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Marine Litter, Marine Mega-Fauna Species and Communities' Knowledge to Identify Marine Species and Ecological Roles along Ilaje Coastal Communities in Ondo State, Nigeria

OGUNJOBI, JA

Department of Forestry, Wildlife and Environmental Resources, Olusegun Agagu University of Science and Technology, Okitipupa, Ondo State, Nigeria

**Corresponding Author Email: ja.ogunjobi@oaustech.edu.ng, ogunjonson02@gmail.com*
**ORCID ID: https://orcid.org/0000-0002-2890-3573*
**Tel: +234(0)8034720031*

ABSTRACT: Maintaining coastline hygiene is important for marine ecosystem conservation strategy. Consequently, the objective of this paper is to investigate the marine litter, marine mega-fauna species and communities' knowledge to identify marine species and ecological roles along Ilaje Coastal Communities in Ondo State, Nigeria using appropriate standard procedures. The field survey yielded 6,047 with mean litter density of 2.02±1.58 item/m^2. A significant relationship existed between the types of marine litter (x^2 =144447.778, df = 17, $p < 0.05$) and study sites. Ten marine mega-fauna: Bottlenose dolphin (*Tursiops truncates*), Spinner dolphin (*Stenella longirostris*), Hump-backed dolphin (*Sousa teuszii*), Olive ridley sea turtle (*Lepidochelys olivacea*), Leatherback sea turtle (*Dermochelys coriace*), Tiger shark (*Galeocerdo cuvier*), Scalloped Hammerhead shark (*Sphyrna lewini*), Bull shark (*Carcharhinus leucas*), African manatee (*Trichechus senegalensis*) and Humpback whale (*Megaptera novaeangliae*) were reported. Out of 339 respondents sampled, 193 had poor knowledge of marine mega-fauna identification while about 86% had no idea of ecological roles of these species. The predictors of knowledge of marine mega-fauna identification among Ilaje coastal communities were age ($\beta = 0.24$, $p < 0.05$) and years of residency ($\beta = 0.25$, $p < 0.05$) while educational background is the predictor of knowledge marine mega-fauna ecological roles ($\beta = 0.02$, $p < 0.05$). The study showed that there were positive and significant relationships between respondents educational background and their knowledge of marine mega-fauna ecological roles ($r = 0.02$, $p < 0.01$). This study recommends among other things, designating the Ilaje coastline in Ondo State, Nigeria as marine mega-fauna conservation site.

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Globally, marine ecosystem is rich in biodiversity and offer significant socioeconomic opportunities for coastal communities living nearby, while also holding ecological importance for conservationists. This makes every anthropogenic activity and natural phenomenon surrounding marine ecosystems a topical issue. In many Africa countries including Nigeria, this same marine ecosystem has long been a vital socioeconomic and spiritual support for many people living along the coast. Recently, the federal government of Nigeria initiated highway construction project along the coastline from Lagos State to Cross River State. Ogunjobi and Ediagbonya (2017) emphasized the important of highways for essay movement of people and goods. Notwithstanding, the construction of coastal highway is a potential risk to marine ecosystem and marine mega-fauna resources along this route. To safeguard this ecosystem and its resources in Ondo State, Nigeria, a baseline data is inevitable. Among many data relevant for ecological

**Corresponding Author Email: ja.ogunjobi@oaustech.edu.ng, ogunjonson02@gmail.com*
**ORCID ID: https://orcid.org/0000-0002-2890-3573*
**Tel: +234(0)8034720031*

studies in and around marine ecosystem are marine litter and species of marine mega-fauna therein and ecological knowledge of the coastal communities.

Marine litter pollution is one of the most significant environmental challenges globally, with its amount increasing rapidly worldwide thereby causing habitat degradation and disturbance ecosystem equilibrium. Combine impact of human activities and natural factors on marine ecosystem results in the deposition of solid materials, commonly referred to as marine litter or debris. Dobler *et al*. (2022) pointed out that coastal currents, tides, wind, and waves play a role in transporting litter away from its source. Lusher *et al*. (2015) opined that marine litter are processed solid material that has been disposed of or abandoned into the marine environment which includes a wide range of materials such as plastics, metals, glass, rubber, and textiles, among others. Habitat assessment is a vital aspect of wildlife conservation strategy and environmental sustainability (Adu *et al*., 2014; Ogunjobi and Ayodele, 2015; Ogunjobi, 2024). Galgani *et al*. (2013) suggest that marine litter monitoring can be conducted through item counts or quantifying litter accumulation.

According to Moleón *et al*. (2020), marine mega-fauna are characterized by their large body size and crucial ecological roles, playing key parts in their environment through ecosystem engineering. Additionally, marine mega-fauna play a significant role in ecotourism activities, drawing attention and interest. Despite the recognized ecological importance of marine mega-fauna in developed countries, information about Ilaje coastal communities' coastline condition and marine mega-fauna species identification and ecological roles is scarce. Consequently, the objective of this paper is to investigate the marine litter, marine mega-fauna species and communities' knowledge to identify marine species and ecological roles along Ilaje Coastal Communities in Ondo State, Nigeria.

MATERIALS AND METHODS

Study Area: Ilaje, which is located on latitude 5.8333° – 6.2500° N and longitude 4.5000° – 5.1667° E in southern part of Ondo State, southwestern Nigeria is covering a total land area of 1318 km^2 (Ogunjobi and Surulere, 2020) is bounded in the east by Benin River in Edo State, in the West by Ogun State coastline and in the North by the land mass of Okitipupa and Irele local government areas in Ondo State. The study area with 180 km is the longest coastline in Nigeria and the primary occupation of the majority of the people in this area is fishing.

Data Collection and Analysis: Most data for planning conservation are often obtained from trained scientists (Turvey *et a*l., 2015), and these data required long time and effort which many cannot afford (Teixeira *et al.*, 2013). Interestingly, similar data can be obtained with little effort and funding through local ecological knowledge (Tengö *et al*. (2021). Primary data was collected in a multistage sampling method. At first stage, reconnaissance survey of twenty-two (22) Coastal communities in Ilaje was carried out from January to February, 2024 with the assistance of volunteers. During the second stage of the research which was done in March, 2024, 50% of the Coastal communities (eleven communities) as shown in Figure 1 were purposively selected based on their proximity to the ocean. Stage three (April to May, 2024) of this study was interview of three hundred and thirty nine (339) purposively selected coastal dwellers based on a minimum of 10 years of residency and readiness to attempt the questions. The interview questions covers among other things species of marine mega-fauna in the study area and, knowledge of ecological roles of the marine mega-fauna. The interview was supported with visual stimulus as described and used by Ogunjobi *et al*., (2018) for easy identification and the correctness of species names. The stimulus consists of colour pictures of different species of marine mega-fauna in Nigeria. Eleven Coastal communities at Araromi, Abeleke, Ogogoro, Gbabijo, Olotu, Obenbe, Oroto, Ayetoro, Obenla, Awoye and Odonla (Figure 1) were visited twice in a month (at the beginning and end of the month) during wet season (June - October, 2024). On each visits, three transects (10 m x 10 m) each at 10 m intervals were established along shorelines using measuring tape in accordance with Galgan (2013) guidance on monitoring of marine litter. Composition of litters encountered were identified, counted and recorded accordingly. Litter Density (LD) and Clean Coast Index (CCI) were estimated using the formula by Ma *et al*. (2021) and Rangel-Buitrago *et al*. (2021), respectively.

$$LD = \frac{N}{W * L} \quad (1)$$

$$CCI = LD * K \quad (2)$$

where LD is the density of litter items/m^2, CCI is Clean Coast Index, N is the number of litter items recorded; W and L are the Width and Length of the sampling unit (transect), respectively.

K is a constant that equals 20. Clean Coast Index (CCI) values from 0 to 2 indicate very clean, 2 – 5

clean, 5 – 10 moderately clean, 10 – 20 dirty, and >20 extremely dirty. Data obtained were analyzed using descriptive statistics (frequency and percentages) and inferential analysis (Analysis of Variance and regression).

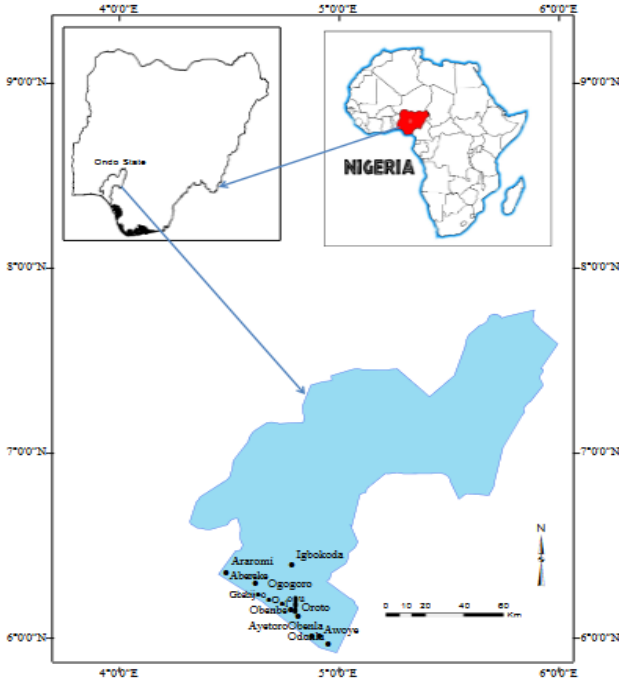

Fig 1: Eleven coastal communities selected as study sites in Ilaje, Ondo State, Nigeria

RESULTS AND DISCUSSION

Marine Habitat Assessment in Ilaje Coastline, Ondo State, Nigeria: Ilaje coastline in Ilaje, Ondo State, Nigeria is being exposed with debris from both domestic and fishing activities sources. In this five month of survey, litter counted from Gbabijo coastal community was the highest (685.00±29.50) followed by Ogogoro coastal community (658.00±30.15) while the least was from Araromi coastal community (459.00±23.36). Figures 2 and 3, below are the pictorial representation of total marine litter in the selected Ilaje coastline communities, and the composition or types of materials in the marine litter in Ilaje coastline, respectively. A total number of 6,047 items were counted as litter. This finding is far lower to 119873 items recovered at Liido Beach in Mogadishu coastal area of Somalia in six months (Hasan *et al*., 2024). It was however higher than a total of 4952 items jointly recorded in Korle and La Beaches (Ghana) by Tsagbey *et al*. (2009); and a total of 445 items were reported in Guafo Island (Chile) from 2013 to 2017 (Perez-Venegas *et al*., 2017). Eighteen (18) different types of materials in the present study is lower compared to 47 sub-categories of marine litter found on sandy beaches along the Indian Ocean coastline in the south Java region, Indonesia (Yona *et al*., 2023). Seventeen of the items are majorly household or domestic uses on land and transported into the ocean by rivers. The pathway by which the litter entered the coastline is similar to the submission of Terzi *et al*. (2020) where it was mentioned that river transportation is the major contributor to the accumulation of litter at shoreline. Ogunjobi and Ediagbonya (2017) emphasized the needs to critically study the association between pathway(s) and contamination in wild animal. This present study agreed with the position of Li *et al*. (2016) that 80% of marine litter stems from land. Plastics/rubber in varying forms was the majority (60.33%) of the count. This finding of this study is in line with the position of Jambeck *et al*., (2015) and Iniguez *et al*.(2016) that says that plastics are the primary source of marine litter that ocean received yearly. This plastic debris was mentioned to pose serious threats to fish, seabirds, and mammals through entanglement and ingestion (Hong *et al*., 2013; Jacobsen *et al*., 2010; North and Halden, 2013). The accumulation of marine litter, especially plastic, has also been reported to have harmful consequences for marine life (Pham *et al*., 2014; Claro *et al*., 2019). Further analysis indicated that there was a significant relationship between marine litter types (x^2 =144447.778, df = 17 $p < 0.05$) and study sites. Interestingly, the Clean Coast Index revealed 2.02±1.58 litter/m^2 which categorized Ilaje coastline as a clean ocean.

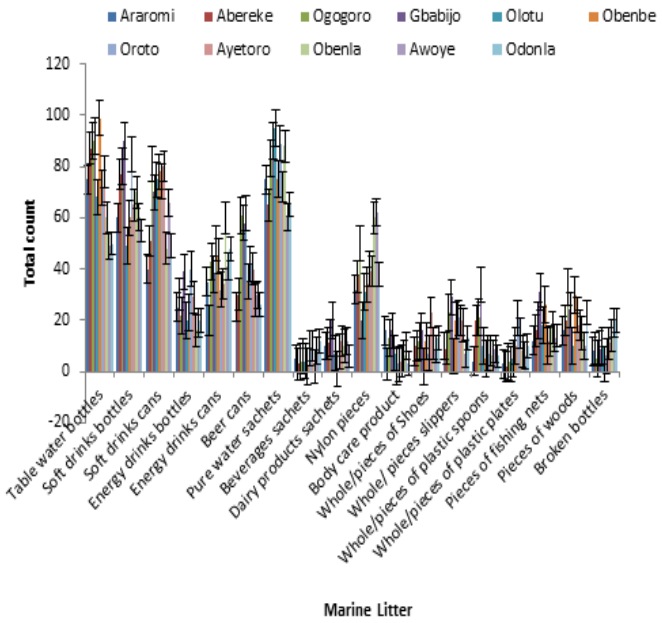

Fig 2: Marine litter assessment from eleven coastal communities in Ilaje, Ondo State, Nigeria

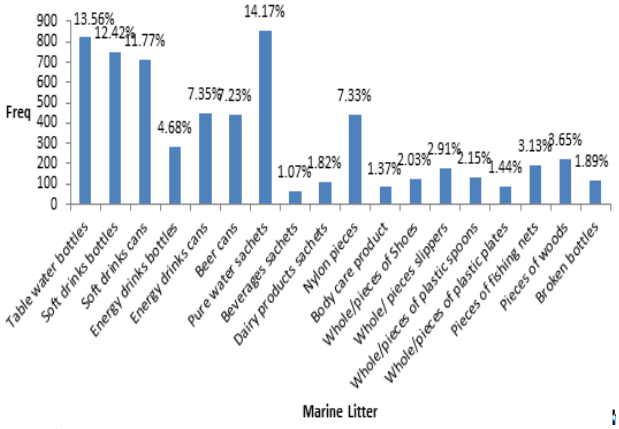

Fig 3: Types of marine litter in selected Ilaje coastline communities, Ondo State, Nigeria

Table: 1. Demographic characteristics of respondents (N= 339)

Variables		Frequency	Percentage (%)
Sex	Male	297	87.61
	Female	42	12.39
Age categories	41-50	239	70.50
	51-60	96	28.32
	61-70	4	1.18
Educational Qualification	Primary Education	10	2.95
	Secondary Education	242	71.39
	Tertiary Education	85	25.07
	Uneducated	2	0.59
Year of residency	11-20	9	2.65
	21-30	29	8.55
	31-40	19	5.60
	41-50	128	37.76
	50 and above	154	45.43

Knowledge of Marine Mega-fauna among Ilaje Coastal Communities in Ondo State, Nigeria: Demographic information of the respondent is shown in Table 1. Gender distribution showed that males comprised of 87.61% (n= 297) of the respondents, while their female counterpart accounted for 12.39%

(n =42). Furthermore, the majority (n=335; 98.82%) of the respondents were Christian, and a considerable number (n=239; 70.50%) fell within the 41 to 50 age bracket. This age bracket highlighting a predominance of middle-aged individuals participated in this study. A significant portion of the respondents (n = 242; 71.39%) had secondary school education. The present study agreed with the position of Ogunjobi and Surulere (2020) as regarding demographic characteristics of Ilaje people. About 45.43% (n= 154) of the respondents were long-term residents, having lived in Ilaje coastal communities for more than 50 years.

Composition of Marine mega-fauna in Ilaje Coastal Communities, Ondo State, Nigeria: Based on the perception of 87.60% males (n= 297) and 12.40% females (n= 42), ten species of marine mega-fauna are in Ilaje, Ondo State, Nigeria (Figure 3). These species are Bottlenose dolphin (*Tursiops truncates*), Spinner dolphin (*Stenella longirostris*), Hump-backed dolphin (Sousa teuszii), Olive ridley sea turtle (*Lepidochelys olivacea*), Leatherback sea turtle (*Dermochelys coriace*), Tiger shark (*Galeocerdo cuvier*), Scalloped Hammerhead shark (*Sphyrna lewini*), Bull shark (*Carcharhinus leucas*), African manatee (*Trichechus senegalensis*) and Humpback whale (*Megaptera novaeangliae*). These was higher compared to two species of whales (*Megaptera novaeangliae* and *Orcinus orca*) and four species of dolpins (*Stenella attenuate, Tursiops trucantus, Delphinus delphis* and *Sousa teuszii*) were reported at in the bight of Bonny in the oil rich south-south region of the Niger delta area of Nigeria by Olakunle and Ndubisi (2012). Higher species diversity in the present study agreed with the position of Murase *et al*. (2002) where it was mentioned that spatial distribution of cetaceans is influenced by the distribution of fish, cephalopod and zooplankton prey. Olive ridley sea turtle (*Lepidochelys olivacea*) is the most (15.93%) available of these ten species of marine mega-fauna while the least (5.90%) available is Humpback whale (*Megaptera novaeangliae*). Six species of marine turtles are known to occur in Macaronesia (McIvor *et al*., 2022). These ten marine mega-fauna are from the order namely cetacea, testudines, carcharhiniformes and sirenia. Two out of the ten marine mega-fauna in Ilaje, Ondo State, Nigeria (Leatherback sea turtle and Hump-backed dolphin) *are c*ritically endangered as listed by international Union for conservation of nature (IUCN).

Knowledge of Marine Mega-fauna identification and Ecological roles among Ilaje Coastal Communities: The data presented in Table 2 show that majority of the respondents (n= 193, 56.90%) had poor knowledge of the functions or ecological roles of the marine mega-fauna that are found in Ilaje. It is rather disheartening to observe that higher proportion (n = 293, 86%) do not know the ecological role of marine mega-fauna in their area (Figure 4). This further confirmed the position of Ogunjobi and Surulere (2020) about poor level of environmental education and awareness in Ilaje coastal communities. The predictors of knowledge of marine mega-fauna identification among Ilaje coastal communities were age ($\beta = 0.24$, $p < 0.05$) and years of residency ($\beta = 0.25$, $p < 0.05$) while educational background is the predictor of knowledge marine mega-fauna ecological roles ($\beta = 0.02$, $p < 0.05$). The study showed that there were positive and significant relationships between respondents educational background and their knowledge of marine mega-fauna ecological roles ($r = 0.02$, $p < 0.01$).

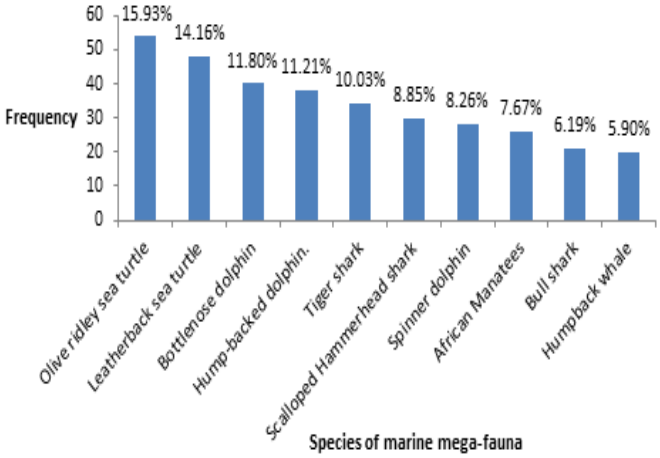

Fig 3: Coastal dwellers perception on species of marine mega-fauna in Ilaje

Table 2: Coastal communities' knowledge of marine mega-fauna identification

Variables	Frequency	Percentage
Very High	11	3.20
High	27	8.00
Low	108	31.90
Poor	193	56.90
Total	**339**	**100**

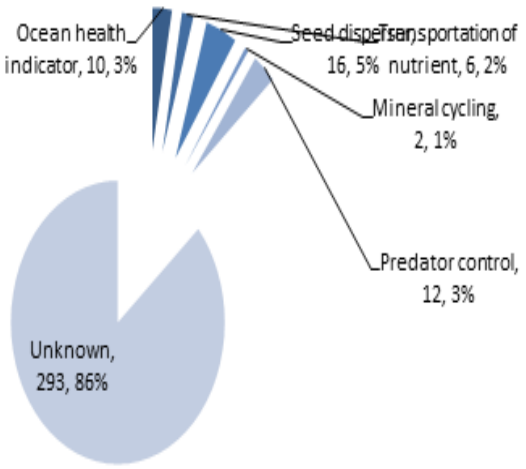

Fig 4: Knowledge of ecological roles of marine mega-fauna in Ilaje coastal communities

Table 3: Relationships between respondent's personal factors and the knowledge of marine mega-fauna among Ilaje coastline communities

Variable	Knowledge of marine mega-fauna	
	β	t-values
Age categories	0.24	4.79
Educational Background	0.02	0.55
Years of residency	0.25	3.67
R	0.63	-
R^2	0.40	-
R^2 (adj)	0.39	-
Df	338	-

Conclusion: This study has provided data that could be essential for the formulation of national conservation policy and strategy capable of driving marine mega-fauna protection in Nigeria for ecotourism development and at the long run to contribute positively to global marine mega-fauna conservation in Nigeria. In order to address the potential environmental health impacts of the litter in Ilaje coastal communities, occasional clearing of coastline in Ilaje in form of monthly environmental sanitation is advocated as well as the establishment of litter deposit and recycling plant.

Declaration of Conflict of Interest: The author hereby declare no conflict of interest

Data Availability Statement: Data are available upon request from the author

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