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Ichthyofauna Diversity of Ilaje Coastal Waters, Ondo State

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Abstract

This study assessed the species diversity in the coastal waters of Ilaje Local Government Area of Ondo State. Four Coastal fishing villages namely Erunna-Ero, Idi-Ogba, Aiyetoro and Igbokoda were purposely selected for monthly sampling from fishermen landings. A total of 27,613 individuals comprising of 36 fish species belonging to 24 families were recorded. *Cynoglossus browni* dominated the catch (75.22%). Simpsons Index, Shannon-Weiner Index and Margarlef Index were measured to be 0.57, 1.129 and 3.423, respectively; Evenness was 0.086. The coastal water is rich in diversity, species were not evenly distributed and subjected to varied pressure.

Keywords:
Ilaje LGA, biodiversity index, Coastal waters, fishing pressure

Introduction

Coastal waters are very important natural resources of any nation, valued for their ecological richness as well as their support for many human activities (Ipinmoroti, 2012). The coastal waters generally support many fish species for at least part of their life cycle, offering some of the most productive fisheries habitats in the world and supporting many other organisms with high public visibility (e.g., marine mammals, corals, and sea turtles) or unique ecological significance (e.g., submerged aquatic vegetation) (Akankali, *et. al*., 2015).

Nigeria is a coastal nation blessed with both inland and marine water fisheries resources; the nation is endowed with a coastline of 853km which stretches from the western border with Republic of Benin to the eastern border with Cameroon Republic (Dublin Green *et al*, 1999). The coastline is well-endowed with river networks, and a large expanse of exclusive ocean waters for commercial fishing. Sustainability of the coastal water fisheries is very important not only to secure livelihood for the aquatic resource dependent population but also to ensure adequate food security; because they are very important sources of domestic fish supply. A basic tool for proper management of any fisheries is regular and periodic assessment of its status for the purpose of gathering information. This study is an assessment of the current status of the fisheries resources of the coastal waters of Nigeria along the Ilaje Local Government Axis of Ondo State, Nigeria.

Materials and Methods

Study area

The Ilaje Local Government Area of Ondo State spans a stretch of 80km along the coast of Nigeria occupying almost the entire coastline of Ondo State. Ilaje Local Government covers almost all the entire stretch of Atlantic ocean boundary of Ondo State.

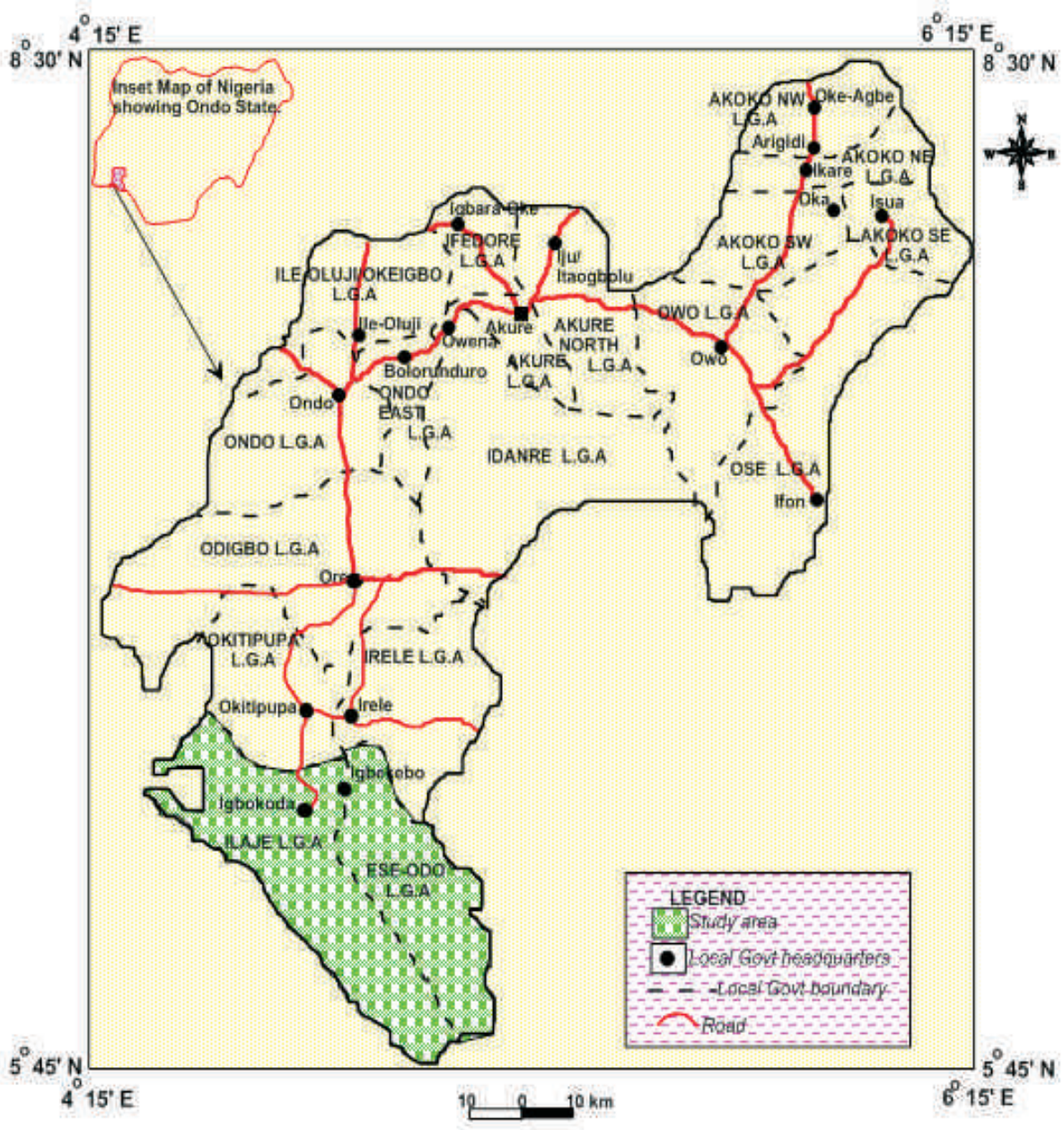

Figure 1: Map of Ondo State

Fish sampling

Fish sampling was carried out using two-stage stratified sampling techniques, by identifying fishers who fish within the study area, followed by random sampling techniques to select fishers whose catch were used in the study. Sampling was carried out fortnightly by collecting the total landings from the selected fishers.

Water quality Assessment

Water samples were taken from different depths within 0 -10m from different sections of the coastal water and analysed for temperature, dissolved oxygen, pH, salinity and conductivity as described by APHA, *et al.,* (2012) and conductivity using conductivity metre CDH-222 manufactured by Omega, United kingdom.

Determination of Fish Abundance, Diversity and Distribution

From the data collected, the relative abundance of the fish species, their families and total monthly catches were determined using the following equations by Pielou (1966):

i) Simpson's Index (d) = $\frac{\Sigma n(n-1)}{N(N-1)}$

Where: n = the total number of organisms of a particular species,
N = the total number of organisms of all species.

ii) Simpson's Reciprocal Index = 1/d

iii) Simpson's Index of Diversity = 1-d

iv) Shannon-Weiner Index (H) = -* pi *In* pi

Where;

pi = n/N= the number of individuals within a species (n) divided by the total number of individuals (N) present in the entire sample

ln = natural Log,

* = sum of the values for each species.

v) Evenness (E) = $\frac{e^{H}}{S}$

Where H = Shannon and Weiner's index
S = Number of species in samples

Statistical Analysis

Other statistical analysis were carried out using descriptive statistics of mean and percentages, Correlation analysis, Regression analysis and Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS) 21 for windows.

Result and Discussion

Water quality parameters

The mean water quality parameters recorded in the different locations are presented in Table 1. Though there were differences in the mean values, only salinity showed significant difference between Igbokoda and the other locations ($P<0.05$).

Table 1: Mean water quality parameters recorded from Lake Asejire during the study period

Parameters	Igbokoda	Aiyetoro	Idi-ogba	Erunna-ero
Temperature (^{o}C)	2915± 0.06	28.95 ± 0.07	29.05 ± 0.03	29.05 ± 0.05
Dissolved Oxygen (mg/L)	7.47 ± 0.06	7.514 ± 0.05	7.59 ± 0.02	7.43 ± 0.03
pH	6.31 ± 0.07	6.26 ± 0.01	6.37 ± 0. 0.05	6.5 ± 0.01
Conductivity (us cm^{-1})	41.38 ± 0.30	40.43 ± 0.70	40.63 ± 0.5	40.69 ± 0.50
Salinity%0	10.50 ± 0.15	10.27 ± 0.80	10.35 ± 0.70	10.25 ± 0.70

The values of the water parameters measured were within the acceptable limits required for the well-being of fish as recommended by Boyd (1979); and were similar to reports on Andoni flats in the Niger Delta (Ansa, 2005).

Species abundance

Thirty one fish species were identified in the catch sampled at different locations in the water body. The family Cynoglosidae which was represented by only one species, *Cynoglossus browni* accounted for 75.22%; followed by the sciaenidae represented by *Pseudotolithus elongates* (5.88%) and *Caranx hippos* of the family carangidae (3.19%), while the cichlidae represented *Sarotherodon galileaus Coptodon marie Oreochromis niloticus* and *Coptodon gunieensis* which accounted for 2.94%. (Table 2).

Table 2: Abundance of fish species in Ilaje Coastal Waters

Species						%
	Igbokoda	**Aiyetoro**	**Idi-ogba**	**Erunna-ero**	**Total**	**Abundance**
Cynoglossus browni	8249	3218	4121	5182	20770	75.22
Pseudotolithus elongates	657	410	287	270	1624	5.88
Caranax hippos	239	198	212	232	881	3.19
Ilisha africana	321	91	141	203	756	2.73
Ethmalosa frimbriata	158	175	191	150	674	2.44
Clarias gariepinus	129	101	99	123	452	1.64
Pentanemus quinquarius	123	83	92	105	403	1.46
Gymnarchus niloticus	99	68	61	76	304	1.10
Zanobatus atlanticus	7	10	2	5	24	0.09
Ophisurus serpens	13	21	18	12	64	0.02
Arius gigas	29	19	21	20	89	0.32
Polydactylus quadrifilis	28	51	28	60	167	0.60
Selene dorsalis	78	36	28	25	167	0.60
Monodactylus sebea	17	9	11	0	37	0.13
Carcharihnus leucas	0	3	5	2	10	0.04
Gnathonemus petersii	7	2	5	4	18	0.06
Xenimystus nigri	32	11	9	5	57	0.21
Drepane africana	3	10	7	8	28	0.10
Papynocranus afer	8	12	4	0	24	0.09
Malapterurus electricus	8	3	0	2	13	0.05
Parachanna obscura	9	6	5	4	24	0.09
Hydrocynus forskahli	6	1	5	0	12	0.04
Barbus stigmatopygus	3	1	2	2	8	0.03
Polycentropsis abbreviate	5	1	3	4	13	0.05
Schilbe uranoscopus	4	0	2	0	6	0.02
Synodontis melanopterus	9	6	1	6	22	0.08
Ophisternon afrum	8	2	4	1	15	0.05
Parauchenoglanis fasciatus	51	25	39	27	152	0.55
Sarotherodon galileaus	51	35	21	41	148	0.53
Coptodon marie	35	53	59	22	159	0.61
Oreochromis niloticus	29	21	46	19	115	0.42
Coptodon gunieensis	36	30	57	16	139	0.50
Moymyrids	79	71	43	52	245	0.88
Total	**10530**	**4783**	**5620**	**6677**	**27610**	
	38.14%	**17.32%**	**20.35%**	**24.18%**		

Seasonal and Spatial Distribution of Species

The monthly numerical catch rose from November (1734) of the previous year and picked in April(3388) after which it fell gradually to the lowest level (1414) in October (Table 3). The mean monthly numerical catch was 2328 in the dry season and 2281 in the wet season(Table 4). This is probably because the water is calmer and fishers find it easier to cover more areas and could also spend more time on the water during the dry season than they do in the wet season. The weather conditions are generally more conducive for fishing during the dry season than the rainy season, thus the fishers find it easier to operate during the dry season than during rainy season. The observation was in line with the findings of Pardios *et al* (2017) at Isabella Sea shore in the Philippines.

Sample catch from Igbokoda was the highest in this study, it accounted for 38.14% of the total catch by number, next was Eruna-Ero (24.18%) then Idiogba (20.35%) while Ayetoro contributed (17.32%) which was the least.

Table 3: Monthly and seasonal distribution of sampled species by location

Species/ months	Nov	Dec	Jan	Feb	Mar	*DST*	Apri	May	June	July	Aug	Sept	Oct	*WST*	Total
Cynoglossus browni	1318	1522	1618	2100	2477	***9035***	2544	2299	2048	1517	1257	1028	1042	***11735***	**20770**
Pseudotolithus elongates	105	120	131	132	166	***654***	189	188	165	140	110	96	82	***970***	**1624**
Caranax hippos	41	57	46	74	97	***315***	102	101	99	84	63	72	45	***566***	**881**
Ilisha africana	60	60	48	63	75	***306***	75	86	73	73	59	50	34	***450***	**756**
Ethmalosa fimbriata	38	43	47	45	60	***233***	104	90	64	61	44	39	39	***441***	**674**
Clarias gariepinus	29	29	31	36	39	***164***	64	51	45	42	30	32	24	***288***	**452**
Pentanemus quinquarius	22	27	22	35	46	***152***	52	41	44	29	33	24	28	***251***	**403**
Gymnarchus niloticus	19	24	18	29	34	***124***	37	36	31	28	20	9	19	***180***	**304**
Zanobatus atlanticus	1	0	1	0	3	***5***	2	5	6	1	2	3	0	***19***	**24**
Ophisurus serpens	5	5	5	5	8	***28***	8	11	5	4	6	0	2	***36***	**64**
Arius gigas	3	4	11	8	8	***34***	15	11	5	3	10	6	5	***55***	**89**
Polydactylus quadrifilis	8	11	10	14	16	***59***	21	20	22	16	6	14	9	***108***	**167**
Selene dorsalis	9	11	9	12	23	***64***	22	17	22	14	12	8	8	***103***	**167**
Monodactylus sebea	0	2	3	4	2	***11***	4	6	3	0	9	0	4	***26***	**37**
Carcharihnus leucas	1	0	0	1	2	***4***	2	1	3	0	0	0	0	***6***	**10**
Gnathonemus petersii	0	0	2	2	4	***8***	2	4	1	0	2	0	1	***10***	**18**
Xenimystus nigri	4	2	5	3	4	***18***	8	8	7	5	4	2	5	***39***	**57**
Drepane africana	2	1	0	4	2	***9***	9	4	2	0	1	2	1	***19***	**28**
Papynocranus afer	1	3	0	2	4	***10***	2	2	2	2	2	1	3	***14***	**24**
Malapterurus electricus	2	1	1	1	0	***5***	0	3	1	1	3	0	0	***8***	**13**
Parachanna obscura	0	3	3	0	3	***9***	5	4	2	2	1	0	1	***15***	**24**
Hydrocynus forskahli	0	0	0	2	2	***4***	0	0	2	3	0	2	1	***8***	**12**
Barbus stigmatopygus	0	0	0	0	1	***1***	4	1	1	0	0	0	1	***7***	**8**
Polycentropsis abbreviate	1	0	0	1	2	***4***	3	3	0	1	0	1	1	***9***	**13**
Schilbe uranoscopus	0	0	0	0	0	***0***	1	1	0	0	2	2	0	***6***	**6**
Synodontis melanopterus	1	0	1	2	5	***9***	0	1	5	3	2	1	1	***13***	**22**
Ophisternon afrum	0	0	1	0	4	***5***	1	4	2	0	0	2	1	***10***	**15**
Parauchenoglanis fasciatus	11	12	15	13	17	***68***	13	11	12	9	10	9	10	***74***	**142**
Sarotherodon galileaus	12	7	10	11	22	***62***	20	11	15	14	8	9	9	***86***	**148**
Tilapia marie	10	1	10	12	18	***51***	23	19	23	13	8	11	11	***108***	**159**
Oreochromis niloticus	9	10	8	8	13	***48***	16	15	9	8	5	10	4	***67***	**115**
Coptodon gunieensis	5	9	8	10	14	***46***	17	19	17	15	12	8	5	***93***	**139**
Moymyrids	17	18	15	22	24	***96***	23	30	25	24	16	13	18	***149***	**245**
	1734	1982	2079	2651	3195	***11641***	3388	3103	2761	2112	1737	1454	1414	***15969***	**27610**

DST = *Dry Season Total*; ***WST*** = *Wet Season Total*

Barbus stigmatopygus was absent in catches from all the stations during the dry season except at Igbokoda but found in catches from all the sample sites during the rainy season. At Igbokoda, *Drepane africana* was absent in dry seasons while *Carcharihnus leucas* was not in the fish sample in any of the seasons. At Ayetoro, *Hydrocynus forskahli*, *Polycentropsis abbreviate* and *Ophisternon afrum* were not encountered during the dry season, *Zanobatus atlanticus, Schilbe uranoscopus* and *synodontis melanopterus* were absent in the dry season samples while *Malapterurus electricus* was absent in both

Table 4: Seasonal distribution of fish by location

Species	Igbokoda		Aiyetoro		Idi-ogba		Erunna-Ero		
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	
Cynoglossus browni	3156	5093	1211	2007	1971	2150	2697	2485	
Pseudotolithus elongates	234	423	184	226	130	157	106	164	
Caranax hippos	79	160	76	122	74	138	86	146	
Ilisha africana	145	176	39	52	45	96	77	126	
Ethmalosa frimbriata	53	105	63	112	76	115	41	109	
Clarias gariepinus	51	78	22	79	46	53	45	78	
Pentanemus quinquarius	47	76	31	52	40	52	34	71	
Gymnarchus niloticus	51	48	27	41	23	38	23	53	
Zanobatus atlanticus	3	4	2	8	0	2	0	5	
Ophisurus serpens	8	5	9	12	7	11	4	8	
Arius gigas	10	19	6	13	9	12	9	11	
Polydactylus quadrifilis	11	17	20	31	9	19	19	41	
Selene dorsalis	30	48	15	21	10	18	9	16	
Monodactylus sebea	4	13	3	6	4	7	0	0	
Carcharihnus leucas	0	0	1	2	3	2	0	2	
Gnathonemus petersii	2	5	2	0	2	3	2	2	
Xenimystus nigri	12	20	3	8	3	6	0	5	
Drepane africana	0	3	3	7	1	6	5	3	
Papynocranus afer	5	3	4	8	1	3	0	0	
Malapterurus electricus	3	5	1	2	0	0	1	1	
Parachanna obscura	4	5	2	4	3	2	0	4	
Hydrocynus forskahli	2	4	0	1	2	3	0	0	
Barbus stigmatopygus	1	2	0	1	0	2	0	2	
Polycentropsis abbreviate	2	3	0	1	2	1	0	4	
Schilbe uranoscopus	0	4	0	0	0	2	0	0	
Synodontis melanopterus	3	6	4	2	0	1	2	4	
Ophisternon afrum	3	5	0	2	2	2	0	1	
Parauchenoglanis fasciatus	31	20	13	12	14	25	10	17	
Sarotherodon galileaus	33	18	13	22	6	15	10	31	
Coptodon marie	13	22	19	34	20	39	9	13	
Oreochromis niloticus	17	12	9	12	15	31	7	12	
Coptodon gunieensis	13	23	12	18	21	36	0	16	
Moymyrids	36	43	29	42	14	29	17	35	
Seasonal total	4062	6468	1823	2960	2550	3070	3213	3464	
Annual total	***10530***		***4783***		***5620***		***6677***		**27610**
Mean Total	812.4	924	364.6	422.8	6510	438.6	642.6	494.9	

seasons at Idiogba. At Erunna-Ero, *Zanobatus atlanticus, Carcharihnus leucas, Parachanna obscura, Barbus stigmatopygus, Polycentropsis abbreviate* and *Coptodon gunieensis* were absent in the dry season samples.

Schilbe uranoscopus did not occur in the sample catch in dry season at Ayetoro and Igbokoda was absent in the catches for both seasons at Idiagbo and Erunna-Ero .

Table 5: Species diversity and distribution

Indices	Igbokoda	Ayetoro	Idi-ogba	Erunna-Ero	Combined
Richness	31	31	31	28	32
Number of individuals	10530	4783	5620	6677	27610
Shannon-Weiner index (H)	0.281	0.290	0.283	0.275	1.129
Evenness	0.022	0.023	0.022	0.019	0.086
Simpson's Index (d)	0.15	0.17	0.15	0.10	0.57
Simpson's Reciprocal index (1/d)	6.66	5.88	6.66	10	1.75
Simpson's index of diversity (1-d)	0.85	0.83	0.85	0.9	0.43

The species richness in the study area is estimated at 32. Igbokoda, Ayetoro and Idi-Ogba had 31 species each, while Erunna-Ero had 28. The higher the Shannon-Weiner Index (H) the more diversified the resources, the H =1.129 value of Shannon-Weiner Index for this study is outside the expected range of between 1.5 and 3.5 for real communities. (Soyinka *et al.,* 2010). The index has an advantage of taking into account every individual including the rare species (Obasokan and Oransaye, 2006).

The Sympson's Index(D), is estimated at 0.10 for Erunna-Ero to 0.17 for Ayetoro. These values show high species diversity for each of the stations and lower diversity (0.57) for the combined. The reciprocal which is more reflective of the extent of diversity showed that each of the stations were more diversified in species than the total area. The Sympson's Index of diversity(1-d) which indicates that any two individuals randomly selected will belong to two different species confirms that each of the stations are more diversified than the total area, since the higher the value(index of diversity) the higher the diversity (Bishr *et al.* 2009).

Conclusion

The study showed that the fish communities of Ilaje Coastal Area of Ondo State were highly diversified. Given the importance of the coastal marine resources to humans, it is important that effort be geared towards improving or in the least maintaining this level of diversity to prevent loss of biodiversity and change in ecosystem stability. This could be achieved by controlling/managing fishing activities (pressure and mode of operation).

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