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ROLES OF HUMAN ACTIVITIES ON THE STATUS (LIVE OR DEAD) OF AN ENDANGERED PEARL MUSSELS *Margaritifera Margaritifera* (L.) IN RIVER BAISSA, TARABA STATE, NIGERIA.

Abwage W. D.[1], Haliru M.[2] and Abwage A. C.[1]

[1]Department of Forestry and Wildlife Management, Taraba State University, Jalingo, Taraba State, Nigeria
[2]Taraba State Universal Basic Education Board (TSUBEB), Jalingo, Taraba State, Nigeria

***Corresponding Author:** *abwage.w@tsuniversity.edu.ng;* +234 802 682 1624

ABSTRACT

Samples of freshwater Pearl Mussels were collected from four (4) different sites, which are the major point of access by the resident. Simple random sampling was used in laying five sample plots across the four study sites and samples of live and dead Pearl Mussels were collected, counted, and returned to their habitat. Data were analysed using Chi-square statistics, Analysis of Variance (ANOVA), and a T-test at α=0.05 was used. Sites' effects on the species' status (live and dead) were identified: Kogin Pastor (KP), Kogin Mata (KM), Kogin Maza (KZ), and Kogin Demcho (KD). A Chi-square value of 29.728 and p-value of 0.00 was observed on sites' effect on species status. This showed that species status depends on location/sites. That is, for a species to survive or die, it largely depends on the location which in turn is a product of human activities carried out. There was no significant difference (p=0.727) in the dead sample collected across the four study locations. While the live sample contrary to the dead sample, significantly differs (p=0.007) across the study sites. The live and dead samples of pearl mussels differ significantly (p=0.037), which signifies that the live and dead samples were not in the same proportion giving hope of restoration of this species. The study site of KP was relatively suitable for this species to strive as it was significantly different from KM and KZ which are the most disturbed among them all, which was attributed to the fact that, fewer social activities and disturbances of any kind are minimum.

Keywords: Pearl Mussels, River Baissa, Human activities, endangered species.

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INTRODUCTION

The consistent disturbance of River Baissa and her environment has become an issue of concern to the life of the aquatic system around. The freshwater pearl mussel *Margaritifera margaritifera* (L.) is one of the most endangered species in Europe (Young, 1991; Geist, 2010, 2011). In the year 2020, it was classified as endangered species globally and critically endangered in Europe (IUCN, 2020). This has led to the commencement of several other breeding programmes to support the population increase of pearl mussels (Thomas *et al.*, 2010; Gum *et al.*, 2011). Furthermore, the complex life cycle of the species, disturbances in her habitat through agricultural exploitation, sand dredging, and hydropower exploitation are factors militating against the population increase (Has-tie *et al.*, 2003). Since then, the decline has progressed unabated, resulting in an alarmingly small

number of remaining populations. Many conservation projects, with various approaches, have since been conducted all over Europe (Geist, 2010, Gum *et al*. 2011). In Austria, all of the remaining populations are over-aged and lack juveniles (Scheder and Gumpinger, 2008), which will inevitably lead to extinction unless comprehensive protection measures are taken immediately. However, pearl mussels are known to be one of the longest-lived animal species in the world with a life span of 100-190 years with the possibility of extending to 210 years (Ziuganov *et al.,* 2000).

Several factors had been responsible for the reason why the freshwater pearl mussel's population keep declining. Among these factors are; environmental degradation, pollution, sand dredging, a decrease in host fish population, and climate change among others (Jung *et al.,* 2013). Freshwater pearl mussels are common in River Baissa, but there is little or no knowledge of their distribution across different locations of the river, nor human activities contributing to their decline. Also, there is a dearth of information about the population distribution of the species in the study area. Over time, River Baissa has been the main river source of water for the locals' all-around seasons, with higher pressure during the dry season when several domestic needs are met. In the same vein, some economic activities such as sand dredging, uncontrol fishing, and water draining for commercial activities have contributed to habitat fragmentation.

This species mainly colonizes rivers with oligotrophic conditions and has been suffering severe declines in abundance and distribution in recent decades owing to increased pollution, habitat loss and fragmentation, overexploitation, climate change, and the introduction of invasive species (reviewed in Geist, 2010). Unlike in Nigeria, the European countries had far gone ahead to put sustainable management plans in place to ensure that the restoration of *Margaritifera margaritifera* is unabated owing to the crucial roles its plays in the water ecosystem (Gum *et al.,* 2011; Lopes-Lima *et al.,* 2017). Also, the sand dredging could in the long run affect the flow of the river which will consequently throw the species at risk (Santos *et al.,* 2015).

River Baissa which is less than 50km away from the Mambilla Plateau, a proposed site for Mambilla hydroelectric dam is expected to experience some ecological imbalance as a result of the presence of the dam when completed. In the same vein, other rivers within the vicinity might experience a similar scenario. This necessitates the need to know the status pearl mussels within the study area to enable researchers to carry out comparative research on the pre and post-effect of the dam on the species along the water body around the environment.

Despite the crucial roles played by the freshwater pearl mussels on an ecosystem in terms of water purification through the removal of suspended water particles, nutrient cycling, and sediment stabilization (Richter *et al*., 2016; Vaughn, 2018) little or none is documented about the state of the population of *Margaritifera margaritifera* in River Baissa. As such, there is an urgent need to know the population and distribution of fresh water pearl mussels (FPM) in River Baissa so as to enable researchers to deploy the appropriate measure in protecting and managing these endangered species.

Therefore, the objective of this research is to assess the effect of locations (human activities) on the live and dead samples of Pearl Mussel in River Baissa.

MATERIALS AND METHODS

Study area.

River Baissa is a freshwater located at the edge of Baissa town, kurmi Local Government area of Taraba State, Nigeria. The study sites are Kogin Pastor (latitude 7.206388 and longitude 10. 628888), Kogin Mata (latitude 7.220833 and longitude 10.634444), Kogin Maza (latitude 7.221944 and longitude 10.6355), and Kogin Demcho (latitude 7.2300 and longitude 10.6422) which are all located along River Baissa (see figure 1)

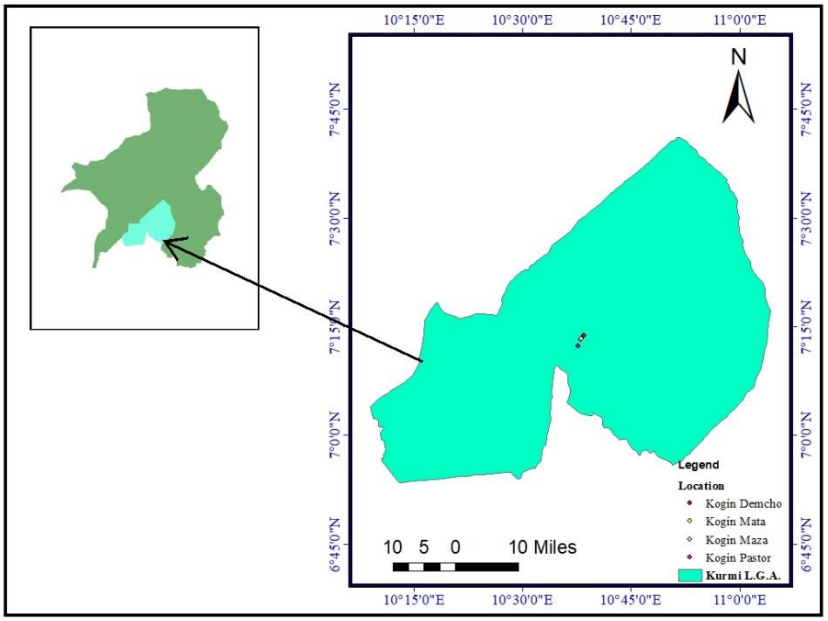

Figure 1: Map of Kurmi L.G.A. Showing the Study Areas

Sample plots and sample collection.
Simple random sampling was applied, where 5 plots of 4m x 4m were laid and samples collected. This method was repeated across the four (4) study sites. The sample collections were done during the dry season when water volume was at its minimum. This was to enable the free collection of the samples as well as plot laying. The pearl mussels within the laid plots were counted and recorded on each plot for the four selected locations and the samples returned to their respective location.

Data Analysis
Descriptive statistic was used in determining the population distribution within the four selected areas. Chi-square statistic was performed with a level of significance being maintained at 95% confidence intervals. While Analysis of variance (ANOVA) was used to compare the location effect on live and dead samples of freshwater pearls mussels. In like manner, t-test statistics was used for the comparison of the live and dead sample of pearl mussels in the study sites.

Chi-square statistics.

$$\chi^2 = \sum_{i-1}^{n} \frac{(o_i - e_i)^2}{e_i} \quad \text{..... (1)}$$

Where
χ^2 - Chi-square statistics,
o_i - observed count and
e_i - expected count

t-test statistics.

$$\boldsymbol{t} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S^2(n_1+n_2)}{(n_1)(n_2)}}} \quad \text{..... (2)}$$

Where:
t - t-test,
$\bar{X}_1$- mean of sample 1,
$\bar{X}_2$ - mean of sample 2,
S^2 - pool within group variance,
n_1 - number of observations in sample 1,
n_2 - number of observations in sample 2.

RESULTS
As evidence from the relatively high numbers of live sample of pearl mussels from the Kogin Pastor (KP) and kogin Demcho (KD) to represent 86.1 and 77.8% respectively within their locations (Table 1). These locations were of less disturbance from human activities. Most importantly, the outcome from Table 2 revealed the dependency of species status (live or death) on location (KP, KM, KZ and KD) with p value of 0.00.

Table 1: Location and sample status of Pear mussels

Sample Status	Location				Sample total
	KP	KM	KZ	KD	
Live sample	62 (86.1%)	8 (36.4%)	6 (40.0%)	42 (77.8%)	118 (72.4%)
	52.12	15.93	10.86	39.09	
Death Sample	10 (14.3%)	14 (63.6%)	9 (60.0%)	12 (22.2%)	45 (27.6%)
	19.88	6.07	4.14	14.91	
Location total	72 (44.2%)	22 (13.5%)	15 (9.2%)	54 (33.1%)	**GT= 163**

KP=Kogin Pastor (Pastor's), KM= Kogin Mata (Female river), KZ= Kogin Maza (Male River), KD=Kogin Dimcho (Dimcho's River), and GT = Grand total.

Table 2: Chi-square outcome (chi-square satistics and probability value)

	Chi-Square	DF	P-Value
Pearson	29.728	3	0.00
Likelihood Ratio	27.818	3	0.00

Figure 2: Sample of pearl Mussels and other activities in the river Baissa.

The dead sample shows no significant difference (p=0.727) across the various locations (KM =2.8±0.35, KD=2.4±0.83, KZ1.8±0.44, and KP=1.8±0.27) of study (Table 3). Meanwhile, outcome from Table 4 revealed live samples from KP to be significantly different (p=0.007) from KM and KZ locations of the study sites (12.4±0.85, 1.6±0.32, and1.2±0.18 respectively). Also, in comparing of the live and dead samples from the four study sites, significant difference (p=0.037) was observed.

Table 3: Means separation for dead sample

Location	n	Mean
KM	14	2.8±0.35[a]
KD	12	2.4±0.83[a]
KZ	9	1.8±0.44[a]
KP	10	1.8±0.27[a]

KM, KD, KZ and KP are as defined earlier with p value of 0.727

Table 4: Means separation for live sample

Location	n	Mean
KP	62	12.4±0.85[a]
KD	42	8.4±1.17[ab]
KM	8	1.6±0.32[bc]
KZ	6	1.2±0.18[c]

KP, KD, KM and KZ are as defined earlier with p value of 0.007.

T-test

Table 5: Comparison of live and dead samples using t-test

Sample	n	Mean	T-value	P-Value
Live sample	118	5.9±1.5	2.25	0.037
Death Sample	45	2.2±0.35		

DISCUSSION

Chi-square analysis on the four different locations revealed significant different with chi-square value of 29.728 and p-value of 0.00. This is evident in the numbers of live Pearl Mussels across the various location (see table 1). The highest survival rate was observed in KP with the least in KZ. The location KP is an open access where little or seasonal activities take place unlike that of KZ where most social and economic (washing, bathing, water drainage, fishing among others) activities usually takes place. There is no doubt that the chemical components release during the washing activities as can be seen in figure 2, might play a key role to the reduction in population of this species and other aquatic organism within this habitat. This activities of recent, have become intensified with the rapid population increase resulting from the Ambazonia crisis in Cameroon leading to the influx of refugees seeking safety. By implication, it means more sodium carbonate, calcium chloride, magnesium, and potassium among others will be released to the water source and more aquatic lives within the habitat will become threatened. This variation across the location is in line with Miguel *et al*, (2004), who observes that the key to protecting and managing rare species lies in understanding their biological relationship with their environment. Other than the direct effect on this species, the host fishes which are key players in the reproductive cycle are also not left out. According to Moorkens, (2011), Pearl Mussel is been classified as "critically endangered" on the IUCN red list, and in some parts of European, it faces extinction already (Jungbluth, 2011). With the status of this Species on the IUCN red list, an urgent call to action on a proactive measure to salvage it is highly needed.

The outcome from ANOVA showed that there was no significant difference (p=0.727) among the numbers of dead Pearl Mussels from the four study sites. On the contrary, the outcome from the live samples showed a significant difference (p=0.007) with KP being significantly different from KZ and KM study sites. This could be a result of less disturbance or activities carried out from KP compare to KZ and KM which were the most disturbed by human activities. This is in line with Olamide, (2019), where mussels samples obtained from Owena reservoir were under regulation from human activities heavier than that of River Ogbese which was freely accessed. Furthermore, it was observed that most of the samples collected were adults with fewer juveniles across the study sites which is an indication of limited recruitment. A similar observation was made in Austria, (Scheder and Gumpinger, 2008), where calls for comprehensive protection measure was made to abate this species from going to extinction. Overfishing along the study sites might be a contributing factor, as the host fishes which usually play the role of attachment and

encystment of glochidia before they dropped off as mussels seed from the gills of the fishes might no longer be available. This breakage in the lifecycle of pearl mussels if not urgently managed, might endanger the species.

The result from the t-test affirms the outcome of the ANOVA on the dead and live samples. The live samples were significantly (P=0.037) different from the dead samples, this is an indication that there is potential for her growth if appropriate measures are taken.

CONCLUSION

In conclusion, it was observed that freshwater Pearl Mussels (which are mostly adult) in River Baissa are relatively available, however, their population is being affected by various Social and economic activities. Furthermore, the strong effects of these social and economic activities were glaring at KM and KZ study sites which are areas with more consistent human activities than the others. It can be concluded that the human activities within and around the study area have negatively affected the aquatic lives within the study sites.

RECOMMENDATIONS

Based on the outcome of the research, the following recommendations are made:

i. There is an urgent need for regulation of Human activities within and around River Baissa to enable breeding ground for freshwater Pearl Mussels.

ii. Regulated or controlled fishing activities are needed to enable host fish of freshwater pearl mussels breed well.

iii. The gap between the juvenile and adult Pearl Mussel must urgently be filled through adequate regulation to support breeding and growth of maturation otherwise, the species may soon be threatened and subsequently endangered.

REFERENCES

Gum, B., Lange, M., and Geist, J., A critical reflection on the success of rearing and culturing juvenile freshwater mussels with a focus on the endangered freshwater pearl the success of rearing and culturing juvenile freshwater mussels with a focus on the endangered freshwater pearl mussel (*Margaritifera margaritifera* L.), Aquatic Conservation: *Marine Freshwater Ecosystem*, 2011, vol. 21, pp. 743–751.

Hastie, L. C., S. Cooksley, F. Scougall, M. R. Young, P. Boon andM. Gaywood, 2003. Characterization of freshwater pearl mussel (*Margaritifera margaritifera*) riverine habitat using river habitat survey data. Aquatic Conservation: *Marine and Freshwater Ecosystems* 13: 213–224.

IUCN. (2020). The IUCN Red List of Threatened Species. Version 2020-2. Available at: https://www.iucnredlist.org [Accessed 9 July 2020]

Jungbluth, J. H., 2011. The freshwater pearl mussel (*Margaritifera margaritifera*) in Germany. Ferrantia 64: 5–12.

Jung, M., Scheder, C., Gumpinger, C .and Waringer, J. (2013). Habitat traits, population structure and host specificity of the freshwater pearl mussel (*Margaritifera margaritifera*) in the Waldaist River (Upper Austria). Biologia, 68(5), 922–931. https://doi.org/10.2478/s11756- 013-0244-9

Moorkens, E., 2011. *Margaritifera margaritifera*. The IUCN Red List of Threatened Species. Version 2014.1. <www.iucnredlist.org>. Downloaded on 10 July 2014.

Olamide O. O. P., 2019. Habitat studies of freshwater mussel (*Etheria elliptica*) in some water bodies in Ondo State Nigeria. *International Journal of Aquatic Science*. 10 (11-18).

Richter, A., Stoeckl, K., Denic, M. and Geist, J. (2016). Association between the occurrence of the Thick-shelled River Mussel (Unio Crassus) and macroinvertebrate, microbial, and diatom communities. Freshwater Science, 35(3), 922–933.

Thomas, J.R., Taylor, J., and Garcia de Leániz, C., (2010). Captive breeding of the endangered freshwater pearl mussel, Mar-Thomas, J.R., Taylor, J., and Garcia de Leániz, C., Captive breeding of the endangered freshwater pearl mussel, *Margaritifera margaritifera* (L.), Endangered Spec. Res., 2010, breeding of the endangered freshwater pearl mussel, *Margaritifera margaritifera* (L.), Endangered Spec. Res., ,12: – 9.

Vaughn, C.C. (2018). Ecosystem services provided by freshwater mussels. *Hydrobiologia*, 810(1), 15–27.

Ziuganov, V., San Miguel, E., Neves, R.J., Longa, A., Fernández, C., Amaro, R., Beletsky, V., Popkovitch, E., Kaliuzhin, S., and Johnson, T. (2000). Life span variation of the freshwater pearlshell: a model species for testing longevity mechanisms in animals. Ambio, 29: 102–105.