

Ecological Evaluation of Natural Resources: A Sustainable Livelihood Capital in Parts of Ilaje Riparian Community, Ondo State, Nigeria.

Comment [SV1]: Title should reflect the study that you have done

Comment [SV2]: Recommended title:
Preliminary Ecological Evaluation of Natural Resources: A **case of** Sustainable Livelihood Capital in Parts of Ilaje Riparian Community, Ondo State, Nigeria.

Or

Ecological Evaluation of Natural Resources: A **Baseline study** of Sustainable Livelihood Capital in Parts of Ilaje Riparian Community, Ondo State, Nigeria.

ABSTRACT

Aim: This study was aimed at evaluating the Ilaje coastal biodiversity scenarios and sustainable livelihood opportunities.

Study design: A Participatory Rapid Appraisal and purposive random sampling technique were adapted.

Place and Duration of Study: Field sampling: Parts of Ilaje littoral community in Ondo State, Nigeria, between September 2020 and October 2021.

Methodology: Data analyses by descriptive analytical tools and Likert-Type scale 7 point and 5 point levels of agreements.

Result: Result of the natural resources biodiversity has recorded 20 representative flora diversity under 12 families across sampled communities, diverse representative fauna in Odonla (28), Ikorigho (14), Molutehin (10), Odun-Igo (8) and Awoye (3). The biodiversity composition has indicated Fishes as the highest resource among others particularly in Awoye with the highest percentage, while the highest mangrove livelihood of 50% for housing in Molutehin which also recorded with Awoye a highest (44%) alternative income source in trading among other communities.

Conclusion: this study was significant while providing a better understanding of the biodiversity scenarios and sustainable livelihoods associated with the Ilaje riparian community and their ecosystem interaction.

Key Words: Biodiversity, flora, fauna, income, assets.

1. INTRODUCTION

Ondo State is among the well-endowed resourceful ecological zones housing the Ilaje community in part of the littoral zones in Nigeria at the lower gulf of Guinea. Livelihood in the Ilaje coastal ecosystem is not so much different from other coastal area. Several school of thought both at the local and international community have made efforts in conceptualizing this terminology with all having similar focus to a common goal of achieving a sustainable social development. A livelihood entails capabilities, assets and activities required for a means of living. In other words livelihood comprises the capabilities, assets (natural, physical, human,

financial and social capital) the activities and the access to these that jointly determine the living gained by the individual or rural household" [1, 2]. It can also be viewed to involve the capacities, goods such as capital and social, and the activities needed to live [3]. A livelihood by Krantz [4] constitute adequate stocks and flows of food and cash to meet basic needs of life and it comprises people, their capabilities (stores, resources, claims and access) and activities required for a means of living including income and assets which can be tangible (physical resources) or intangible (claims and access) assets.

Livelihood is sustainable when it is resilience, recover from and cope with any form of stress and shocks while maintaining or enhancing its capabilities and assets without compromising the future, if it can provide opportunities for the next generation, which contributes net benefits to other livelihood at the local as well as global levels in the short and long term and not undermining the natural resource base [4, 3, 5, 6]. A livelihood can be classified as sustainable, if it is independent from external support, if it is able to maintain the long-term productivity of natural resources and if it does not undermine the livelihood options of others [7]. Other assertions have divergence bases of what constitute livelihood sustainability: A livelihood is environmentally sustainable when it contributes to the stability of environmental assets and has a sustainable positive net benefit effects on other livelihoods sources [8]. It has also been explained that livelihood is sustainable when it has the capacity to meet the immediate needs of the people while its ability to meet future needs is not jeopardized [9]. In determining the level of household livelihood sustainability, several factors considered as the principal assets, pillars or capital have been grouped into five categories, viz: natural resources, human, financial, physical and social capitals [10]. These assets contribute or enhance the situation of a family by responding to shocks and stresses as they adjust to overcome them and stay sustainable over a period of time. The natural resource capital consists of resource stocks of biotic and abiotic nature (soil, water, air, genetic resources) used to support livelihood activities of household.

Sustainable livelihood in relation to coastal environment can be their sustainable utilization of natural resources biodiversity for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem." It can also be defined as: "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations [11]. Several studies have been reported on coastal ecosystem and its biodiversity scenarios in the light of its' conservation priorities and sustainable livelihood in parts of Niger Delta. This include the; sustainable livelihoods assessment of project in the Nigeria's Niger Delta Communities [12]; delineation of selected site of mangrove and *Nypa* for biodiversity conservation in Rivers State [13, 14]; the development of sustainable livelihoods and biodiversity project (SLBP)

communities' operational plans in the Niger Delta, Nigeria [15]; assessment and valuation of wetland ecosystem services in the Niger Delta, Nigeria [16] and assessment of wetland degradation and loss of ecosystem services in the Niger Delta, Nigeria [17]. Others include sustainable livelihoods and biodiversity project (SLBP) in Nigeria's Niger Delta, ecological and socio-economic baseline studies [18].

The main occupation of Ilaje community is predominantly aquaculture and fishing. However, the inhabitants have other alternative source of income for wages to give them a sustainable livelihood. However, the entire livelihoods in the study location are not sustainable, shocks, trend and seasonality are more or less in every activity. Due to this, their economic condition is at messy. The rationale for this research corroborates part of agreements on the goals of the United Nation Conference on Environment and Development (UNCED) that sustainable livelihoods serve as an integrating factor between the politics of resource management and poverty reduction among sustainable practices for environmental improvement and the pursuit of economic development [19]. To understand the livelihood of this community (study location), DFID framework is being used to explain all the livelihood activity.

This study was aimed at evaluating the Ilaje Coastal biodiversity scenarios and sustainable livelihood opportunities; with the objectives of: i) establishing through ecological field studies and ground truting appropriate data on the existing status of all identifiable and associated livelihood components of the study location and ii) assessing the Ilaje biodiversity ecosystem of the various study sites (**Odonla, Ikorigho, Molutehin, Odun-Igo, and Awoye**) in Ondo State. The study is significant hence it is expected to provide a better understanding of the biodiversity potential of the Ilaje people in Ondo State, provide data information that can be a baseline for impact prediction and judgment in environmental assessment of any envisaged ecological disaster in the area, widen the knowledge on biodiversity scenarios, sustainable livelihood and ecological scenarios associated with the interaction between the inhabitant of the area and capital assets of the environment. It will provide additional information that would form the basis for further research, development, utilization and perpetuation of the ecological importance of the natural resources capital assets of the area. This will assist policy and decision makers, agencies, ministries and environmental scientists and conservationist in the selection of areas for conservation priorities, sustainable development planning and investment.

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2. MATERIAL AND METHODS

2.1. Study area, location and site:

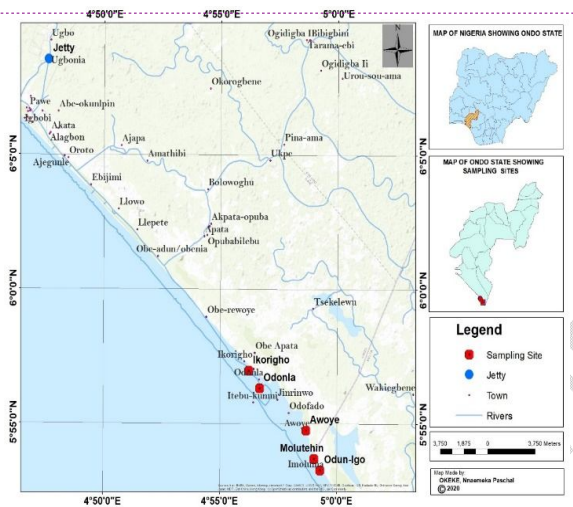
The study area is Ondo State with its' capital in Akure; situated between longitudes 4°30' and 6° East of the Greenwich Meridian, 5°45' and 8° 15' North of the Equator (Fig. 1). The state lies entirely in the tropics, bounded in the North by Ekiti, Kwara, and Kogi States; in the East by Edo State; in the West by Oyo, Ogun and Osun States; in the and in the South by

Delta and the Bight of Benin of the Atlantic Ocean. The State among others in Nigeria is characterized by two distinct environmental conditions (rainy and dry seasons) of a tropical climate, associated with an annual maximum temperature range (21°C to 29°C), high relative humidity due to proximity to the high sea, and maximum rainfall range of 2000mm in the southern part to 1150mm in the northern area and decreases in amount and distribution from the coast to the hinterland. The area is characterized by luxuriant with both heterogeneous and homogenous discrete structural formation, composition and stratification of a high forest zone consisting of the mangrove-swamp forest near the Bight of Benin, tropical rain forest in the centre part, and sub-savannah forest comprising the woodland savanna on the gentle slopes of the Yoruba Hills in the northern fringes.

The State is endowed with both human and natural resources involving well blessed resourceful, industrious and hospitable people, who are predominantly Yoruba and Ijaw speaking tribes (the Akoko, Akure, Apoi, Idanre, Ijaw, Ikale, Ilaje, Ondo and the Owo) that cut across 18 local council areas. Beside the prowess as the most educationally advanced State in Nigeria the people are mostly subsistence farmers, fishermen and traders. Their livelihood represents an embodiment of culture, ranging from the local foodstuff to the mode of dressing, dancing, wood crafts, such as carved house post and decorated doors. Natural resources include timber and non-timber forest products and non-forest resources. Traditional industries include pottery making, cloth weaving, tailoring, carpentry, and blacksmithing as well as diverse mineral deposits.

The state with its land mass area of 14,788.723 square kilometers comprises 18 local council areas, viz: Akoko north east, Akoko north west, Akoko south east, Akoko south west, Akure north, Akure south, Ese odo, Idanre, Ifedore, Ile-oluji/Okeigbo, Irele, Odigbo, Okitipupa, Ondo east, Ondo west, Ose, Owo and Ilaje - study location (Fig. 2) located in the south western zone of Nigeria. The study location -Ilaje (Fig. 2) with headquarter at Igbokoda occupies the entire southern part of Ondo State, Nigeria. It is bordered in the south by the Atlantic ocean, in the west by Ogun state, east by Ese-odo local council area and delta state and in the north by Okitipupa local council area. Its coastline covers a distance of 82 kilometres making it the local government area with the longest coastline in Nigeria. Ilaje land has an area not less than 1,318 square kilometres, with associated climatic conditions of maximum rainfall and relative humidity due to proximity to the coastal ecology. Edaphic condition is sandy silt and sandy loam soil complex. The area is characterised by riparian vegetation of fresh and marine ecosystem heterogeneous in nature. The study location is known for its major five kingdoms: Ugbo, Mahin, Etikan, Aheri and Igbotu consisting of over 100 communities including such sampled sites (Fig. 3) as: Odonla, Ikorigho, Molutehin, Odun-Igo and Awoye.

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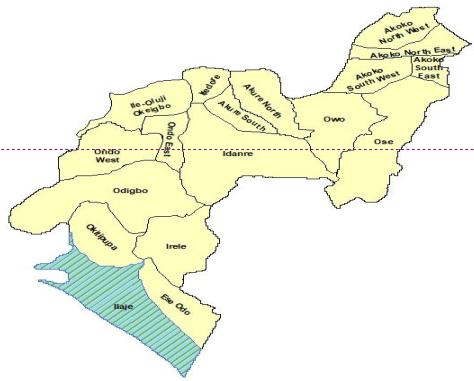
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Fig. 1: Nigeria indicating Ondo State (the study areas)

2.2. Field sampling and analysis

The field sampling of response by the littoral community and their interaction with the natural resources involved descriptive and explorative approach based on Participatory Rapid Appraisal (PRA) by the use of well-structured questionnaires and personal interviews / discussions, focused group discussions, and key informant interviews [20, 21]. A purposive and random sampling technique was used to determine sampling size for respondents of selected sampled sites (Odonla, Ikorigho, Molutehin, Odun-Igo and Awoye) (Figs.4 to 8) to administer the questionnaire.

Comment [SV6]: What are the data obtained through these, such socioeconomic details of respondents, ecosystem services that they received, environmental and economic benefits due to ecosystem services, etc. Please mention these here.



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Fig. 2: Ondo State indicating Ilaje – study location

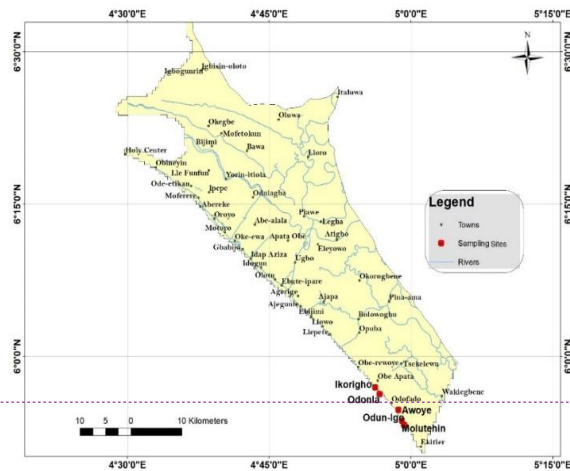


Fig.3: Ilaje –study location indicating sampled sites

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A direct observational and ground-truthing to acquire information on the livelihood natural resource capital assets was adopted to validate the sampled site using a hand-held **Garmin Geographic Positioning System (GPS - Garmin Dakota 10 model)** for georeferencing of exact sampled point (Table 1) and imagery production of the sampled sites (**Odonla, Ikorigho, Molutehin, Odun-Igo and Awoye**) as exemplified in Figs.4 to 8. The data generated were subjected to descriptive analytical tools such as: frequency count, percentages and charts as adopted in Edeter *et al.* [20] and levels of response anchors using the Likert –Type scale 7 point level of agreement and 5 point level of agreement [22] to ascertain the natural resources capital assets of the respondents of the coastal environment at study area.

Comment [SV9]: Mention the number of ground-truth points for each site of the study location. Is it random points?

Table 1: Coordinates of Sampled Site in parts of Ilaje Coastal Ecosystem, Ondo State

Lat. (N)	Long. (E)	Alt.	Community / Sampled site
06°08.543'	004°47.618'	17ft	Jetty Odonla

05°56.407'	004°56.768'	9	Jetty
05°56.391'	004°56.743'	28	Sampled site
05°56.387'	004°56.737'	21	Sampled site
Ikorigho			
05°57.042'	004°56.241'	27	Sampled site
05°57.035'	004°56.222'	43	Sampled site
Molutehin			
05°53.816'	004°59.048'	30	Jetty
05°53.802'	004°59.025'	15	Jetty
05°53.782'	004°59.034'	15	Jetty
05°53.817'	004°59.054'	10	Sampled site
05°53.743'	004°59.021'	4	Sampled site
05°53.743'	004°59.017'	7	Sampled site
05°53.774'	004°59.046'	-15	Sampled site
Odun-Igo			
05°53.433'	004°59.231'	7	Jetty
05°53.427'	004°59.226'	13	Jetty
05°53.404'	004°59.237'	14	Jetty
05°53.446'	004°59.250'	14	Jetty
05°53.297'	004°59.287'	-1	Sampled site
05°53.300'	004°59.287'	4	Sampled site
05°53.324'	004°59.288'	15	Sampled site
05°53.299'	004°53.302'	24	Sampled site
05°53.444'	004°53.189'	59	Sampled site
Awoye			
05°54.838'	004°58.766'	9	Sampled site
05°54.901'	004°58.737'	4	Sampled site
05°54.904'	004°58.693'	12	Sampled site

UNDER REVIEW

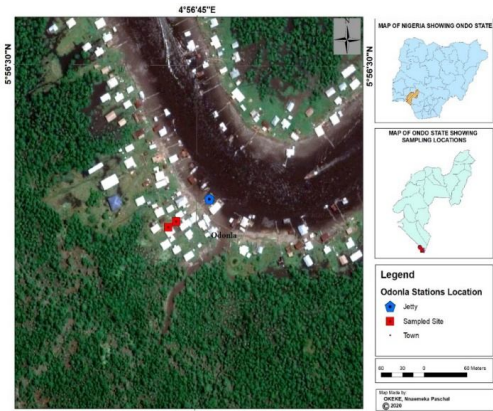


Fig. 4: Imagery of Odonia sampled site at Ilaje study location

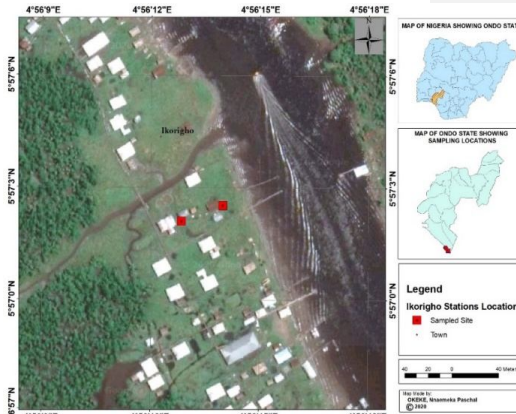


Fig. 5: Imagery of Ikorigho sampled site at Ilaje study location

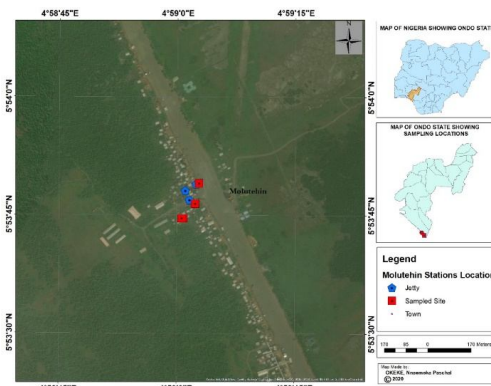


Fig. 6: Imagery of Molutehin sampled site at Ilaje study location

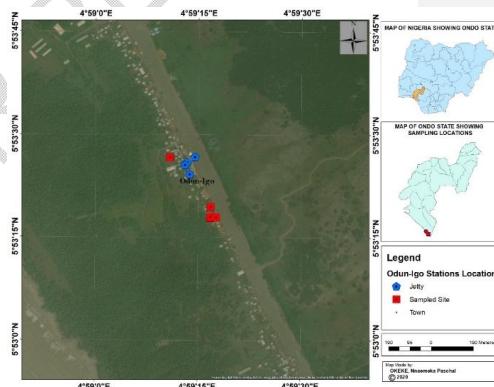


Fig. 7: Imagery of Odun-Igo sampled site at Ilaje study location

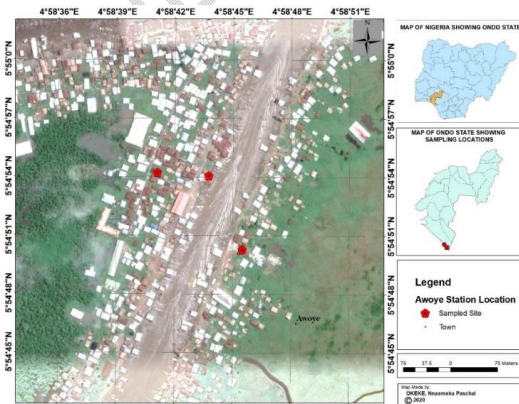


Fig. 8: Imagery of Awoye sampled site at Ilaje study location

3. RESULTS

The results of the study on natural resources sustainable livelihood in parts of Ilaje coastal ecosystem are exemplified in Figures 9-12. The result interpretation of study observations in quantitative presentation of frequency and percentage composition of natural capital assets (Figs. 09-11) has revealed various trends of sustainable livelihood of the ecosystem services of the coastal environment with regards to the economic / biodiversity environmental data of respondent based on livelihood capital or asset in parts of Ilaje coastal communities.

The natural resources biodiversity has recorded 20 representative flora diversity under 12 families across sampled communities, diverse representative fauna in Odonla (28), Ikorigho (14), Molutehin (10), Odun-Igo (8) and Awoye (3). The frequency composition of biodiversity natural resources of sustainable livelihood across the community has indicated fishes as the highest resource among other resources with 84% status in Odonla, Molutehin and Odun-Igo respectively; 88% in Ikorigho and 92% in Awoye. The least natural resources include: pig, mudskipper, and tortoise respectively with 4% status in Odonla, 4% for snail in Molutehin, and 8% for cray fish and periwinkle respectively in Odun-Igo and Awoye being recorded in Fig. 9.

The significance of the mangrove ecosystem services within and among the communities has recorded varying percentage of livelihoods with the highest livelihood of 34% for firewood in Ikorigho, and 24% as herbs in Odonla, and 46%; 50%, 26% and 28% were respectively for housing in Ikorigho, Molutehin, Odun-Igo and Awoye, which also had 30% of the mangrove used as firewood. The least livelihood of mangrove in the various communities were as follows: food and hunting (2%) in Odonla and Awoye, footbridge (8%) in Ikorigho, farming and logging (2%) respectively in Molutehin, while Odun-Igo had farming as the least (4%) livelihood of the mangrove as exemplified in Fig. 10.

A varying trend of alternative income sources of respondents within and among the respective study communities as presented in Fig. 11, has recorded high income of 20% trading in Odonla and 44% trading in Molutehin and Awoye respectively and 36% in Odun-Igo; 44%, 48% and 56% of fishing respectively in Ikorigho, Odun-Igo and Awoye which recorded the highest income from fishing across the communities among the various indices of income source.

Comment [SV10]: Please include the results of these if you have in the questionnaire: Percentage of gender, education, occupation, income, willingness to protect their ecosystems, average income from coastal and mangrove ecosystems (in terms of products sold in the market), and so on.

These data are necessary to improve the quality and worth of this study, since it is a good topic and needed to enhance the sustainable livelihood and ecosystem conservation

Comment [SV11]: Below this paragraph, insert the Fig.9

Comment [SV12]: Below this paragraph, insert the Fig.10

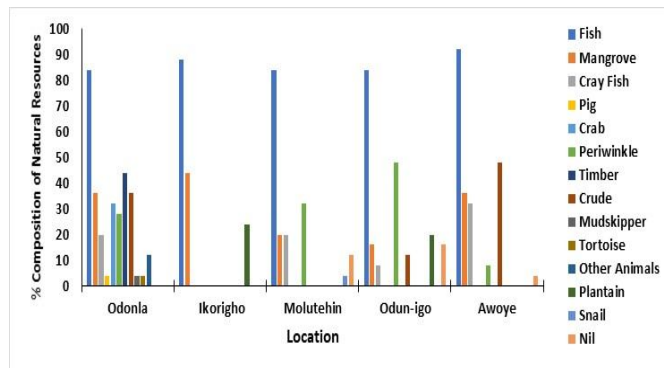


Fig. 9: Frequency composition of biodiversity natural resources in parts of the studied communities in Ilaje

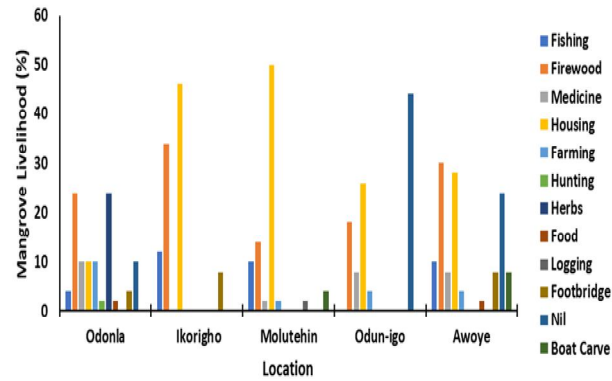


Fig. 10: Livelihoods of the mangrove in the studied communities in Ilaje

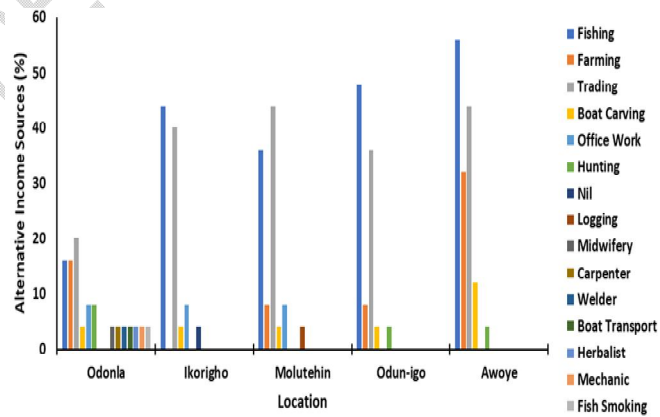


Fig. 11: Alternative sources of income in parts of the studied communities in Ilaje

4.1. DISCUSSION

This paper provides an example of a cutting-edge, multi-disciplinary research effort that couples natural resources biodiversity scenarios and livelihoods in light of their ecological evaluations. The research is also significant in that it has pioneered sustainable livelihood programme at Ilaje in the field of natural resources capital and management. The present study has reported the general observations and opinions of rural dwellers of Ilaje communities in Ondo State, Nigeria in light of sustainable livelihood natural resources capitals. As exemplified in the Tables and Figs., there are diverse trend of natural resources capitals across the various studied communities in Ilaje littoral zone.

The study has also revealed that various natural assets (resources) accessed by the inhabitants of the studied community include: Cray fish, Pig, Crab, Periwinkle, Timber, Crude oil, Mudskipper, Tortoise, Plantain, Snail and other animals in their percentage proportion. However, the greater percentage of the accessed natural assets by the inhabitants was Fishes and Mangroves. The findings imply that most of the coastal inhabitants are rural dwellers and have access to natural assets for their sustainable livelihood. This corroborates the assertion that such natural assets can be used for productive purposes to support livelihood activities [2, 23]. This also suggests that households would survive with the help of key environmental resources and services as well as food produced from natural capital [20]. Related study has revealed that fisheries-related activities provide important sources of livelihoods for nearly 7 million people in India [24]. A large percentage of rural dwellers are involved in artisanal, small-scale fishing operations in open water bodies including the sea, rivers and creeks, as well as in fish trading, processing and related activities [25]. The Ninth Five-Year Plan of the Government of Orissa recognizes the crucial role that the fisheries sector has played in generating income and employment in the state, and places adequate emphasis on improving the employment potential of the sector [26].

Mangroves are a group of highly adaptive salt tolerant plant species inhabiting intertidal zones of tropical and subtropical coastlines. They possess important ecological and socio-economical livelihoods. In the various studied communities of Ilaje coastal ecosystem the mangrove resources have significant livelihoods in different dimension ranging from provisioning, habitat-support, regulating and socio-cultural services; in light of fishing, firewood, medicine, housing, farming, hunting, herbs, food, logging, foot bridge and boat carving. Though, with the highest livelihoods as firewood, herbs and housing, these livelihoods were at significant variance among the study communities in Ilaje. Related study had revealed some vital livelihoods of mangrove in many aspects of human endeavours in terms of therapeutic uses for malaria, diarrhea, ulcer, skin infections, diabetes and snake bite [27], as food, fuel and fodder and medicine for coastal communities [28,29, 30]. Mangroves are also potential sources of

Comment [SV13]: Suggestion: Please read this to know more about the economical and ecological livelihoods of mangrove ecosystem-[Restoration and Conservation Benefits of Mangrove Forest to the Coastal Communities: A Review on Sri Lankan Perspective](#)

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livelihood for communities through the development of policies and programmes that can help provide incentives to local people who are largely dependent on mangroves [31]. In some coastal areas mangrove ecosystems are converted into farm lands, resorts and aquaculture [32, 33, 34, 35].

Analysis of the socio-economic profile of the study communities has revealed that greater percentage of the inhabitants had fishing, farming and trading as their major alternative source of income among other sources of self-employed means of livelihood survival beside the secondary occupational office work. This implies that majority of the inhabitants have alternative means of livelihood survival apart from office work. This is in tandem with several other studies which have however recorded farming and trading among other alternative as major livelihood activity done by rural dwellers in Nigeria [36, 37, 38, 39]. However, it has been observed that younger people have the tendency to pursue multiple livelihood activities in rural areas of Nigeria [40, 41, 42]. The provision of alternative income-generating sources has become one of the most widely used strategies at the community level to improve local livelihoods [43] and participation in different income generating sources have effect on rural household welfare and vice-versa [44].

4.2 CONCLUSION

Wetland resources contribute significantly to the household economy of people living near the coastal ecosystem. Generally the Ilaje coastal communities depend on the ecosystem for either their own consumption or the sale of such resources for money to buy food. Fuel wood, fish, periwinkle and crayfish were the major wetland resources being extracted. Using the explanatory based Participatory Rapid Appraisal (PRA) approach in the study to identify the various ecosystem services and their ranking significance to livelihood it was evident that Food, Aquaculture practices, craftsmanship, sea transport and trading are the most important livelihood benefit of biodiversity provisioning service of the ecosystem. Sustainable livelihood especially among rural dwellers is one of the prerequisites for the envisaged rural development and diversification in the country. Sustainable livelihood among coastal communities of Ilaje will help to reduce poverty, crimes; militancy, terrorism and reduce over dependency on government among others. However, sustainable livelihood itself is conditioned by the quality, quantity, accessibility and sometimes affordability of the identified natural assets. Hence, sustainability in livelihood of Ilaje coastal community is hinged on the balance in these assets, and it degree of resilience to shock or stress.

Comment [SV15]: It seems a weak section, need to strengthen by adding limitations, recommendation, and future studies. Include some significant findings

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