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Assessment of Aquatic Flora and Fauna Diversity in Rice Field Ecosystems in Ekiti State, Nigeria

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ABSTRACT

Aquatic biodiversity within rice-based ecosystems serves as a readily available source of protein, minerals, and fatty acids, providing a substantial portion of human diet and ensuring food security. This study was carried out in Ekiti State Preliminary rural appraisal was carried out during the visit to the study areas to obtain information from the rice farmers to know the type of aquatic fauna and flora that could be found on their rice fish farms. Identification of aquatic fauna and flora showed the presence of fish species, amphibians, etc., and spinach, water leaf, bitter leaf etc., for flora. The utilization of fish species (smoking, boiling and sun drying). Relationship between the utilization and food security of aquatic fauna and flora showed that rice farmers find the presence of aquatic plants and animals in their rice fields as a means of meeting both the economic and nutritional needs of the households.

Keywords:
Food security, Aquatic flora and fauna, Rice farmers, Fish species

Introduction

For a considerable amount of human food, aquatic biodiversity in rice-based ecosystems is a cheap and easily accessible source of animal protein, mineral, and fatty acid in addition to rice. The conventional farming systems may have provided a sustainable supply of these ecological services. The amount of food produced in inland waters in general (FAO/MRC 2003) and rice fields (other than rice itself) in particular (Halwart 2003) is generally underestimated and undervalued because it is small quantities (although collected by many individuals and in large areas) which are all locally consumed or marketed and therefore not recorded in official statistics. This resulted in monoculture, higher cropping intensities, and an increase in the use of chemical inputs, even with the brief respite offered by an effective integrated pest management (IPM) programme. The result was expected: there has been a decrease in the quantity of aquatic life. (Halwart and Bartley, 2005). The aquatic fauna and flora are essential to preserving the ecological equilibrium of rice field ecosystems. For example, aquatic fauna aids in pest management, nutrient cycling, and overall ecosystem resilience, while aquatic plants aid in nutrient cycling, water filtering, and sediment stabilization (Halwart, 2008). This study will contribute valuable insights into status trends and drivers of aquatic flora and fauna diversity in rice field systems, while also fostering partnerships and actionable recommendations for promoting sustainable development and biodiversity conservation in Ekiti state, Nigeria.

Materials and Methods

Study Area

This study was carried out in Ekiti State, Nigeria because of their relative importance in the rice production landscape in Nigeria. Site selection and identification of fields for the study period (wet and dry seasons). The site of this study was selected based on the most rice producing state in the Southwest of Nigeria. Local governments were then selected from Ekiti State (Igbemo and Ijero). Two local governments were chosen in Ekiti given the upland rice cultivation which only run once in a year (March through to July/August when they harvest).

Ekiti State

The study was carried out in Ekiti State. It is one of the South-Western States created on the October 1, 1996. There is total number of sixteen local government areas in the State. The State is located between latitudes 7025 and 8005'N and between longitude 4045' and 5'46N East. The State is bounded to the North by Kwara and Kogi States while it is bounded by Osun State to the west (Omotayo, 2017).

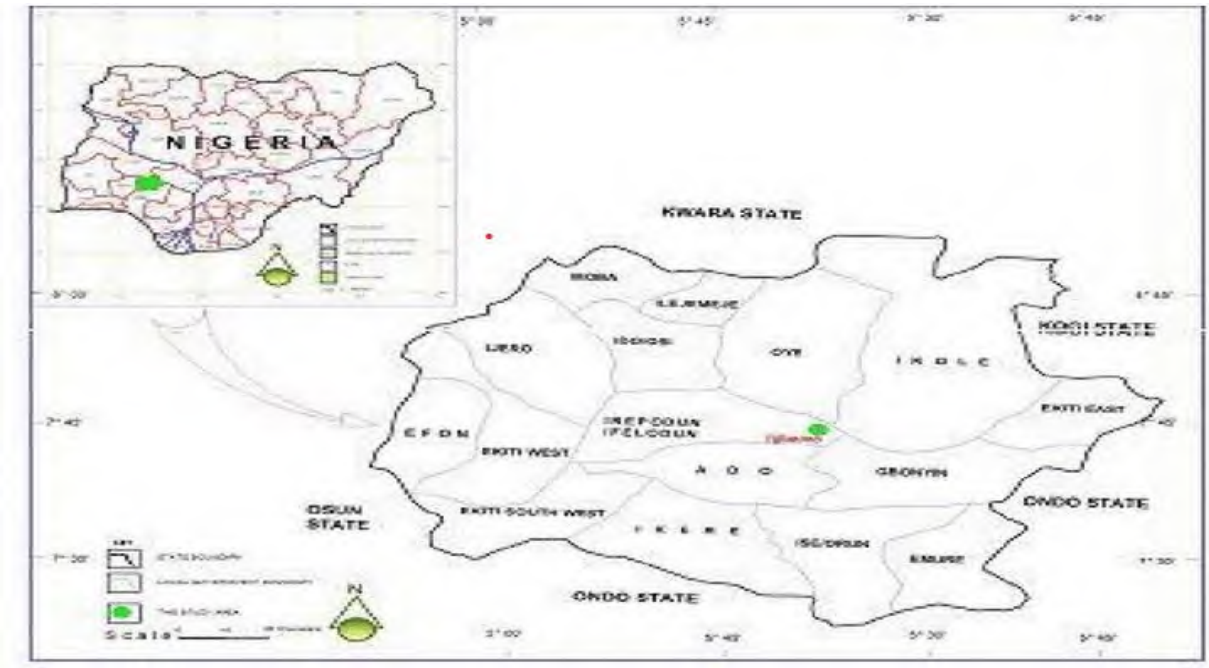

Fig 1: Map showing the Ekiti state study area
Source: Olabode, 2015

Sampling size and technique

Using Krejcie and Morgan Table of sample size determination, a total of 32 respondents (Ekiti= 22) was sampled using snow-balling technique. Data was collected from August to December 2023 for Igbemo and Ijero Ekiti.

These periods shall cover all the phases of rice cropping seasons. The series of activities to be included are a preliminary participatory rural appraisal, data collection, data verification and analysis and reporting.

Target Population

The target population for this research were the rice farmers in Ekiti State, given their abundant practice of rice farming.

Preliminary participatory rural appraisal

The preliminary participatory rural appraisal and participatory rural appraisal followed the methods of Tonette *et al.*, (2014) to obtain preliminary information and get some insight into the present knowledge about the aquatic organisms in rice ecosystems, including the way they are collected, specific sites in the paddy field ecosystem where they are commonly found, and the way they are used by the people.

Questionnaire design

Data was collected from rice farmers with the aid of semi- structured questionnaire generated using an open-source data collection platform - KoboToolBox and filled out on the KoboCollect App v.2022.4.4 using an Android device. The questionnaire consisted of five (5) sections; Section A consisted of questions on Socio-economic characteristics, Section B consisted of questions on General Awareness of Integrated Rice Fish Farm, Section C consisted of questions on Rice Cropping Activities, Section D consisted of questions on Aquatic organisms found on the farm and their uses to the community, Section E consisted of questions on Acceptability of Integrated Rice Fish Farming by the farmers and support from the Government.

Validation of Instrument

Before initiating data collection. The questionnaire was subjected to face and content validity test by expert in Fisheries ecology from the department of Aquaculture and Fisheries Management, University of Ibadan. Adjustments to the questionnaire were implemented based on the feedback during the validity test.

Assessment of Aquatic flora and fauna

Aquatic flora collection and identification followed the methods of the British Columbia Ministry of Forests (1996). In addition, taxonomy-related work, particularly verification of the scientific name of aquatic organisms was based on the manual on taxonomy and fish identification (Olasebikan and Raji, 1998), online resources such as Fishbase, FAO guide, reptile database amphibia web, Wikipedia, etc.

Data Collection Procedure

Based on the information obtained from PRA, I visited the study sites regularly and documented activities, organisms collected and explored further information with the farmers. Taxonomy- related work, particularly verification of local and scientific name of aquatic organisms was based on several sources. These included the manual on taxonomy and fish identification, online resources such as fishbase (Froese and Pauly 2014), reptile database (Uetz and Hosek, 2014) amphibian web, Wikipedia, etc. The data for the study pertaining to the perception, awareness, and acceptability of farmers on integrated rice-fish farming was sourced from primary data using self-administered questionnaire survey designed on three-point Likert scale.

Data Verification

A meeting with the respondents was organized to verify the accuracy of the data that had been compiled. This was carried out prior to the end of the study.

Result

Table 1: Fauna Species Identified in Sampled Rice Fields and its common uses in Ekiti State

S/N	Taxon	Common names	Scientific Names	Local (Yoruba) names	Uses
1	**Amphibians**	Frogs	*Rana temporaria*	Konkon	Serves as food and medicine
2	**Annelids**	Earthworms	*Lumbricus terrestris*	Ekolo	Used as bait for catching fish in rice fields
3	**Reptiles**	Black snake		Ejo	Traded in the market for food, medicine and skins used to make belts
4	**Molluscs**	Gaint Africa land snail Chivita snail	*Archachatina smithii* *Pomacea flagellate*	Igbin Isewuru	Serves as food and traded in the market.
5	**Arthropods**	Crab	*Carcinus maenas*	Alakan	Serve as food
6	**Fungi**	Mushroom	*Pleurotus ostreatus*		Serve as food

Table 2 Common uses of aquatic plants identified in rice fields in Ekiti States

Common names	Part used	Yoruba names	Botanical names	Uses
Spinach	Leaves	Efo shoko	*Celosia Argentea*	Serves as vegetables for soup
Bologi	Leaves	Worowo	*Solanecio biafrae*	Serves as vegetables for soup

Plate 1: Chivita Snail (*Pomacea flagellata*) in a rice field at Igbemo in Ekiti State (Mg x 4)

Plate 2: Tilapia (Cichlids) in rice field at Ijero at Ekiti state (Mg X 12)

Plate 3: African Giant African Land Snail at a rice field (*Achachatina marginata*) in Ijero, Ekiti State (Mg X 4)

Plate 4: Water leaf **(***Vernonia amygdalina*) in a rice field in Igbemo in Ekiti State (Mg X 10)

The relationship between the fish species utilization and food security in rice field community in Ekiti State

During the participatory rural assessment conducted among rice farmers in Ekiti State, it was observed that the utilization of fish species has played a crucial role in ensuring food security, particularly during the rainy season when these species are prevalent in rice fields. The easy access to these fish species and their abundance has contributed to the provision of nutritious food and cost savings for farmers. However, there has been a notable decline in the presence of these fish species over the years, potentially due to factors such as pollution, poaching, and habitat degradation within the rice fields.

The relationship between other aquatic animals' utilization and food security in rice- fish farming community in Ekiti State

In the course of participatory rural assessment, rice farmers noted that amphibians(frogs), molluscs (snails), fungi (mushrooms) and arthropods (crabs) found on their farms serve as a source of meat, providing protein at minimal cost, thereby meeting both economic and nutritional needs of rural dwellers and their households. Additionally, farmers informed on how, after processing, these aquatic animals could be stored for months and used to meet daily household requirements. Despite the scarcity of these animals over time, their value has remained significant in sustaining households over the years.

The relationship between other aquatic plants utilization and food security in rice- fish farming community in Ekiti State

During the participatory rural assessment, rice farmers extensively shared the utilization of aquatic plants such as spinach, bitter leaf, and water leaf as vegetables with high nutritional value. These plants provide economic benefits as farmers can harvest them alongside having their rice fields. Additionally, the aquatic plants have medicinal properties, functioning as herbs that benefit rural dwellers.

Discussion

The utilization of aquatic fauna and flora in the rice-fish communities

In the course of this study the utilization of the fish species and processing methods were identified which are, for fish species (catfish and tilapia) smoking salted method, sun dried salted method, boiled, fresh and for traditional use and rural dwellers consumption. For other aquatic animals (frogs, snails, crab etc.), it serves as food (meat), bait, and sold, etc. for aquatic plants (spinach, water leaf, bitter leaf, etc.), they serve has food like vegetable and medicinal uses and this study is in line with that of Halwart, 2006 and Freed *et al.*, 2020 that also states the uses of aquatic fauna and flora as food where every rural dwellers/ household with little or no income their dietary diversity to satisfy carbohydrate, protein, lipid and micronutrient.

Aquatic animals and plants play a crucial role in ensuring food security and maintaining a balanced diet for communities

During this study the farmers reported that the aquatic plants and animal found in their farms helps in providing nutritional value, medicinal value and also helps in assisting the farmers households by giving a reduced cost since aquatic species are found in their households and this is in line with Halwart, 2006 and Freed e*t al.*, 2020 findings that emphasized that for many rural households with limited income, their immediate environment must provide dietary diversity to fulfill various nutritional needs, including carbohydrates, protein, lipids, and micronutrients. Fish, in particular, are valued for their role as a primary protein source. Furthermore, plant and animal resources from rice field environments supply essential micronutrients that may be lacking in rice alone, such as calcium, iron, zinc, vitamin A, and certain fatty acids and amino acids.

The abundance of Aquatic species over the past decades in the study area

During Participatory Rural Appraisal (PRA), rice farmers from Ekiti state were questioned about changes in the abundance of aquatic fauna and flora over recent decades. They reported a decline in the numbers of aquatic plants and animals observed on their rice farms. When asked about potential reasons

for this decline, they cited habitat degradation, poaching, pollution (both human and environmental), among others. These findings align with those of Luo (2005), who noted a decrease in the availability of wild aquatic resources from rice fields. A decade ago, rice-based capture contributed to half of a household's consumption, whereas nowadays, only one-fifth to one-third is derived from such capture in rice-based farming.

Conclusion

This study found the presence of aquatic fauna and flora in rice fields in Ekiti state, the research evaluated the utilization of the aquatic fauna and flora which serve as essential food and medicinal resources for rural inhabitants. The research explored how the utilization of aquatic flora and fauna in rice-fish farming communities relates to food security. It revealed that rice farmers view the presence of aquatic plants and animals in their communities as essential for meeting both the economic and nutritional requirements of their households.

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