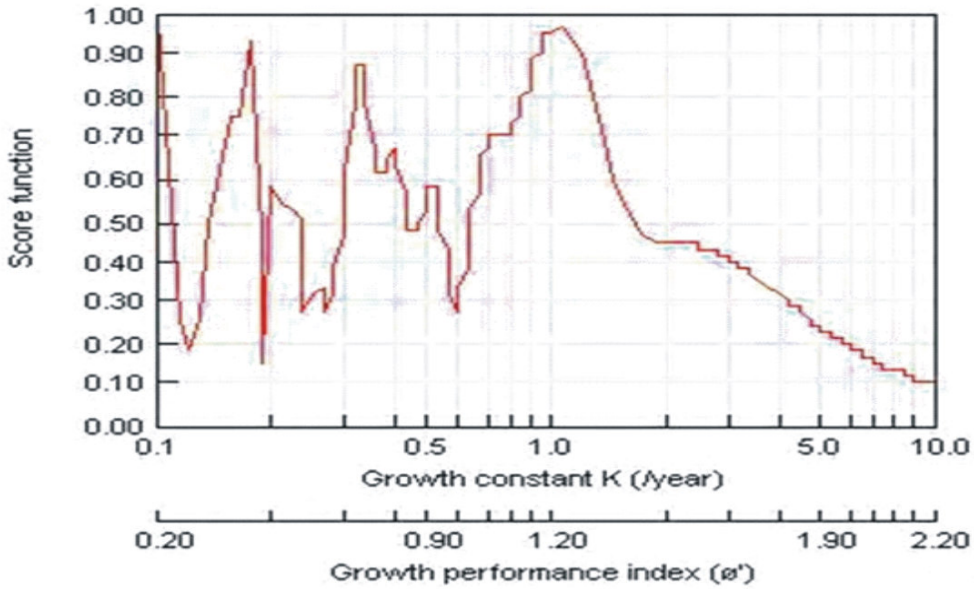

Fig. 2: Mortality of *Ucatangeri*using the Shepherd's method in Mbo River.

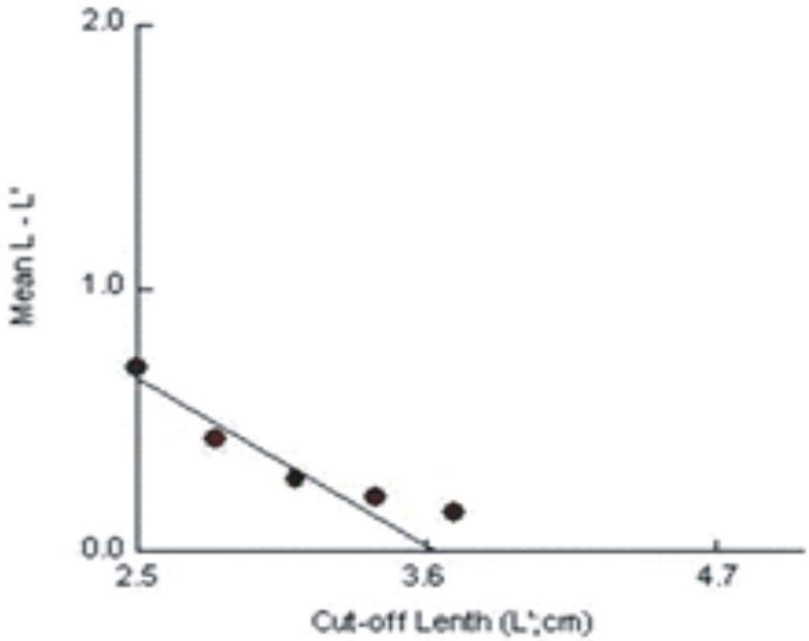

Fig. 3: Powell-Wetherall Plot for *Ucatangeri*in Mbo River

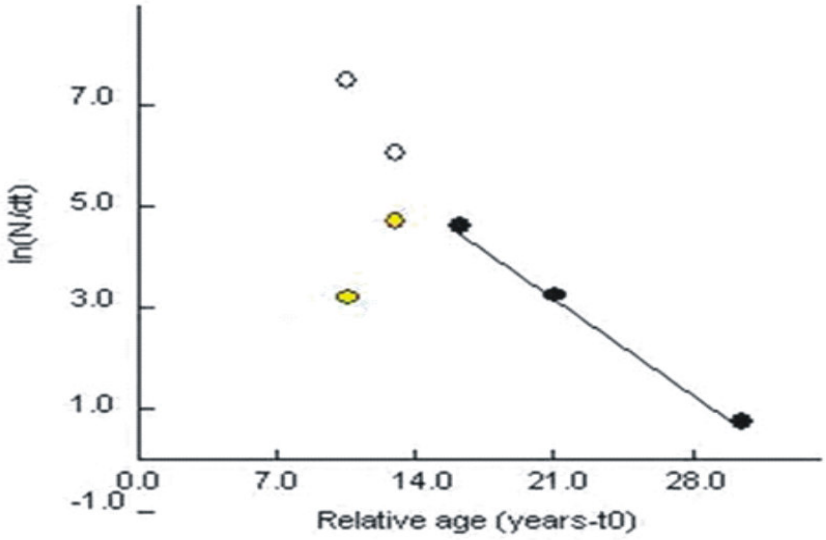

Fig. 4: Length-Converted Catch Curve of *Ucatangeri*in Mbo River

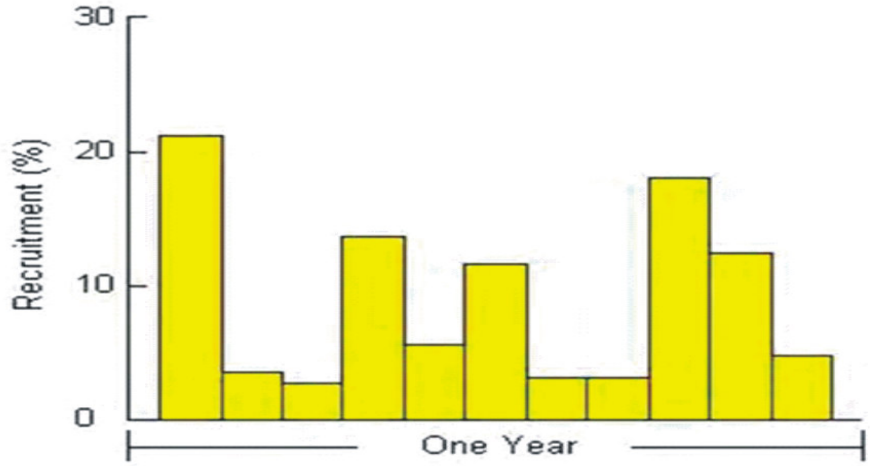

Fig. 5: Recruitment Pattern of *Ucatangeri*in Mbo River

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