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Biodiversity and Abundance of Shell Fish in Akor and Itu Rivers of Niger Delta Region, Nigeria

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Abstract
Shellfish are important source of protein and essential amino acids. There are no regulations of shellfish exploitation in Nigeria leading to overfishing loss of species due to oil pollution especially in the Niger delta region. There is paucity of information on shellfish biodiversity in Niger delta region Nigeria. A survey on the biodiversity of shellfish of Akor River, Itunta Ibere Ikwuano Local Government Area Abia State and Itu River in Itu Local Government Area of Akwa Ibom State both in Nigeria. There were three sampling stations per river covering upper river, midriver and lower river sections. The shellfishes were caught with caught with traps and handpicked from the rivers over a period of 18 months. There were two species of mussels Aspatharia dahomeyensis and Margaritifera margaritifera, caught within the period. The periwinkles that were caught, were Tympanotonus fuscatus, and Pachymelania aurita. Pachymelania aurita was specifically found at Itu River alone. The freshwater shrimp, Macrobrachium macrobrachion and Macrobrachium vollenhoveni were the two species of shrimp caught on both rivers during the period of the experiment. The species of clam found in the rivers was Galatea paradoxa. There was only one species of fresh water oyster found at Itu river and this was Crassostrea gasar. There was no fresh water oyster found at Akor river. At Akor River, two species of snail; Melanoides Maculata and Pila ovata were obtained. The weight of crabs obtained at Akor and Itu Rivers were 35.64±11.67g and 31.81±10.71g respectively. Prawns gotten from Akor River weighed 22.32±24.97g and Itu River was 46.39±16.02g. Mussels weighed 4.74±5.10g and 8.66±3.00g at Akor and Itu river respectively. Periwinkle obtained from Akor River was 0.36±0.44g and 0.53±0.35g at Itu River and oyster 33.89±11.00g. Results shows that shell fishes are dominant in both Akor river and Itu river. Results also show some shellfishes that have normally been caught in marine and brackish water ecosystem, can now be found in the fresh waters of the Niger delta, probably due to migration, climate change or tidal systems.
Key words**; **Biodiversity, Abundance, Shellfish, Akor River, Itu River

Introduction

Shellfish being a general term encompassing edible freshwater, marine and brackish water invertebrates with exoskeleton made of chitin (exceptions include octopuses, squid, and most sea cucumbers). They include various species of crustaceans and molluscs. Crustaceans have segmented bodies protected by hard chitin (shells) and include prawn, lobster, crayfish, crab, and krill, whereas molluscs have soft bodies divided into foot and visceral sections, and are divided into bivalves, cephalopods, and gastropods (Venugopal and Gopakumar, 2020; Moruf *et al.,* 2020). The largest source of shellfish is coastal water (Nybakken, 2001). Nigeria has a diverse range of water bodies, from the marine (Atlantic Ocean), to brackish waters (delta rivers and estuaries), to inland freshwaters. Although fisheries interest in coastal shellfish in Nigeria has been centered on the marine species harvested offshore by commercial trawlers, other economically important crustaceans and molluscs remain largely unexplored. Land reclamation, overfishing, and water pollution, all of which result in habitat degradation, are currently posing threats to

the conservation of shellfish resources and their fisheries (Jacqueline *et al.,* 2017). In places where competent management is lacking, there is also a risk of overexploitation of natural resources and the collapse of environmental services.
Fisheries and Aquaculture have been considered as an important means of poverty alleviation and food security besides promoting health and well-being. Fish continue to be one of the most traded food commodities worldwide. It contributes to around 17% of the global population's animal protein intake. Around 125-210 million tonnes of fish is projected to be required by 2050 to meet the annual per capita requirement of 15-20 kg (Moruf *et al.*, 2022).

The exploitation of shellfish resources plays an important role in the national economies of many countries. This can range from being used as a cheap source of protein to being a source of significant export earnings when highly developed. In addition to being used as a source of food and economic wealth, Bivalves also decrease concentrations of particulate matter in water, thereby increasing water transparency and primary productivity (Newell and Koch, 2004; Abayomi, 2010). Shellfish cultures enhance water quality through nitrogen uptake and removal (Hudson, 2010), and their provision of habitat and structure for juveniles of other species (Abayomi, 2010). Shellfish resources are poorly utilized in West Africa, (FAO Fish Statistics, 2010). Only 29,815 tonnes of marine shellfish, including crustaceans, were captured in West Africa in 2008. Aquaculture production of these species was very limited in West Africa with only Senegal producing 40 tonnes of the mangrove oyster, *Crassostrea gasar*. The estimate of worldwide aquaculture production of shellfish in 2008 was 801,360 tonnes of which 710,395 tonnes are bivalves excluding crustaceans (Abayomi, 2010).

Biodiversity is a concept to ecology and its measurements is essential to ecosystem health (Nazeef *et al.,* 2021); due to wide variations of ecosystems in distribution, abundance, dominance and biodiversity levels (Omayio and Mzungu, 2019). In a functional diversity context; richness is understood to increase or enhance community functionality and complexity (increases in productivity) (Nazeef, 2017 and Daly, *et al.,* 2018). Species richness in sub-lakes was assumed to be positively associated with water depth and aquatic habitat availability with connectivity; in all which increase in wet season (Jin *et al.,* 2019). Besides species richness which receives prominent attention however, evenness is also ecologically important as it portrays been a key factor in preserving functional stability of ecosystem as well as improving productivity by enhancing representation of each species' functional traits or characteristics, contrary however, community's uneven dispersion pattern tend to have less resilience to disturbance and environmental stresses (Nazeef, 2017 and Daly, *et al.,* 2018). A central issue in community ecology is understanding and predicting the structure of species assemblages and their spatio-temporal variations across multiple scales (Jin *et al.,* 2019 and Jianhua *et al.,* 2020).

Global demand for seafood products alone is projected to increase by 70 percent in the next 30 years as harvests from traditional capture fisheries either remain stable or continue to decline. At the same time, coastal marine ecosystems worldwide that support wild shellfisheries are threatened by pollution, habitat degradation, overharvesting and a growing dependence on common pool-resources among other concerns, lending an increasingly important role for sustainably produced and managed shellfish resources to fill the widening gap in the world's capacity for food production, hence the application of genetic technology (Moruf and Adekoya, 2018). This work is aimed at studying the biodiversity and the abundance of the shellfish in the rivers.

Materials and Methods

Study Area

This study was carried out in two different rivers sited in Abia and Akwa Ibom States. Akor River of Itunta Ibere present in Ikwuano Local Government Area, Abia State is between latitudes 05.34829°N and Longitude 007°.34468' E with elevation of 77m and is located within the rainforest zone of Eastern Nigeria between longitudes 7ºN and 8ºE and latitude 4º 45º E and 6º17º N. Akor flows from its reservoir North-Southerly which is observed to come from Ozuitem hill called Mgbele Akor and empty into the stream branching into other rivers that continued through Ibere, Amoeba and then to Akwa Ibom Rivers (Ukagwu, 2015). This region has average temperature of 26º to 32ºC and am average annual rainfall of 2169.8mm within a rain period range of about 148-155days (Enyidi *et al.,* 2019). The depth of the stream has average

range from 1-4m at the deepest and 0.91-1.22m towards the exteriors. Although there are run offs into the river as a result of agricultural activities the water serves as a major source of irrigation for the community as there are also recreational activities such as swimming and leisure washings done at separated regions or channels there. On seasonal occasions there are over flows which at times cover the site of the bridge above. Flanking both sides of the river are different categories of aquatic vegetation which are either submerged or floating which all form natural habitats for various species of fishes and other aquatic fauna. The substrate is 31.3% gravel/ coarse sand and decaying debris, and 68.2% sand/mud (Ukagwu, 2015).

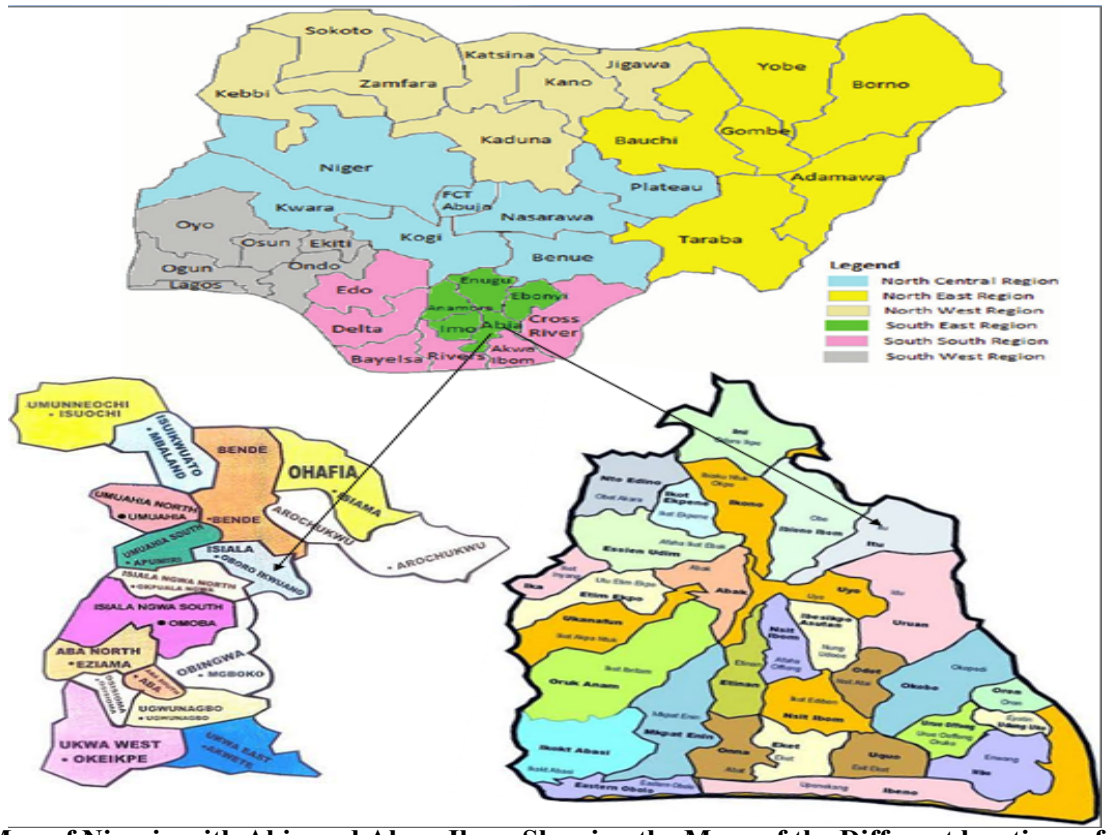

Fig. 1: Map of Nigeria with Abia and Akwa Ibom Showing the Maps of the Different locations of Akor and Itu Rivers

Fig. 2 Showing Akor River Map with the different stations

Itu a river in Itu local government in Akwa Ibom State which bears the Itu river and this shares a boundary with the Cross River State. Itu river is a tributary of Niger river with coordinates latitude 5.765N and longitude 8.941E. Itu has a landmass that covers approximately 606.10 km^2 and is located about 27km from Uyo the capital city of Akwa Ibom (Udosen *et al.,* 2015). Itu River is a fresh water ecosystem and is a habitat of many animals such as fish, shellfish such as prawns. Crabs, etc. the inhabitant of that region are mainly fish farmers, petty traders and also timber dealers

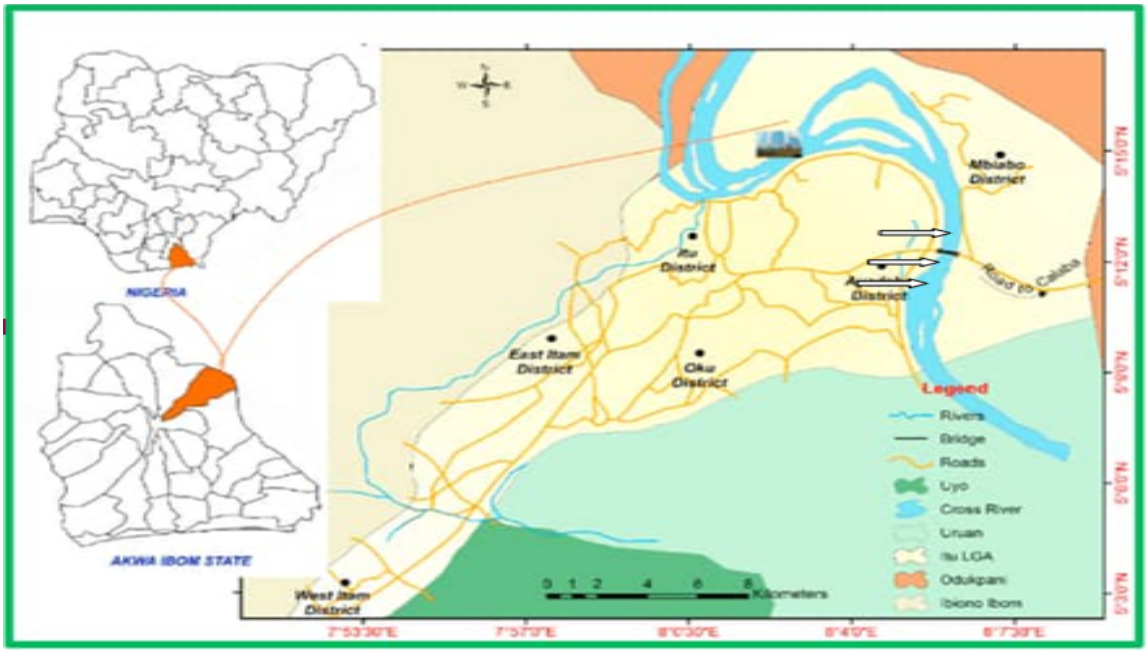

Fig. 3 Showing map of Itu River Map

Collection of Samples

Each of the sites was divided into three stations (station 1, 2 and 3), these stations were 46-61m apart. These stations were different positions at the rivers giving rise to different points for sampling

Sampling was carried out monthly for eighteen (18) months comprising the peak of the raining season and the dry seasons depending on Nigerian seasonal variations. The physicochemical parameters were taken in the morning hours. Some of the physicochemical parameters were carried out in-situ such as temperature, pH, dissolved oxygen etc. while biological oxygen demand, chemical oxygen demand, heavy metals etc. were carried out ex-situ. Samples were collected using a clean container, rinsed 2-3 times with the river water before filling making sure that there was no bubble captured in the container and taken to the laboratory for further analysis. Shellfish such as crabs and prawns were caught using traps while others such as periwinkles, mussels, clams, oysters and snails were picked from the bottom of the rivers.

Identification of Samples and Experimental Shellfish

The shellfish obtained from Akor and Itu Rivers were taken to Department of Fisheries and Aquatic Resource Management, Michael Okpara University of Agriculture Umudike, Abia State laboratory for measurements and identification.

The shellfish were identified following fish identification guide of Idodo-Umeh (2003) and Fish Base databases (Froese and Pauly, 2017). Their morphometric measurements such as weight, length and width were taken using a pair of calipers. Sexes were also identified and sorted based on morphological characteristics as stated by New and Singholka (1982) and Sagua (1980) also into different groups and identified to specific level using the FAO Species Identification Sheets, (Volume VI). The female prawn was generally bigger than their male counterparts and the ventral line of the female crabs' abdomen is wider in the females while it is taper in the males. Sample was analyzed for sex and months of collection.

Samples of shellfishes were preserved in 95% alcohol for identification. Samples were identified using standard keys to interpret the morphological features of each species (Talwar and Jhingran, 1991). Shellfish obtained included prawn, crab, periwinkle, mussels, clam and snails.

Samples of shellfishes were preserved in 4% formalin for identification. Samples were identified using standard keys which interpret the morphological features of each species (Talwar and Jhingran, 1991). All samples were sorted at the species level and were counted and weighed onboard. Only shellfishes were included in the analysis. Shellfish obtained includes prawn, crab, periwinkle and mussels.

Morphological identification using fish guide could not be achieved due to unavailability of whole fish specimens. We preserved tissues in 95% ethanol and subsequently stored under −80°C

Results

Crabs

From entries in Table 1, the crabs caught from the rivers were analyzed, the number of their occurrence in months and sexes were considered in weight, dorsal length, and dorsal width morphometric values. The males obtained from Itu River within the course of this study were 6.11±2.166 and females were 6.72±2.59, the females also weighed more than the males with 36.87±13.05 and 34.41±10.34g respectively. The dorsal length mean values were 5.26±0.814cm and 6.03±1.13 for males and females respectively. The females were more than the males in Akor River. In Itu River the females were 23.72±12.69 and the males were 23.33±10.59. Females also weighed more with 33.46±10.25g and the males 30.16±11.19g. This continued in their dorsal length and width of the crabs as seen in Table 1.

Table 1: Gender Distribution of Crabs in Akor and Itu River

Parameter	Akor		Itu	
	Male	Female	Male	Female
Frequency	6.11±2.166	6.72±2.59	23.33±10.59	23.72±12.69
Weight	34.41±10.34	36.87±13.05	30.16±11.19	33.46±10.25
Dorsal length	5.26±0.814	6.03±1.13	5.28±0.82	5.26±0.81
Total width	4.33±0.57	4.36±0.66	4.08±0.58	4.34±0.51

In months, crabs obtained from Akor River was between the mean value of 2.50±0.71 of May 2024 and 12.00±1.41 of August 2024, catches were observed to decline during the dry seasons and increased during the rainy seasons. The weight of crabs caught during the period of this research was at its peak in the month of July 2023 with 52.20±0.00 g and reduced to 19.91±1.82g in the month of September 2023. The dorsal length of the crabs was between 4.70±0.14 cm and 7.50±0.00 in the months of September 2023 and July 2023 respectively whereas the dorsal with of the crabs were between 3.60±0.00cm as observed in the months of October 2023 and February 2024, and 5.10±0.00cm in the month of July 2023 as seen in Table 1.

From Itu River, the number of catches made varied between 11.00±1.41 which was obtained in the months of June 2023 and August 2023, and 45.00±7.07 obtained in the months of December 2023. The crabs obtained weighed most in the month of April 2024 with 45.00±7.07g but the weight was reduced to 24.65±1.63g in the month of May 2024. The dorsal length of itu river crabs obtained was between 4.68±0.17cm and 6.30±1.70cm as dorsal width were 3.85±0.35cm and 5.00±0.14cm. In Itu River, the crabs were more abundant in the dry season than in the rainy seasons and they were caught all-round the year.

Table 2: Spatiotemporal distribution of crabs in Akor and Itu River

Month	Akor				Itu			
	Frequency	Weight	Dorsal length	Dorsal width	Frequency	Weight	Dorsal length	Dorsal width
May 2023	7.50±0.71	33.65±14.35	4.75±0.49	4.25±0.92	15.00±0.00	30.95±7.28	5.55±0.06	4.30±0.28
June 20203	6.50±2.12	29.91±9.06	5.45±0.49	4.05±0.64	11.00±1.41	28.01±13.28	5.30±0.99	4.20±0.57
July 2023	8.00±1.41	52.20±0.00	7.50±0.00	5.10±0.00	9.50±0.71	25.33±2.58	5.20±0.14	3.85±0.35
August 2023	8.00±0.00	37.40±0.00	6.00±0.00	4.60±0.00	11.00±1.41	29.80±8.91	5.30±0.28	4.05±0.64
September 2023	6.50±0.71	19.91±1.82	4.70±0.14	3.70±0.14	18.50±2.12	33.65±14.35	4.75±0.49	4.25±0.92
October 2023	6.00±1.41	29.73±8.80	5.55±0.64	3.60±0.00	23.50±2.12	25.33±2.58	5.20±0.14	3.85±0.35
November 2023	4.50±0.71	36.56±21.74	6.00±1.70	4.35±1.06	27.50±3.54	33.65±14.35	4.75±0.49	4.25±0.92
December 2023	3.50±0.71	41.48±5.77	5.28±1.02	4.70±0.14	45.00±7.07	26.48±0.95	5.45±0.21	4.10±0.00
January 2024	3.50±0.71	34.53±15.60	4.83±0.38	4.20±0.85	40.00±0.00	35.28±23.55	5.90±1.84	4.45±0.92
February 2024	6.00±1.41	22.35±1.63	4.95±0.21	3.60±0.00	45.00±7.07	39.88±5.55	5.20±1.13	4.65±0.35
March 2024	7.00±1.41	48.88±4.70	6.03±2.08	4.95±0.21	27.50±3.54	33.38±17.23	4.68±0.17	4.20±0.85
April 2024	5.00±1.41	48.00±5.94	5.95±2.19	5.00±0.14	27.50±3.54	48.00±5.94	5.95±2.19	5.00±0.14
May 2024	2.50±0.71	44.26±11.24	6.65±1.20	4.80±0.42	17.50±3.54	24.65±1.63	5.35±0.35	3.85±0.35

June 2024	7.50±0.71	30.45±9.83	5.55±0.64	4.10±0.71	16.00±1.41	33.65±14.35	4.75±0.49	4.25±0.92
July 2024	9.50±0.71	29.91±9.06	5.45±0.49	4.05±0.64	12.50±0.71	28.01±13.28	5.30±0.99	4.20±0.57
August 2024	12.00±1.41	48.00±5.94	5.95±2.19	5.00±0.14	16.00±1.41	25.33±2.58	5.20±0.14	3.85±0.35
September 2024	6.50±0.71	28.57±10.44	5.40±0.85	4.00±0.57	27.00±2.83	33.38±17.23	4.68±0.17	4.20±0.85
October 2024	5.50±0.71	25.80±0.00	5.59±0.00	4.10±0.00	33.50±2.12	37.85±20.29	6.30±1.70	4.35±1.06

Plate 1: Showing dorsal view of *Sudanonautes floweri* obtained from Akor River Abia State

Plate 2: Showing Ventral view of *Sudanonautes floweri* obtained from Akor River Abia State

Plate 3: Showing dorsal view of *Sudanonautes floweri* obtained from Itu River Akwa Ibom

Plate 4: Showing ventral view of *Sudanonautes floweri* obtained from Itu River AkwaIbom

Plate 5: Showing female crab

Plate 6: Showing male crab

Mussels

In Akor River mussels were caught in the dry seasons during the period of this research, there were no catches in the months of June, July august and September of 2023 and April through august of 2024. The quantity of mussels caught ranged between 2.00±0.00 in the months of December 2024 and 4.50±0.71 caught in the month of December 2024. The weight of these mussels caught ranged between 7.00±2.83g and 11.40±0.14g obtained in the months of February and January 2024 respectively, their lengths were also measured in centimeters as average of 3.55±2.05cm and 6.30±0.14cm if March and February 2024 respectively. The hinge length of the mussels was between 2.10±1.56 and 5.85±0.64cm obtained in the months of March and February respectively.

In Itu River the number of catches made was between 6.00±1.41 obtained in the month of July 2023 and 20.00±7.07 of the month of November 2023. The weight of the mussels was 4.05±1.34g in the month of February with a peak of 11.15±0.21g in the month of September 2023. The length of the mussels included a range of 2.75±0.35cm and 6.15±0.07cm which were gotten in the months of December and September 2023. The width of the mussels was between 1.10±0.14cm obtained in the month of February 2024 and 3.15±0.07cm at September 2023 and the same goes for the hinge length as seen in Table 3.

Table 3: Spatiotemporal Distribution of Mussels in Itu and Akor River

Month	Akor					Itu				
	Frequency	Weight	Length	Width	Hinge length	Frequency	Weight	Length	Width	Hinge length
May 2023	3.00±0.00	10.37±0.10	5.35±0.07	2.50±0.00	3.95±0.07	9.00±1.41	8.25±3.18	4.05±2.05	1.90±0.99	2.45±2.19
June 20203	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	7.00±1.41	10.75±1.06	5.90±0.71	2.85±0.78	5.15±1.63
July 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	6.00±1.41	9.95±1.34	5.40±0.57	2.50±0.42	3.70±0.71
August 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	7.50±2.12	8.45±3.46	4.35±2.05	2.15±0.92	2.60±2.26
September 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	11.00±5.66	11.15±0.21	6.15±0.07	3.15±0.07	5.20±0.28
October 2023	3.50±0.71	11.00±5.66	5.50±3.54	2.80±2.12	5.10±5.52	15.00±7.07	10.05±0.07	5.20±0.28	2.20±0.14	3.90±0.14
November 2023	3.50±0.71	10.85±0.78	5.75±0.64	2.85±0.49	4.55±0.92	20.00±7.07	10.00±4.24	4.95±2.62	2.50±1.41	4.05±4.31
December 2023	3.50±0.71	9.10±1.56	4.30±1.13	1.90±0.28	2.90±1.27	17.50±6.36	6.50±0.71	2.80±0.28	1.25±0.07	1.05±0.21
January 2024	4.00±1.41	8.30±3.25	4.20±1.84	2.10±0.85	2.50±2.12	20.00±0.00	9.40±1.98	4.70±1.70	2.40±0.99	3.50±2.12
February 2024	4.50±0.71	11.40±0.14	6.30±0.14	3.30±0.14	5.85±0.64	19.00±2.83	4.05±1.34	2.00±0.71	1.10±0.14	0.95±0.07
March 2024	3.00±0.00	7.00±2.83	3.55±2.05	1.55±0.92	2.10±1.56	20.00±2.83	8.40±9.33	4.25±5.30	2.60±2.40	5.05±5.59
April 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	14.00±1.41	6.00±1.41	2.75±0.35	1.25±0.07	1.10±0.14
May 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	11.00±1.41	8.10±2.97	3.85±1.77	1.65±0.64	2.35±2.05
June 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	8.50±2.12	9.35±1.91	4.65±1.63	2.20±0.71	3.05±1.48
July 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	8.00±0.00	8.20±3.11	4.10±1.70	2.05±0.78	2.45±2.05
August 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	9.00±0.00	9.00±5.66	4.65±3.04	2.35±1.63	4.05±4.31
September 2024	2.00±0.00	9.00±1.41	4.45±1.34	2.00±0.42	3.00±1.41	10.50±3.54	9.10±2.97	4.50±2.12	2.15±1.20	3.10±2.69
October 2024	3.00±0.00	8.22±3.14	4.15±1.77	2.00±0.71	2.50±2.12	16.50±2.12	9.25±3.18	4.75±2.33	2.45±1.34	3.65±3.75

In both Akor and Itu River, different species of mussels were obtained which included *Aspatharia dahomeyensis* and *Margaritifera margaritifera*. At Akor River, the number of *Aspatharia dahomeyensis* caught was 1.72±1.90. With hinge length of 1.32±1.73cm their length and width were 2.09±2.33cm and 1.01±1.12cm respectively and weight of the mussels obtained was 4.22±4.55g. 1.61±1.72 catch of *Margaritifera margaritifera* weighed 5.25±5.68g having length, width and hinge length of 2.74±3.02cm, 1.33±1.51cm and 2.29±2.79cm respectively.

At Itu, *Aspatharia dahomeyensisi* the number of catches was 11.61±5.21 and the weight of the catches was 7.51±2.90g. With hinge length of 2.33±1.67cm the length and width were 3.73±1.74 cm and 1.83±0.75cm respectively. *Margaritifera margaritifera* with 4.04±2.47cm hinge length recorded length and width of 5.04±1.67 and 2.47±0.97cm and a weight of 9.82±2.69g as seen in Table 4.

Table 4: Spatiotemporal Distribution of Mussels in Akor and Itu River

Parameters	Akor		Itu	
	Aspatharia dahomeyensis	***Margaritifera margaritifera***	***Aspatharia dahomeyensis***	***Margaritifera margaritifera***
Frequency	1.72±1.90	1.61±1.72	11.61±5.21	13.89±5.78
Weight	4.22±4.55	5.25±5.68	7.51±2.90	9.82±2.69
Length	2.09±2.33	2.74±3.02	3.73±1.74	5.04±1.67
Width	1.01±1.12	1.33±1.51	1.83±0.75	2.47±0.97
Hinge length	1.32±1.73	2.29±2.79	2.33±1.67	4.04±2.47

Plate 7: Showing Dorsal View of *Aspatharia dahomeyensis* obtained from Akor River

Plate 8: Showing Dorsal view of *Magaritifera falcata* Obtained from Akor River

Plate 9: Showing Dorsal View of *Margaritifera margaritifera* Obtained from Itu River

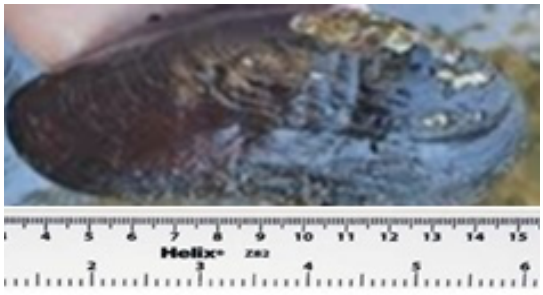

Plate 10: Showing Dorsal View of *Aspatharia dahomeyensis* Obtained from Itu River

Periwinkles

From Table 5, the periwinkles were not caught in Akor River in the months of July and August 2023 also in the months of April, May, June, July and August 2024. There were catches round the months during the research at Itu River. At Akor River, the number of catches made ranged between December 2023 and February 2024 with 6.00±1.00 and 2.00±1.00 respectively. The weight of the periwinkles obtained in the month of May 2023 with 1.24±0.08g before the non-catch period was the month with the weightiest catch during the period of the research and the lowest in weight was recorded in the month of January 2024 with 0.21±0.02g. The length of the periwinkles was also in line with the May 2023 and January 2024 ranges with 2.77±0.25g and 1.60±0.20g respectively. At Itu River the maximum number of periwinkles caught was in the month of 28.50±16.26 in the month of March 2024 and the minimum was 8.50±0.71 in the month of July 2024. Their weight ranged between 0.25±0.08g and 0.74±0.75g in the month of July 2023 and October 2024. The length of periwinkles was between 1.11±0.72 cm and 2.20±0.85cm in the months of august and October 2024 respectively.

Table 5: Spatiotemporal Distribution of Periwinkles in Itu and Akor River

Month	Akor	Itu

	Frequency	Weight	Length	Frequency	Weight	Length
May 2023	5.00±1.00	1.24±0.08	2.77±0.25	12.50±3.54	0.69±0.74	2.10±1.00
June 20203	0.00±0.00	0.00±0.00	0.00±0.00	11.00±1.41	0.56±0.49	2.01±0.55
July 2023	0.00±0.00	0.00±0.00	0.00±0.00	10.50±0.71	0.25±0.08	1.72±0.16
August 2023	0.00±0.00	0.00±0.00	0.00±0.00	9.00±0.00	0.26±0.06	1.73±0.15
September 2023	4.00±1.00	0.22±0.02	1.60±0.20	11.00±1.41	0.46±0.37	1.85±0.35
October 2023	3.00±1.00	0.77±0.03	2.40±0.20	14.50±0.71	0.59±0.55	1.95±0.64
November 2023	5.00±1.00	0.64±0.01	2.07±0.15	11.50±9.19	0.71±0.29	2.15±0.35
December 2023	6.00±1.00	0.68±0.02	2.30±0.20	20.00±0.00	0.76±0.22	2.20±0.28
January 2024	5.00±1.00	0.21±0.02	1.60±0.20	25.00±0.00	0.51±0.29	2.02±0.26
February 2024	2.00±1.00	0.22±0.01	1.60±0.20	25.50±6.36	0.43±0.31	1.86±0.34
March 2024	3.00±1.00	0.93±0.03	2.30±0.20	28.50±16.26	0.50±0.43	1.95±0.49
April 2024	0.00±0.00	0.00±0.00	0.00±0.00	13.50±2.12	0.56±0.50	1.95±0.64
May 2024	0.00±0.00	0.00±0.00	0.00±0.00	10.50±0.71	0.70±0.57	2.16±0.47
June 2024	0.00±0.00	0.00±0.00	0.00±0.00	9.00±1.41	0.51±0.42	1.99±0.52
July 2024	0.00±0.00	0.00±0.00	0.00±0.00	8.50±0.71	0.60±0.42	2.12±0.40
August 2024	0.00±0.00	0.00±0.00	0.00±0.00	9.50±0.71	0.31±0.13	1.11±0.72
September 2024	0.00±0.00	0.00±0.00	0.00±0.00	16.00±1.41	0.44±0.34	1.90±0.57
October 2024	5.00±1.00	0.90±0.01	2.50±0.20	20.00±0.00	0.74±0.75	2.20±0.85

The species of periwinkle caught from Akor River was *Tympanotonus fuscatus* but *pachymelania aurita* and *Tympanotonus fuscatus* were the species caught at Itu River. At Akor River, the *Tympanotonus fuscatus* caught was 2.11±2.35 with weight and length of 0.32±0.42g and 1.07±1.14cm respectively. At Itu River, *pachymelania aurita* was the more abundant with 15.17±8.97, it weighed 0.52±0.39g and recorded length of 1.88±0.55cm. *Tympanotonus fuscatus* was 14.39±4.89 with weight of 14.39±4.89g and 2.00±0.35cm length as seen in Table 6.

Table 6: Spatiotemporal distribution of Periwinkles in Akor and Itu River

Parameters	**Akor**	**Itu**	
	Tympanotonus fuscatus	***pachymelania aurita***	***Tympanotonus fuscatus***
Frequency	2.11±2.35	15.17±8.97	14.39±4.89
Weight	0.32±0.42	0.52±0.39	0.54±0.31
Length	1.07±1.14	1.88±0.55	2.00±0.35

Plate 11: Showing *Tympanotonus fuscatus* from Akor River

Plate 12: Showing *Pachymelania aurita* from Itu River

Plate 13: Showing *Tympanotonus fuscatus* from Itu River

Prawn

The prawns caught from Akor River were within 1.25±0.50 and 5.50±2.52 which were obtained in the months of May 2023 and February 2024 respectively. Their total length peak within the period of research was 12.53±2.59cm and 15.43±3.50cm in the months of May and January having the standard length as 7.75±1.12cm for the maximum value of the prawns obtained in the month of October 2023. The head length of the prawns ranged between 5.85±0.98cm of the month of March 2024 and 7.42±1.51 of January 2024 with the peak of the weight of the prawns as 53.18±24.45g, the minimum weight obtained from Akor River was 34.00±6.88g which were obtained in the months of January and March 2024 respectively.

Prawns obtained from Itu River were more than the ones obtained from Akor; they were between 16.00±1.15 and 56.25±4.79 caught in the months of august 2024 and December 2023. The total length of the prawns ranged between 12.93±2.24 and 16.88±2.84cm of august 2024 and June 2023. The standard length and head length had their minimum at the months of august 2024 and their maximum values at the month of June 2023. The weight of prawns caught from Itu River had its peak with 56.73±19.97g in the month of June 2023 and the minimum weight was observed in the month of august 2024 with 35.43±5.91g as seen in Table 7.

Table 7: Spatiotemporal distribution of Prawns in Itu and Akor River

Month	Akor					Itu			
	Frequency	Total length	Standard length	Head length	Weight	Frequency	Total length	Standard length	Head length
May 2023	1.25±0.50	14.55±1.68	7.15±0.75	6.73±0.10	38.75±6.08	46.25±11.09	14.00±1.41	7.05±0.58	6.60±0.22
June 20203	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	20.00±4.08	16.88±2.84	8.50±1.34	7.72±1.12
July 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	18.25±2.22	13.48±2.54	6.82±1.17	6.30±1.01
August 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	19.00±2.71	14.83±2.88	7.5±1.19	7.00±1.18
September 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	21.00±5.89	15.75±3.20	7.86±1.57	7.67±1.24
October 2023	4.00±0.82	15.50±2.08	7.75±1.12	7.23±1.05	50.40±15.93	28.00±9.09	14.85±2.84	7.49±1.25	7.12±1.07
November 2023	2.75±1.71	15.23±3.24	7.53±1.13	7.18±1.03	45.58±19.92	51.00±2.94	13.95±2.10	7.05±1.01	6.70±1.02
December 2023	3.00±0.82	15.18±0.72	7.67±0.42	7.10±0.55	42.48±4.92	56.25±4.79	14.95±2.72	7.59±1.12	7.07±1.08
January 2024	5.00±0.82	15.43±3.50	7.76±1.64	7.42±1.51	53.18±24.45	36.25±4.79	16.38±2.87	8.10±1.22	7.25±0.97
February 2024	5.50±2.52	14.48±2.71	7.53±1.51	7.20±1.51	52.15±23.02	55.00±5.77	15.83±3.12	7.96±1.47	7.62±1.30
March 2024	2.75±0.96	12.53±2.59	6.35±1.07	5.85±0.98	34.00±6.88	52.50±0.58	14.85±2.84	7.49±1.25	7.12±1.07
April 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	40.50±0.58	14.15±3.33	7.06±1.48	6.85±1.36
May 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	22.50±2.89	16.13±2.46	8.14±1.26	7.25±0.96
June 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	19.50±0.58	15.25±2.63	7.66±1.11	7.10±1.07
July 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	17.50±2.89	16.18±2.46	8.21±1.24	7.42±0.92
August 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	16.00±1.15	12.93±2.24	6.50±0.94	6.10±0.74
September 2024	3.00±0.82	14.95±2.37	7.48±1.24	7.18±1.02	46.78±19.46	21.00±1.15	16.25±2.75	8.11±1.35	7.70±1.21
October 2024	4.75±0.96	13.48±2.54	6.85±1.23	6.43±1.18	38.45±7.74	28.50±1.73	14.15±1.52	7.20±0.74	6.83±0.51

The number of male prawns obtained from Akor River were 1.72±2.01 and the females 1.83±2.31, the males had a total length of 6.79±6.98cm with standard and head length of 6.84±7.15 and 3.30±3.44cm respectively weighing 20.68±23.76g. The females had a total length of 7.80±8.12cm with a standard and head length of 3.92±4.07cm and 3.66±3.81cm weighing 23.96±26.36g. Itu River were 31.00±15.40 with a total length of 14.33±1.89cm the males had a standard and head length of 7.30±1.00 and 6.77±0.64 with a weight of 39.75±9.94g. The females were 32.22±14.65, with weight of 53.03±18.21g female's standard length and head lengths were 7.85±1.29 and 7.85±1.29cm respectively as seen in Table 8.

Table 8: Gender Distribution of Prawn in Akor and Itu River

Parameter	Akor		Itu	
	Male	Female	Male	Female
Frequency	1.72±2.01	1.83±2.31	31.00±15.40	32.22±14.65
Total length	6.79±6.98	7.80±8.12	14.33±1.89	15.75±2.94
Standard length	3.42±3.50	3.92±4.07	7.30±1.00	7.85±1.29
Head length	3.26±3.34	3.66±3.81	6.77±0.64	7.38±1.22
Weight	19.17±20.56	25.47±28.67	39.75±9.94	53.03±18.21

Two species of prawns were caught in both Akor and Itu rivers namely *Macrobrachium macrobrachion* and *Macrobrachium vollenhovenni*. *Macrobrachium macrobrachion* caught from Akor River were 1.53±1.87 and they have total length of 6.84±7.15cm with total and head length of 3.49±3.64cm and 3.30±3.44 weighing 20.68±23.76g. *Macrobrachium vollenhovenni* weighing 23.96±26.36g, were 2.03±2.40 with standard and head length of 3.85±3.9cm and 3.62±3.72cm. From Itu River 30.64±14.66 *Macrobrachium macrobrachion* weighed 43.23±14.67g having a

Plate 14: Showing Lateral view of *Macrobrachium vollenhoveni* from Akor River

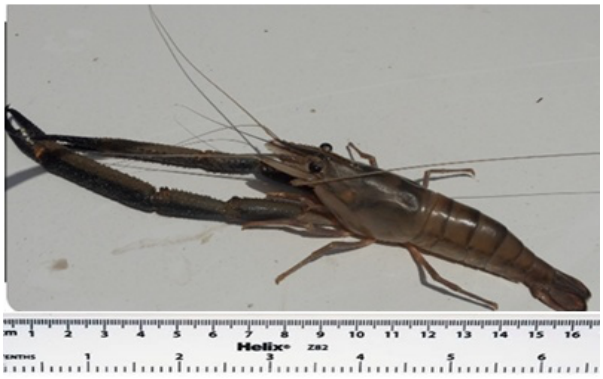

Plate 15: Showing Lateral view of *Macrobrachium vollenhoveni* from Itu River

Plate 16: Showing Lateral View of *Macrobrachium macrobranchion* Caught from Akor River

Plate 17: Showing Lateral View of *Macrobrachium macrobrachion* Caught from Itu River

total, stand and head length of 14.37±2.40, 7.38±1.21 and 6.79±1.01cm respectively. *Macrobrachium vollenhoveni* were 32.58±15.35 with a total, standard and head length of 15.71±2.55, 7.77±1.13 and 7.36±0.94cm weighing 49.56±16.88g as seen in Table 9.

Table 9: Species Distribution of Prawn in Akor and Itu River

Parameters	Akor		Itu	
	Macrobrachium macrobrachion	***Macrobrachium vollenhoveni***	***Macrobrachium macrobrachion***	***Macrobrachium vollenhoveni***
Frequency	1.53±1.87	2.03±2.40	30.64±14.66	32.58±15.35
Total length	6.84±7.15	7.75±7.98	14.37±2.40	15.71±2.55
Standard length	3.49±3.64	3.85±3.9	7.38±1.21	7.77±1.13
Head length	3.30±3.44	3.62±3.72	6.79±1.01	7.36±0.94
Weight	20.68±23.76	23.96±26.36	43.23±14.67	49.56±16.88

Clam

From Table 10 clams were only caught in Itu River that means none was caught in Akor River. Only one species of clam was obtained throughout the period of this research (*Galatea paradoxa*). With number of catches lowered during the rainy season and increased during the dry season, the lowest catch was observed in the months of July and August of the different years of research with 4.33±2.08 and 4.33±2.08respectively. The highest catch occurred in the month of February with 24.33±2.08 g but the weight of clams of the month of June and February were the highest with 45.00±2.00 g while the lowest occurred in the month of July 2024 with 14.00±2.00g. Clams caught during the dry seasons weighed more than the rainy season. The length, width and the hinge length in the same vein showed that clams obtained during the dry seasons were bigger than the ones obtained during the rainy season. The highest length was in the month of September 2023, same with width and hinge length with 7.00±1.00 cm, 7.00±1.00cm and 2.60±0.17 cm respectively. The lowest occurred in August 2024 for the three parameters with 4.40±0.87 cm, 4.40±0.87 cm and 0.90±0.17cm respectively.

Table 10: Prevalence of *Galatea paradoxa* obtained from Itu Rivers

Month /year	Frequency	Weight	Length	Width	Hinge length
May 2023	9.33 ± 2.08^{cd}	40.00 ± 2.00^{ab}	5.23±0.86	5.20±0.92	1.30 ± 0.17^{cde}
June 2023	7.33 ± 2.08^{d}	45.00 ± 2.00^{ab}	6.10±0.95	6.10±0.95	2.07 ± 0.12^{b}
July 2023	4.67 ± 1.53^{d}	39.00 ± 2.00^{ab}	6.23±0.93	6.23±0.93	2.17 ± 0.12^{ab}
August 2023	4.67 ± 1.53^{d}	20.00 ± 2.00^{de}	5.00±1.00	5.00±1.00	1.10 ± 0.17^{de}
September 2023	6.33 ± 2.08^{d}	25.00 ± 2.00^{cd}	7.00±1.00	7.00±1.00	2.60 ± 0.17^{a}
October 2023	9.33 ± 2.08^{cd}	30.00 ± 2.00^{c}	5.23±0.93	5.23±0.93	1.30 ± 0.17^{cde}
November 2023	14.33 ± 2.08^{bc}	30.00 ± 2.00^{c}	5.13±0.96	5.17±0.91	1.10 ± 0.17^{de}
December 2023	19.33 ± 2.08^{ab}	25.00 ± 2.00^{cd}	6.00±1.00	6.00±1.00	2.10 ± 0.17^{b}
January 2024	19.33 ± 2.08^{ab}	43.00 ± 2.00^{ab}	6.10±0.95	6.07±1.01	1.30 ± 0.17^{cde}
February 2024	24.33 ± 2.08^{a}	45.00 ± 2.00^{a}	6.10±0.95	6.07±1.01	1.30 ± 0.17^{cde}
March 2024	19.33 ± 2.08^{ab}	40.00 ± 2.00^{ab}	5.00±1.00	5.00±1.00	1.07 ± 0.12^{de}
April 2024	17.33 ± 2.08^{b}	38.00 ± 2.00^{b}	6.00±1.00	6.00±1.00	1.37 ± 0.12^{cd}
May 2024	14.33 ± 2.08^{bc}	30.00 ± 2.00^{c}	6.03±1.00	6.03±1.00	2.07 ± 0.12^{b}
June 2024	9.33 ± 2.08^{cd}	20.00 ± 2.00^{de}	5.40±0.87	5.40±0.87	2.07 ± 0.12^{b}
July 2024	4.33 ± 2.08^{d}	14.00 ± 2.00^{e}	5.47±0.84	5.47±0.84	2.07 ± 0.12^{b}
August 2024	4.33 ± 2.08^{d}	16.00 ± 2.00^{e}	4.40±0.87	4.40±0.87	0.90 ± 0.17^{e}
September 2024	7.33 ± 2.08^{d}	15.00 ± 2.00^{e}	5.00±1.00	5.00±1.00	1.07 ± 0.12^{de}
October 2024	9.33 ± 2.08^{c}	17.00 ± 2.00^{e}	6.10±0.95	6.10±0.95	1.57 ± 0.12^{c}

At $p\leq0.05$ there were significance difference with length and width of clams caught within the period but the changes in number of catches, weight and hinge-length in the month brought about subsequent change in other months. This occurred in the months of May 2023, October and July 2024 in the number of catch with 9.33±2.08, 9.33±2.08 and 9.33±2.08 respectively. More so, 7.33±2.08, 4.67±1.53, 4.67±1.53,

6.33±2.08, 4.33±2.08, 4.33±2.08 and 7.33±2.08 in the months of June 2023, July, august, September, July 2024 august and September respectively etc. similarly corresponding changes in weight occurred in the months of May 2023, June, July, January and March with 7.33±2.08 g, 4.67±1.53 g, 4.67±1.53 g, 6.33±2.08 g, 4.33±2.08 g, 4.33±2.08g and 7.33±2.08 g etc expressing no significance difference with the weight levels amongst them in the months. The months of May 2023, October, January and February showed a higher level of effect or influence amongst them in the months with 1.30±0.17 cm, 1.30±0.17 cm, 1.30±0.17 cm and 1.30±0.17 cm respectively as seen in Table 10.

Plate 3.18: Showing Clam (*Galatea paradoxa)* caught from Itu River

Plate 3.19: Showing Oyster (*Crassostrea gasar)* caught from Itu River

Oyster

From Table 11, oyster was caught throughout the season but the highest seasons of the catches were in the dry seasons and the lowest were in the rainy seasons. This was as a result of the reduced water that aids the flow of the oysters. The highest catch was in the month of October with 7.50±0.71and the lowest in the month of august 2023 with 1.50±0.71, but we had the lowest of the weights obtained in the dry seasons and the weightier ones obtained during the rainy season. The highest weight was obtained in the month of March 2024 with 44.50±0.71g while the lowest was obtained I the month of October 2023 with 14.50±0.71g. The length, width and the hinge length of oysters obtained from Itu river may 2023 and September 2023 with 3.43±0.69and 7.50±0.71cm, 3.36±0.53 and 6.50±0.71cm and 1.02±0.05 and 1.75±0.35cm respectively. There was no significance difference amongst the months in the number of catches, weight, length, width and hinge length of the oysters as seen in table 11. At $p \leq 0.05$. change in number of catch in the month of May 2023 resulted a change in June 2023, September 2023, December 2023, January 2024, February and march with 5.25±0.79, 5.50±0.71, 6.50±0.71, 6.50±0.71, 5.50±0.71, 5.50±0.71, 6.50±0.71 and 5.50±0.71 respectively at $p \leq 0.05$. The weight varied greatly as seen in table 11 the length, width and hinge length also having no significance difference within the months at $p \leq 0.05$.

Table 11: Morphometric Characteristics of Oyster (*Crassostrea gasar*) obtained from Itu River

Month /year	Frequency	Weight	Length	Width	Hinge length
May 2023	5.25 ± 0.79^{ab}	43.25 ± 0.79^{a}	3.43 ± 0.69^{c}	3.36 ± 0.53^{b}	1.02 ± 0.05^{ef}
June 2023	5.50 ± 0.71^{ab}	40.50 ± 0.71^{bc}	6.25 ± 0.07^{ab}	5.65 ± 0.78^{ab}	1.20 ± 0.00^{def}
July 2023	4.50 ± 0.71^{bc}	38.50 ± 0.71^{c}	6.45 ± 0.07^{ab}	5.85 ± 0.92^{a}	0.95 ± 0.07^{ef}
August 2023	2.50 ± 0.71^{cd}	29.50 ± 0.71^{d}	5.50 ± 0.71^{ab}	4.50 ± 0.71^{ab}	1.20 ± 0.14^{def}
September 2023	6.50 ± 0.71^{ab}	20.50 ± 0.71^{f}	7.50 ± 0.71^{a}	6.50 ± 0.71^{a}	1.75 ± 0.35^{bc}
October 2023	7.50 ± 0.71^{a}	14.50 ± 0.71^{g}	5.55 ± 0.07^{ab}	4.95 ± 0.78^{ab}	1.75 ± 0.35^{bc}
November 2023	6.50 ± 0.71^{ab}	15.50 ± 0.71^{g}	5.35 ± 0.07^{b}	4.75 ± 0.78^{ab}	1.75 ± 0.35^{bc}
December 2023	5.50 ± 0.71^{ab}	14.50 ± 0.71^{g}	6.00 ± 0.00^{ab}	5.50 ± 0.71^{ab}	0.75 ± 0.07^{f}
January 2024	5.50 ± 0.71^{ab}	16.50 ± 0.71^{g}	6.25 ± 0.07^{ab}	5.65 ± 0.78^{ab}	0.95 ± 0.07^{ef}
February 2024	6.50 ± 0.71^{ab}	39.50 ± 0.71^{c}	6.10 ± 0.14^{ab}	5.65 ± 0.78^{ab}	1.35 ± 0.21^{cde}
March 2024	5.50 ± 0.71^{ab}	44.50 ± 0.71^{a}	5.50 ± 0.71^{ab}	4.50 ± 0.71^{ab}	1.05 ± 0.21^{ef}
April 2024	4.50 ± 0.71^{bc}	38.50 ± 0.71^{c}	6.50 ± 0.71^{ab}	5.50 ± 0.71^{ab}	1.90 ± 0.14^{b}
May 2024	4.50 ± 0.71^{bc}	19.50 ± 0.71^{f}	6.20 ± 0.14^{ab}	5.50 ± 0.85^{ab}	1.95 ± 0.21^{ab}
June 2024	2.50 ± 0.71^{cd}	24.50 ± 0.71^{e}	5.85 ± 0.07^{ab}	5.10 ± 0.99^{ab}	0.95 ± 0.07^{ef}
July 2024	2.00 ± 0.00^{cd}	29.50 ± 0.71^{d}	5.95 ± 0.07^{ab}	5.15 ± 1.06^{ab}	2.40 ± 0.14^{a}
August 2024	1.50 ± 0.71^{d}	29.50 ± 0.71^{d}	4.90 ± 0.14^{bc}	4.10 ± 0.99^{ab}	1.15 ± 0.07^{def}

September 2024	2.50±0.71^{cd}	24.50±0.71^{e}	5.50±0.71^{ab}	4.50±0.71^{ab}	0.95±0.07^{ef}
October 2024	4.50±0.71^{bc}	42.50±0.71^{ab}	6.10±0.14^{ab}	5.65±0.78^{bcd}	1.60±0.57^{ef}

Snails

From Table 12, there were no catch made in the some of the months during the rainy season which included June 2023 to August 2023 and April 2024 to August 2024. The lowest of the catch during the research was made in the month of March 20224 and the highest was recorded in the month of October 2023 with 2.25±0.50cm and 4.25±0.50cm respectively. The weight of the snails obtained ranged between 1.62±1.69g recorded in the month of September 2024 and 2.20±1.71 in the month of September 2023. This showed no significance difference with the length of the snails at P≤0.05. The diameter of snails recorded the highest in the month of September 2023 with 0.79±0.69cm and the lowest in the month of May 2023 with 0.45±0.33cm.

Table 3.12 Spatiotemporal Distribution of Snails in Akor River

Months	Frequency(cm)	Weight(g)	Length(cm)	Diameter(cm)
May 2023	3.00±0.82	1.84±1.22	1.98±0.68	0.45±0.33
June 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
July 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
August 2023	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
September 2023	2.75±0.50	2.20±1.71	2.48±0.50	0.79±0.69
October 2023	4.25±0.50	2.18±1.55	2.40±0.56	0.75±0.64
November 2023	3.50±1.73	1.97±1.33	2.23±0.51	0.60±0.52
December 2023	2.75±2.22	1.93±1.49	2.20±0.50	0.65±0.57
January 2024	3.00±0.82	1.83±1.64	2.13±0.52	0.66±0.58
February 2024	3.75±0.96	1.75±1.45	2.01±0.52	0.53±0.39
March 2024	2.25±0.50	1.68±1.25	1.99±0.47	0.50±0.36
April 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
May 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
June 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
July 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
August 2024	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
September 2024	2.50±0.58	1.62±1.69	1.65±1.05	0.65±0.61
October 2024	3.75±0.50	1.81±1.71	2.21±0.78	0.67±0.64

From Table 13, species of water snails obtained from Akor River included *Pila ovata* and *Melaniodes maculata.* There were more records of *P. ovata* in the river than *M. maculata* with 1.78±1.81 and 1.72±1.78 respectively. the weight of *P. ovata* caught was 1.72±1.63g with a diameter of 0.58±0.58cm. the weight of *M. maculata* was 0.37±0.45g and diameter measured 0.11±0.10cm.

Table 13 Snails Obtained from Akor River

Parameter	*Pila ovata*	*Melanoides maculata*
Frequency	1.78±1.81	1.72±1.78
Weight	1.72±1.63	0.37±0.45
Length	1.23±1.22	1.13±1.10
Diameter	0.58±0.58	0.11±0.10

Plate 20: Showing Dorsal view of *Pila ovata* from Akor River

Plate 21: Showing *Melanoides masculata* from Akor River

Discussions

The number of crabs caught during the research were lower during the rainy season and higher during the rainy season but the weight of the crabs caught during the rainy season were higher than the crabs caught during the dry season, this also applied to the dorsal width and length of the crabs caught. In addition, the 2024 catches made were more than the catch of the previous year. The catch made at the Akor river was less than the Itu river and more female crabs than the male crabs caught during the research. This result was in line with the work of Olawusi-Peters and Ajibare (2014) who obtained crabs species from different sites in their work Species richness, diversity and abundance of some Decapod Crustaceans in coastal waters of Ondo State, South West, Nigeria. Flourizel *et al.,* (2024) also obtained crabs species in their research Shellfish Species Abundance and Diversity in River Donga, Taraba, Nigeria

Mussels catch was also lower during the rainy season than the dry season. The weight of the mussels caught was also higher during the dry season and this also extended to the length, width and hinge length of the mussels. Mussels obtained in Itu river were more than the mussels obtained from Itu river. Both *Aspatharia dahomeyensis* and *Margaritifera margaritifera* were obtained in the different rivers but *Margaritifera margaritiferacaught* were higher than the *Aspatharia dahomeyensis caught in the rivers.* Martin *et al.,* (2020) in line with the result obtained different species of mussels and went further to examine their relationships to migratory factors in their work The genetic diversity and differentiation of mussels with complex life cycles and relations to host fish migratory traits and densities. Muhammad *et al.,* (2023) also obtained mussels as bio-indicators in the littoral zones of some water reservoirs in Kastina state Nigeria.

Periwinkles were caught more also during dry season as they are bottom crawling gastropods, their weight also varied with length inclusive. The periwinkles caught at Itu river were more than the catch of Akor river. Three species of periwinkle were caught from Akor river where two were caught from Itu river. *Tympanotonus fuscatus, Melanoides fasciolata* and *Melanoides maculate* were obtained from Akor river but only *Tympanotonus fuscatus and pachymelania aurita* gotten from Itu and *pachymelania aurita* were not gotten from Akor river. *pachymelania aurita* was the highest species that was obtained while the *Melanoides maculata*was the lowest in number obtained. John *et al., (*2017) in his work Aspects of the Population Dynamics of Periwinkle (*Tympanotonus fuscatus*) along the Bonny River, Nigeria obtained similar periwinkle along Bony River and in different years. Periwinkles were also gotten from Bodo creek Niger Delta Nigeria in which were found to contain some traces of heavy metals which could be detrimental to human health in the work of Chimezie *et al.,* 2024 in his work Ecological and Human Health Risk Assessment of Sediment, Periwinkle and Water in Bodo Creek, Niger Delta Nigeria.

Prawns were also caught in the two rivers; the prawns caught recorded a low catch in the rainy seasons as well and higher catch during the dry seasons. The weight of prawns obtained during the dry season was also more than the rainy season as well as the standard length and head length. There were more prawns caught at Itu than Akor river and more females were caught than male prawns. Both *M. macrobrachion* and *M. vollenhoveni* were all caught in the two rivers but *M. vollenhoveni* was more than *M. macrobrachion*. Prawns were also obtained in abundance in the work of Olawusi and Ajibare (2014), Species richness, diversity and abundance of some Decapod Crustaceans in coastal waters of Ondo State, South West, Nigeria and is in line with this research also in Florizel *et al.,* (2024) work on Shellfish Species Abundance and Diversity in River Donga, Taraba, Nigeria.

Plate 19: Ventral view of *Pila ovata* from Akor River

Plate 20: dorsal view of *Pila ovata* from Akor River

Clams caught were only caught at one of the rivers and the species of clam caught were also of one species; *Galatea paradoxa*. The number of clams caught was also higher during the dry season than the rainy season this also implied to the weight which also reflected in the total length and width of the clams. This result corresponds with the work of Flourizel *et al.,* (2024) on the Shellfish Species Abundance and Diversity in River Donga, Taraba, Nigeria where they caught only one species of clam. Akinjogunla and Moruf (2019) in their work shell growth pattern and percentage flesh yield of the West African clam *Galatea paradoxa* (Born, 1778) from Itu Creek, Niger Delta Nigeria had the same result in the total length, width and weight range of clams obtained from the rivers. Egwali *et al.,* (2018) had a record of only one terrestrial species (African Zebu snail, *Anixa zebuensis*: Camaenidae) and as such reported that they were very abundant in the bank of the aquatic ecosystem.

Conclusion and recommendation

The presence of shellfish in South Eastern Nigeria showed that her rivers contain diverse sea-foods which could augment the drowning economic situation in terms of nutritional supplement. The diversity and abundance of shellfish provided variety and contributed to a complete food-web in the ecosystem. Shellfish abundance was more during the dry seasons than in the rainy season of the year. The prevalence of shellfish in Itu river than Akor showed that it is a tributary of a resourceful source and seasonal migrations occur Moreso, there were more impact of exploitation in Akor river and this may bring about extinction of endangered species soon.

References

Abayomi A, (2010). Developing Shellfish Industry in Nigeria: Technology and Economics. FISON EKO 2010: Invited Paper

Akinjogunla V. F. and Moruf R. O. (2019). Shell Growth Pattern and Percentage Flesh Yield of the West African Clam *Galatea paradoxa* (Born, 1778) from Itu Creek, Niger Delta Nigieria. *National Journal of Basic and Applied Sciences*. 27 (**2**) 119-126.

Chimezie O, Bernard B. B, Aroloye O. N, Emoyoma U, (2024). Ecological and Human Health Risk Assessment of Sediment, Periwinkle and Water in Bodo Creek, Niger Delta Nigeria. *Annals of Ecology and Environmental Scienc*e. Vol. 6, 2637-5338

Daly A. J, Baetens J. M, and Baets B (2018). Ecological Diversity: Measuring the Unmeasurable. *Mathematics*. 2018; 6: 2-28.

Enyidi, U.D. and Princess U. (2019). Parasites of African Catfish *Clariasgariepinus* and *Oriocromisniloticus*Polyculturedin Earthen Ponds. *Aquaculture studies*. 19(**2**):2-3

FAO (2010) Fishstat plus—universal Software For Fishery Statistical Time Series, *Fisheries and Aquaculture Department*. http://www.fao.org/fishery/statistics/software/fishstat/en accessed 04 October 2010

Flourizel I, Mbanefo O, Tubasen V. S, (2024). Shellfish Species Abundance and Diversity in River Donga, Taraba, Nigeria. *International Journal of Fisheries and Aquaculture Research*. Vol.10 (2), pp.28-50.

Hudson, B. (2010). Environmental and Economic Benefits of Washington State Shellfish Production" Paper presented at the World Aquaculture Society (WAS)/National Shellfisheries Association (NSA)/American Fisheries Society (AFS) Finfish Section meeting March 1-5, 2010. San Diego.

Jacqueline S. S, Jose D. B, Elton J, Maria C. B. and Felipe G, (2017). Microplastics Ingestion by a Common Tropical Freshwater Fishing Resource. *Environmental Pollution.* 221, 218-226.

Jianhua L, Xiaochen C, Xinliang Z, Zhenjia H, L. X., Liangliang H, Yuichi K, Tatsuro S, Yukihiro S and Chunpeng Z, (2020). Fish Biodiversity Conservation and Restoration, Yangtze River Basin, China, Urgently Needs 'Scientific' and 'Ecological' *Action*. *vol*, *12*, 3043.

Jin B, Ge G, Winemiller K. O, Shao B, Si J, and Jin J. (2019). Fish Assemblage Structure in Relation to Seasonal Environmental Variation in Sub- Lakes of the Poyang Lake floodplain, China. *Fish Manage Ecology*. 131-140.

John O, Adaobi U. and Oye A. O. (2017). Aspects of the Population Dynamics of Periwinkle (*Tympanotonus fuscatus*) along the Bonny River, Nigeria

Martin O, Manuel L, E, Amra H. and B. (2020). The Genetic Diversity and Differentiation of Mussels with Complex Life Cycles and Relations to Host Fish Migratory Traits and Densities. *Nature Research Scientific Report*. 10(1) 17435

Moruf H. A, Ogunbambo M. M, and Moruf R. O, (2020). The Relevance of Information of Shellfish Quality on Consumers Purchase Decision in Lagos Metropolis, Nigeria. *Journal of Agricultural Economics, Environment and Social Sciences.*6(1) 71-79

Moruf R. O, Aminu M. U, Garba A. A and Oluboba T. F, (2022). Coastal Shellfish as Harvestable Resources in Nigeria; A Review. NSAP 47th Annual Conference; Securing Animal Agriculture Amidst Global Challenges.

Moruf, R. O. and Adekoya, K. O. (2018). Molluscan and Crustacean Genetic and Biotechnology Interventions: A Review. *Animal Research International*. 15(1): 2906 – 2917.

Muhammad D, Hamidu S, Musa M. T. (2023). Diversity of Mussels and Snails as Bio-Indicators in the Littoral Zone of Some Selected Water Reservoirs in Katsina State, Nigeria. *Best Journal of Innovation in Science, Research and Development*. Vol. 2. 2835-3579

Nazeef S, Ja'afar A, Abubakar K. A and Kabiru M. (2021). Fish Species Biodiversity of Dadin-Kowa reservoir: Current status. *World Journal of Advanced Research and Reviews.* 11(**2**), 100–111

Nazeef S. (2017). Evaluation of Fish Biodiversity and Yield Potentials of Challawa Gorge Dam, Kano State, Nigeria.

Newell, R. I. E. and Koch, E. M. (2004). Modeling Seagrass Density and Distribution in Response to Changes in Turbidity Stemming from Bivalve Filtration and Seagrass Sediment Stabilization. *Estuaries* 27:793-806.

Nybakken J. W. (2001). Marine Biology: An Ecological Approach. 4th ed. Boston, Mass: Addison-Wessley Publishing. p 516.

Olawusi-Peters O. O and Ajibare A. O (2014). Species Richness, Diversity and Abundance of Some Decapod Crustaceans in Coastal Waters of Ondo State, South West, Nigeria. *International journal of fauna and biological studies*. 1 (**5**): 44-51

Omayio D. O, and Mzungu E. (2019). Modification of Shannon-Wiener Diversity Index towards Quantitative Estimation of Environmental Wellness and Biodiversity Levels under a Non-comparative Scenario Modification of ShannonWiener Diversity Index towards Quantitative Estimation of Environmen. *Journal Environmental Earth Science*. 9.

Udosen E.D, Afitijagun P.I, Udosen I.E, Udoidiong O. M, (2015). Risk Assessment of Trace Metals in Chrysichthys nigrodigitatus and Pachymelania aurita from Cross River, Itu, Akwa Ibom State, Nigeria.

Ukagwu, J. I. (2015). Aspects of the ecology and Population Characteristics of Macrobrachium species in Akor River, IbereIkwuanoAbia State. *Ph.D Thesis,* Department of Fisheries and Aquatic Resources Management, Michael Okpara University of Agriculture Umudike, Abia state Nigeria.

Vazhiyil V. and Kumarapanicker G, (2020). Shellfish: Nutritive Value, Health Benefits, and Consumer Safety. Comprehensive review of food science and food safety. Vol (16) 1219