



SUSTAINABLE HARVESTINGS, PROCESSING AND MARKETING STRATEGIES FOR THE AFRICAN RIVER PRAWN (*MACROBRACHIUM VOLLENHOVENII*) IN ASEJIRE LAKE, NIGERIA: A VALUE CHAIN ANALYSIS

¹Oyekanmi, F. B., ²Oyekanmi, O. A. and ¹Ekundare, V. O.

¹University of Ilesha, Ilesha, Osun State, Nigeria.

²Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria.

Corresponding Author's Email: funmilayo_oyekanmi@unilesa.edu.ng

ABSTRACT

The African River Prawn (*Macrobrachium vollenhovenii*) plays a vital role in supporting rural livelihoods and nutrition around Asejire Lake, Nigeria. Despite its economic potential, the species remains underexploited due to fragmented harvesting, processing, and marketing systems. This study investigates the sustainability of existing value chain activities and proposes strategies for improvement. Using a mixed-methods approach, data were collected through surveys, questionnaires, interviews, focus group discussions, and direct observation involving 220 stakeholders (fishermen (22%), wholesalers (39%), retailers (22%) and consumers (17%). Value chain analysis revealed inefficiencies in gear use, post-harvest losses, and limited market access. Economic assessments highlighted low profitability for primary actors, while sustainability indicators showed vulnerabilities in ecological practices and gender inclusivity. Results showed that prawns (63%), fish (30%) and wild animals (7%) accounted for the total marketed animal products in the study area. Marketing of prawns is by hawking mainly carried out by women (43%) and young secondary school children (57%). The cost benefit ratio showed that fishermen and retailers make substantial profit from prawn sales and there are often travelers who make purchases daily at high prices (₦4500.00/kg). Prawns were sold fresh (15%), smoked (25%), boiled (48%) or fried 12%). Prawns were valuable as food, bait and as foreign exchange earnings and may be used to substitute fishmeal in fish and livestock feeds. Postharvest losses of products can be reduced if stalls are provided with adequate storage facilities for fresh and dried products. Post harvest losses can be drastically reduced by a well developed organized marketing system or strategies and provision of solar storage facilities to stalls in Asejire Lake at subsidized rates by the government. The study recommends policy interventions, improved extension services, and investments in cold chain infrastructure to enhance value retention and ecological resilience. Findings contribute to the design of inclusive and sustainable value chain models for freshwater prawns in West Africa.

Keywords: River, Prawn, Harvesting, Processing, Marketing, livelihoods

INTRODUCTION

Prawns and shrimps are highly sought after globally, generating significant revenue and employment opportunities for Nigeria. They are an important source of protein and have potential health benefits. However, the country's shrimp fishery is overfished and mostly export-oriented, leaving a domestic shortage. Freshwater prawn production and marketing offer a promising solution to meet nutritional and economic demands. By developing this industry, Nigeria can improve food security, boost its economy, and provide a sustainable source of income for fishermen and farmers. This would also help to reduce the pressure on wild shrimp stocks and promote sustainable aquaculture practices (Faruque, 2007). The growing demand for high-quality animal protein in sub-Saharan Africa has renewed interest in inland fisheries and aquaculture as essential components of food security (FAO, 2022). Among freshwater species, the African River Prawn (*Macrobrachium vollenhovenii*) has emerged as a valuable resource due to its nutritional quality, market demand, and compatibility with artisanal fisheries systems. In Nigeria, particularly around Asejire Lake, this species contributes significantly to rural income generation and gender-inclusive employment opportunities.



The African River Prawn in West African Inland Fisheries

M. vollenhovenii is native to West African freshwater systems and is known for its adaptability, rapid growth, and high protein yield. Studies by Dadzie and Owusu-Frimpong (2014) emphasize its ecological importance and economic viability in artisanal fisheries. However, its sustainable management remains constrained by overfishing, habitat degradation, and poor policy enforcement.

Value Chain Analysis in Small-Scale Fisheries

Value chain analysis (VCA) has emerged as a critical tool for understanding market linkages, stakeholder roles, and value addition in fisheries (Kaplinsky & Morris, 2001). VCA frameworks have been applied to tropical shrimp fisheries (Bosma *et al.*, 2017), revealing inefficiencies and inequities that hinder sustainability. Integrating sustainability into VCA, as advocated by Trienekens (2011), allows for assessment of environmental, social, and economic dimensions in tandem.

Sustainable Harvesting, Processing, and Marketing Strategies

Sustainable harvesting emphasizes the use of eco-friendly gear, seasonal regulations, and community co-management. Processing innovations such as solar drying and improved smoking kilns reduce post-harvest losses and enhance product quality (FAO, 2020). Market strategies that link producers to urban centers or export markets through cold chains and cooperatives have been effective in similar settings (Njoku *et al.*, 2019).

Gaps in the Nigerian Context

While Nigeria has developed national aquaculture strategies, implementation remains weak at the community level. Studies on *M. vollenhovenii* have primarily addressed aquaculture trials (Oyelude *et al.*, 2021), with limited integration of field-based, value chain-oriented research. This study contributes by bridging ecological and socio-economic perspectives using empirical data from a key freshwater system.

Utilization of Prawns

Prawns are good sources of protein and minerals. Its protein content ranges between 18% and 58% depending on its moisture content (Bello-Olusoji *et al.* 2000). This facilitates its use as condiment in cooking. The consumption of prawn as fresh or processed (boiled or fried) vary considerably between different communities. Consumption is localized to area of production due to high cost and post-storage facilities to prevent spoilage. Prawn is very flavour -some and when added to soup improves its acceptability.

The African River Prawn (*Macrobrachium vollenhovenii*) is a significant aquatic species native to West Africa, including Nigeria. This species thrives in freshwater and brackish environments, such as Asejire Lake in Oyo State, Nigeria, where it supports local fisheries and contributes to the livelihoods of surrounding communities. Despite its ecological and economic importance, the sustainable management of *M. vollenhovenii* populations remains a challenge due to overexploitation, inadequate processing techniques, and limited access to markets.

Recent studies have highlighted the need for comprehensive value chain analyses to identify opportunities for sustainable harvesting, processing, and marketing of this species. For instance, research on the gut contents and feeding patterns of *M. vollenhovenii* in Asejire Lake has provided insights into its dietary habits and ecological role, which are crucial for developing effective management strategies. Additionally, investigations into the morpho-fecundity of berried prawns have offered valuable data on reproductive parameters, informing sustainable harvesting practices.

Marketing of freshwater prawn has been practiced for a long time in the regions where they were caught. Catches in lagoon area were usually sold live, or within a few hours after they were caught. They are very popular and form an important ingredient of the local dishes. Live prawns were kept in covered floating baskets, partially sub-merged in the water pending when buyers would come. Smoking was the only method used for the preservation of dead prawns.

Consumer countries are almost entirely the industrialized countries. Prawns and shrimps are still a luxury product, although their consumption has been encouraged by a tendency for prices to fall appreciably as a result of increased production. Therefore there is a lot of pressure on producers to increase their supply.



Methods of Harvesting Prawns in Nigeria

Various types of traps have been used for harvesting prawns in streams, rivers and rivulets that flow into the lagoon. Such traps include single inlet/single chamber variety, double chamber variety, round scoop net with handle, triangular scoop net with handle (Marioghae, 1990). Baits used are cassava tuber, (*Manihot*), ripe oil palm (*Elaeis guineensis*) fruits, coconut (*Cocos nucifera*), fish entrails, decaying fish etc. The baits are sometimes tied up in plastic sheet in order to protect it from other aquatic animals such as crabs which could pinch the food from outside the traps. It has been reported that the prawns are not discriminatory in their choice of food. (Marioghae, 1990)

Nets of various kinds were used for harvesting *Macrobrachium* spp, at Isheri and other villages in the Ogun river estuary, cast nets with or without segments and pockets as it is practised in the Gulf of Mexico are used (Udolisa and Solarin, 1979). Set nets, beach seines and circular seines are used in Lagoons with flat and shallow floor. The mesh size of the nets used varies from 0.5 to 1.5cm for prawn. Scooping gears are not only effective at harvesting in shores with aquatic weeds and grasses covers but also used for harvesting the juveniles which usually take refuge beneath the aquatic weeds flanking the shores. However, the use of scooping gears should be discouraged because they harvest both juveniles and adults.

This paper aims to conduct a comprehensive value chain analysis of *M. vollenhovenii* in Asejire Lake, focusing on sustainable harvesting methods, efficient processing techniques, and effective marketing strategies. By integrating recent research findings and engaging with local stakeholders, this study seeks to propose actionable recommendations that promote the conservation of *M. vollenhovenii* populations while enhancing the socio-economic benefits for local communities.

METHODOLOGY

Study Area

The study was conducted in the Asejire Lake region, located in southwestern Nigeria between Oyo and Osun States (7°24'N, 4°05'E). The Lake created primarily for domestic water supply and fishing activities, supports a significant local fishery including *Macrobrachium vollenhovenii*, the African River Prawn. The ecological characteristics of the lake provide a suitable habitat for this species, which is of both economic and ecological importance to local communities.

Research Design

This study employed a mixed-methods approach combining qualitative and quantitative data collection and analysis to map and evaluate the value chain of *M. vollenhovenii*, focusing on sustainability across harvesting, processing, and marketing.

Sampling Procedure

A purposive sampling technique was used to select key stakeholders involved in the prawn value chain, including:

Fisherfolk
Middlemen/women
Processors

Traders (wholesale and retail)

A total of 300 questionnaires were sent out, 220 responded and were selected using stratified random sampling from fishing communities and market centers around the Lake, ensuring representation across gender and stakeholder type.

Data Collection

1. Primary Data

a. Structured Interviews and Questionnaires:

Structured questionnaires were administered to stakeholders to gather data on:

Harvesting techniques, frequency, and gear types

Post-harvest handling and processing methods

Storage and transportation facilities

Market structure, pricing, and marketing channels

Challenges and opportunities in each value chain node



b. Key Informant Interviews (KIIs):

KIIs were conducted with local fisheries officials, extension workers, and community leaders to provide contextual insights into regulatory frameworks, sustainability practices, and historical trends.

c. Focus Group Discussions (FGDs):

Separate FGDs (6–10 participants each) were held with fisherfolk and processors to gather in-depth data on traditional ecological knowledge, gender roles, seasonal patterns, and community-driven sustainability practices.

d. Direct Observation:

On-site visits and field observations were conducted to validate responses, inspect gear types, processing units, and local markets.

2. Secondary Data

Secondary data were collected from published reports, scientific journals and records from the local government fisheries departments.

Data Analysis

1. Value Chain Mapping:

A detailed value chain map was developed using Porter's Value Chain Framework to illustrate the flow of prawns from capture to consumption. Nodes, actors, roles, and linkages were identified and analyzed.

2. Economic Analysis:

Cost-benefit analysis was performed at different nodes using gross margin analysis and profitability indices to determine the economic viability of current practices.

3. Statistical Analysis:

Quantitative data were analyzed using Descriptive statistics (means, percentages, frequencies) to summarize data.

Informed consent was obtained from all participants. The study followed ethical research protocols, including confidentiality, voluntary participation, and cultural sensitivity.

RESULTS AND DISCUSSION

A total of 220 questionnaires (73%) were recovered out of 300 distributed to respondents. The results obtained from the study are presented below:

Socio-economic Characteristics of Respondents

The majority of respondents (65%) were male, while 35% were female. Most participants (72%) had primary-level education or less. The mean age of fishers was 42 years, with a standard deviation of ± 9.4 . Women dominated processing and retailing nodes, comprising 80% of participants in those categories.

Classification of Respondents based on Job Types

Value Chain Mapping (Job classification of respondents)

The value chain structure identified five main nodes: input suppliers, harvesters, processors, traders, and consumers. Economic analysis revealed that processors retained the highest margins (35%), while fishers received only 20% of the final consumer price.

This is further illustrated in Fig. 1

Table 1: Type of Job Classification of Respondents

JOB CLASSIFICATION	PERCENTAGE FREQUENCY	(%)	CUMMULATIVE FREQUENCY
Fisherman	22		48
Retailer	39		134
Wholesale	22		182
Prawn consumers	17		220

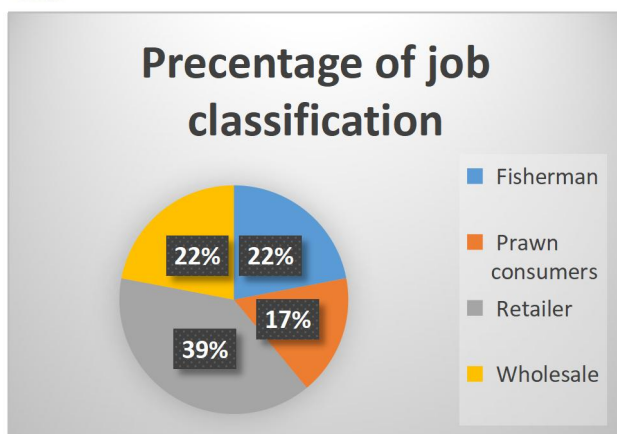


Figure 1: Percentage of Job Classification Recorded

The survey found that prawns (63%) were the most sold item at Asejire market, followed by fish products (30%), and wild animals (7%), which includes grass cutters, antelopes, bush pigs, squirrels and giant rats as shown in Table 2 and Fig 2

Table 2: Items Obtained at Asejire Lake

ITEMS	FREQUENCY OF OCCURRENCE	PERCENTAGE (%)
Prawn	102	63
Fish	48	30
Wild animal	12	7
TOTAL	162	100

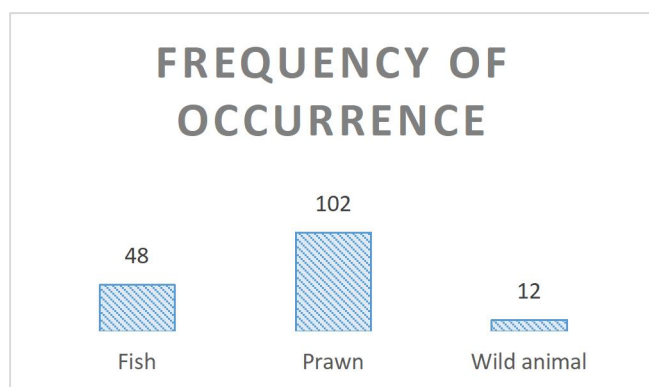


Figure 2: Frequency of Occurrence of Animals Discovered

Type of Gear for Harvesting Used by Fishermen

Among 48 fishermen interviewed, various gear types were used to harvest prawns, including single and double chamber traps, scoop nets, and scooping gear (Table 3). Baits used included cassava, coconut, fish trash, and ripe palm fruits (Jimoh *et.al.*, 2011), although unbaited traps were also used. Cast nets and set nets were also used, with prawns often caught as secondary catches. Scooping gears were effective in collecting juvenile prawns hiding in aquatic weeds along the shores. Fishers employed baited traps (60%), traps without bait (08%) cast nets (15%), set nets (06%), long lines (-), scooping gears (10%) Only 15% reported compliance with local fishing regulations. Over 60% of fishers noted declining catch volumes, attributing this to habitat degradation and overfishing.

Table 3: Type of Gear Used and Percentage Number of Users.

TYPES OF GEAR	NUMBER OF USERS	PERCENTAGE (%)
Cast net	07	15
Set net	03	6
Long lines	-	-
Scooping gears	05	10
Baited traps	29	60
Traps without bait	04	8

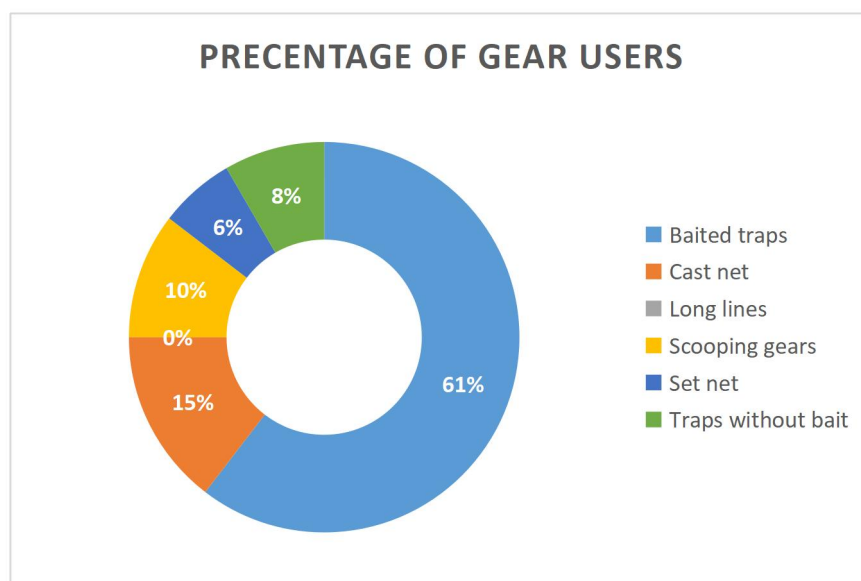


Figure 3: Percentage Usage of the Various Types of Harvesting Gears

Prawn Processing Practices at Asejire

The processing methods include, smoking, drying, freezing and boiling. The quantity processed per day per household ranged between 5kg and 30kg (smoked); 10kg and 30kg (Dried/fried); 16kg and 60kg (frozen) and 2kg and 5kg (boiled) as indicated in table 4.

Processing and Storage

Processing was predominantly manual, involving smoking (24%), drying/frying (42%), freezing (20%) and boiling (14%).

Lack of modern kilns resulted in post-harvest losses of up to 25%. Only 12% had access to cold storage facilities, and 76% used traditional preservation methods.

Table 4: Processing Practices at Asejire Town

Processing method/technique	Percentage of processors	Range of quantity processed per day per house (kg)
Smoking	24	5-30
Drying/frying	42	10-30
Freezing	20	16-60
Boiling	14	2-5

Live prawns were kept in covered floating partially submerged baskets. They were sold to travelers or tourists live or fresh within a few hours after death before deterioration sets in.

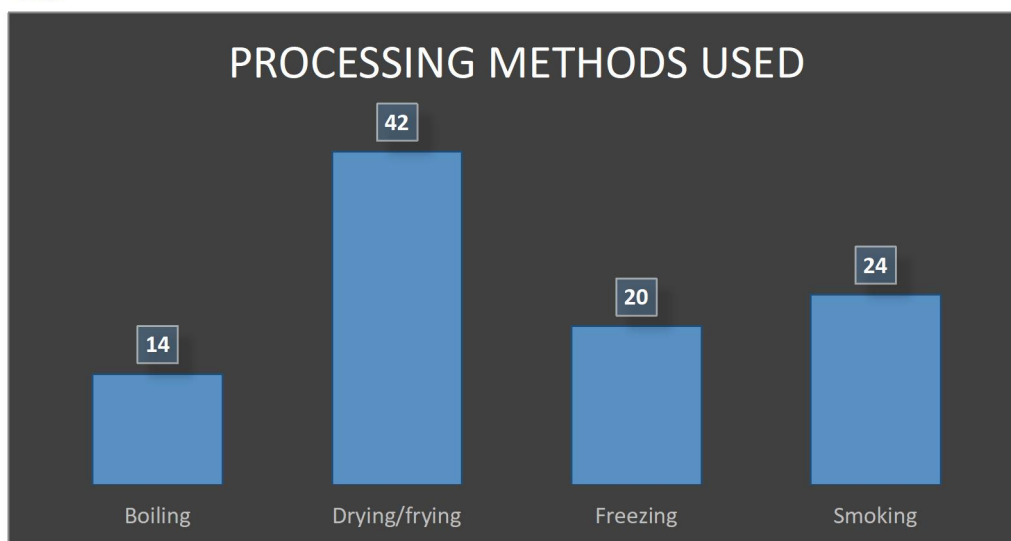


Figure 4: Processing Methods Adopted

The processors of prawns were mainly wives of fishermen and other fishmongers. The daily processing quantity varied depending on the catch, ranging from 12kg to 50kg per fisherman. Iced prawns were preserved for wholesalers, while smoked prawns were stored in sacks and baskets for market sale. Smoking was done using a makeshift kiln, with temperatures between 60-95°C for quick drying and preservation. Smoking accounted for 24% of processing, while deep-frying accounted for the highest percentage at 42%.

Marketing and Value Addition

The marketing chain was fragmented, with 68% of producers selling to local middlemen and 22% to direct consumers. Less than 10% accessed urban or export markets. Price volatility and poor bargaining power were reported by 80% of respondents.

Sustainability Indicators

Environmental practices were weak: only 18% used selective fishing gear. Gender inclusion was low at the harvest level but high in processing. Institutional support was minimal; 84% of actors had never interacted with extension officers or cooperatives

Pricing and Profit Determination

The price of fresh or processed prawns depends on size, which is often sex-related, with males being larger than females. The average weight of prawns per set (stick) is between 54.10g and 64g, selling for N2,500 to N3,000. Thus, 1kg of prawn costs N45,000. Prices vary by season and bargaining power. Retailers make a daily profit of N5,000 to N15,000 per kg, while fishermen earn N15,000 to N25,000 per kg. Fishermen catch between 1 and 3 baskets (4kg each) per day, with higher catches during the rainy season, and sell 1kg for N30,000 to retailers.

The operating cost of prawn monthly is shown in table 5.

Table 5: Cost Benefits Ratio of Prawns

Item	Cost (N)
Traps	2,000 each
Baits	1,000each
Baskets	5,000each
Transportation	2,000each
Taxation	1,000.00each
Labour	3,000.00each
Miscellaneous	1,000each
Total	15,000.00



Gross Income

Cost of Prawn/kg = N4,500 per retailer of boiled and fried prawns
= N3,000 per fisherman for a kg

Live Prawn = N1,500 each depending on size and weight

Profit/ kg for retailers

Fishermen earn a monthly profit of N5,150.00 per kg of prawns, after deducting operating costs of N3,850.00 from their total revenue of N9,000.00. Retailers, on the other hand, make a monthly profit of N4,500.00 per kg. In Asejire town, prawn retailers sell their products in an informal setting, without stalls, which leads to varying prices based on bargaining power, time of purchase, demand, shelf life, and size. According to FAO (2022), prawns are more expensive than fish and meat, and their prices depend on species, size, and source, as shown in Table 6.

Table 6: Comparative Cost of Animal Products (kg)

Animal Product	N	cost/kg
Tilapia	1,000	
Cat fishes	2,000	
Beef	2,000	
Pork	1,200	
Turkey	2,000	
Goat meat	1,500	
Prawn	4,5000	

*Please note that prices are not stable

Constraints Associated with the Marketing of Prawn in Asejire Market

The prawn Retailers in Asejire town face various constraints, including lack of storage facilities, high costs, no stalls, limited help/labour, and insufficient funds, which hinder their business operations and expansion.

DISCUSSION

The study highlights critical inefficiencies and unsustainable practices within the M. vollenhovenii value chain in Asejire Lake. Consistent with findings from Bosma *et al.* (2017), the dominance of traditional gear and lack of resource regulation suggest overexploitation risks. The low income share received by fishers reflects inequitable value distribution, as seen in similar Nigerian inland fisheries (Njoku *et al.*, 2019).

The concentration of women in processing nodes aligns with global patterns in small-scale fisheries (FAO, 2020), but the absence of gender-sensitive policies limits empowerment. Moreover, significant post-harvest losses and lack of infrastructure highlight the need for investment in low-cost, energy-efficient processing and cold chain solutions.

The under-utilization of extension services and weak stakeholder coordination undermine sustainability goals. Adopting community-based co-management and value chain governance mechanisms could enhance both ecological outcomes and income distribution (Trienekens, 2011).

CONCLUSION AND RECOMMENDATION

The study concludes that targeted interventions such as improved fishing technology, investment in processing infrastructure, and cooperative marketing are critical to enhancing sustainability and equity. Policy recommendations emphasize stakeholder inclusion, gender-sensitive capacity building, and co-management frameworks to promote sustainable fisheries development. An efficient marketing system can reduce post-harvest losses and make fishery products more widely available. The government should establish special stalls with storage facilities in Asejire Local Market to reduce losses, and provide loans to fishermen through cooperative societies to support expansion. Intensifying the culture of prawns can help meet Nigeria's aquatic food demand and reduce prices.



REFERENCES

- Akinwumi, F. O., Omitoyin, B. O., & Adedeji, O. B. (2018). Growth performance of *Macrobrachium vollehovenii* in polyculture. *Journal of Aquatic Sciences*, 33(1), 55–62.
- Bello-Olusoji, O.A., Oyekanmi, F.B. and Aderiye, B.A. (2000). “Physio-Biochemical parameters of the Natural Habitat of the African River Prawn *Macrobrachium vollehovenii* (Herklots, 1857) in some lentic and lotic environment in Nigeria”. *African Journal of Ecology*, **35**: 80-81.
- Bello-Olusoji, O.A., Oyekanmi, F.B. Fasakin, E.A. (2000). “Nutritional values and flesh yield of some unprotected Crustaceans in the South Western Nigeria”. *Journal of Nigeria Association for Aquatic Science*, 14th and 15th Annual Conference/International workshop Oct. 2000. NnamidiAzikwe University Awka14.
- Bello-Olusoji, O. A. and Bankole, N. O. (2020). Aquaculture potential of African River Prawn. *Nigerian Journal of Fisheries and Aquaculture*, **8**(2): 90–101.
- Bosma, R. H., Nguyen, T. L., and Siahainenina, A. J. (2017). Value chain analysis of shrimp farming in Indonesia. *Aquaculture Economics & Management*, 21(2), 230–249.
- Dadzie, S., and Owusu-Frimpong, M. (2014). Ecology and distribution of *Macrobrachium vollehovenii* in West African freshwater bodies. *African Journal of Aquatic Science*, **39**(1): 47–53.
- FAO. (2020). The State of World Fisheries and Aquaculture 2020. Rome: FAO.
- FAO. (2022). Fisheries and Aquaculture Country Profile: Nigeria. Food and Agriculture Organization.
- FAO (Food and Agriculture Organisations of the United Nations) World Food and Agriculture - Statistical yearbook (2022) Rome In *aquaculture* 583
- Faruque, G. (2007). An exploration of impacts of aquaculture production and marketing on rural Livelihoods in three regions in Bangladesh.
- Jimoh, A. A., Clarke, E. O., Whenu, O. O., and Adeoye, H. (2011). Food and feeding habits of the African River Prawn (*Macrobrachium vollehovenii*, Herklots, 1857) in Epe Lagoon, southwest Nigeria. *International Journal of Fisheries and Aquaculture*, **3**(1): 10-15
- Kaplinsky, R., & Morris, M. (2001). A Handbook for Value Chain Research. IDRC. Njoku, D. C., Eyo, A. A., & Ojutiku, R. O. (2019). Strengthening fish value chains in Nigeria. *Journal of Agricultural Extension*, **23**(3): 48–57.
- Oyelude, E. O., Adewolu, M. A., & Adikwu, I. A. (2021). Reproductive biology of *M. vollehovenii* under controlled conditions. *Aquaculture International*, **29**(1): 71–82.
- Trienekens, J. H. (2011). Agricultural value chains in developing countries. *International Food and Agribusiness Management Review*, **14**(2): 51–83.