World Journal of Fish and Marine Sciences 2 (4): 297-302, 2010
ISSN 2078-4589

Assessment of Aqua-tourism Potentials in Some Fishing Sites in Bitumen Bearing Wetlands of Ondo State, Nigeria

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Abstract: A 24-month survey was conducted during the wet (May- August) and Dry (October –April) seasons of 2004 and 2006 along 8 economic fishing sites in Ondo State bearing Wetland, with the aim of determining the abundance , specie diversity, promoting ecotourism potential , preventing the loss of some ornamental fish species in the area during and after exploitation. The study was carried out in 4 study zones namely Odigbo (S1), Ode-Aye (S2), Okitipupa (S3) and Ilaje ese-odo (S4) noted for active bitumen seepage. Fishing potential of the area was assessed using catch per unit effort method as well as physico chemical analysis of water samples obtained from designated sites in the area in accordance with AOAC methodology .Fish compositions were assessed using multifilament gillnet, of different sizes hanging from 38to 178mm. Results revealed that the area is blessed with 24 economic species of fishes belonging to 13 families which could boost the touristic potential of Ondo state. The composition of families identified varies as follows: *Ariidae* (2.04), *Anabantidae* (3.27), *Bagridae* (6.36), *Channidae* (4.32), *Characidae* (10.62) *Cichlidae* (45.65) *Clupeidae* (3.94), *Clariidae* (11.78), *Hepsetidae* (0.95), *Mormyridae* (7.42), *Melapteruridae* (1.13), *Schilbiidae* (1.76) and *Polypteridae* (0.76). The family *Cichlidae* was the most abundant in the area during the study period. The diversity of fish during the study varied with locations and season .The study showed higher fish population during the dry season than raining season and lower population in study zones highly polluted by bitumen seepages. The study emphasizes the need for sustainable resource management during bitumen exploitation.

Key words: Aqua tourism · Bitumen · Wetlands · Ondo state

INTRODUCTION

Tourism has continued to play a vital role in world economy since time immemorial. Tourism serves as a source of pleasure, holiday and travel, provides job opportunity, small scale business for several people and also serve as a source of earning and revenue yielding to most countries and governments of the world [1].

Despite the high demand for tourism in the world today, Nigerian tourism still remains at its infancy stage, so it becomes necessary to give attention to this aspect of our economy. Aqua tourism as popularly known as an aspect of ecotourism which currently require urgent attention in the country so as to prevent specie extinction and to bridge the gap between the ever increasing pace at which the world demand for tourism outstrip our poor tourist industry.

Nigeria as a nation is blessed with a vast potential in aqua tourism which are largely distributed in the coastal and riverine areas of the country. Nigeria has a coastline covering a distance of 79km. [2]. However, Ondo state bitumen deposit belt falls within this region.

This study was carried out with the aim of providing baseline information on the aquatic diversity, abundance and the aqua tourist potential of species in this area and how they could be managed effectively for sustainable use.

MATERIALS AND METHODS

The Study Area: Falls within the riparian bitumen deposited belt in the southern fringe of Ondo state lying within latitude 04°44' and 05°20' and latitude 06°29' and 06°45' Covering a landed area of 800sqkm stretching

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Table 1: Description of the study area.

S/N	Study Zones	Study stations	Description of study location	characteristic of the Ecosystem	Functional role of wetlands	Degree of bitumen seepage
1	Odigbo zone	R. Ominla River Oluwa At Agbabu	Station1 Station2	A Forested Riverine area	Active feeding ground Active feeding ground for wildlife	Active Bitumen seepage
2	Ode-aye zone	River Akeun River Gbaagba	Station3 Station4	Marshland colonized by aquatic submerged plants (water weeds)	Active fishing ground , Active feeding ground and floating plants (water lilies).	Active Bitumen seepage
3	Okitipupa zone	River Yewa River Oluwa at Okitipupa (local jetty)	Station5 Station6	riverine`	for wildlife Active fishing and breeding ground ,	Active Bitumen seepage Active feeding ground for wildlife
4	Igbokoda zone	Igbekebo.fishing community Igbokoda Fishing terminal	Station7 Station8	creeks	Active feeding ground for some aquatic plants wildlife, Active fish landing and navigational site	low bitumen activities

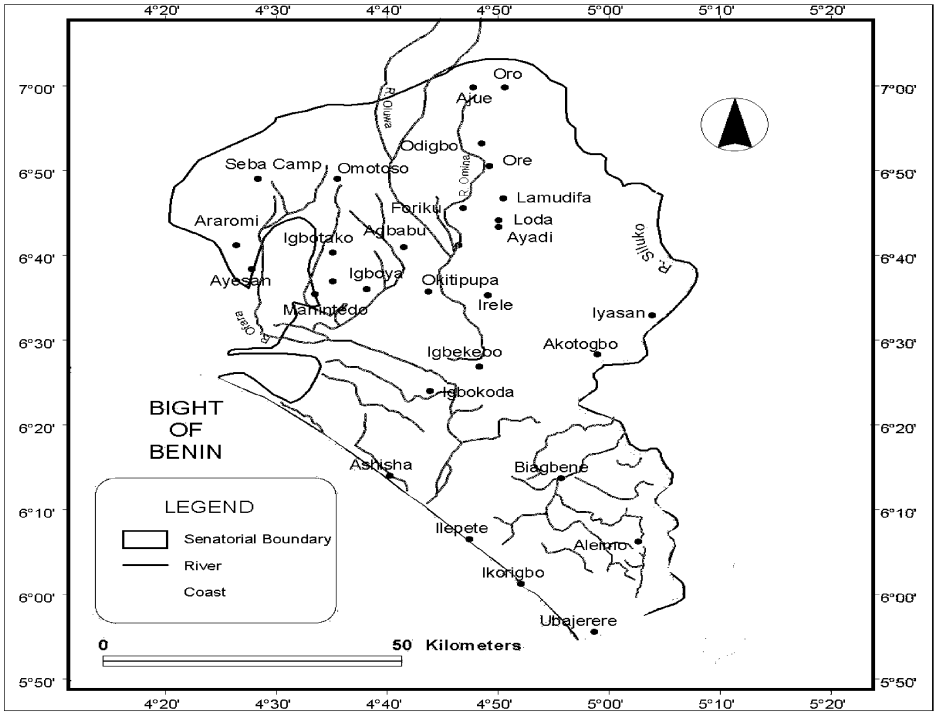

Fig. 1: Map of the study area

across 4 local government areas namely Odigbo, Irele, Okitipupa and Ese odo local government area as shown in Table 1. The study area contained the largest Nigerian deposit of Tarsand (bitumen oil sand) [2].

The region is inhabited by over 200 settlements containing about 699,033 human populations according to 1991 population census figure.

Methodology: Data for the survey was collected bi-monthly during the wet (May-August) and dry (October-April) seasons of 2004 and 2006. Fish sampling was done using monofilament gillnets of 38 to 178mm mesh sizes hung up at 50% hanging ratio each with a net area of 150m^2. Long lines with different hook grades were set across the sampling zones. Fish identification was performed based on morphometric and meristic features of the fishes [4].Physicochemical analysis was carried out in line with the method of AOAC [5].

RESULTS

The result of the survey on fish composition is shown in Tables 2 and 3. With 24 species of fish belonging to 13 families found in the study area.

Table 2: Distribution of Ornamental fishes in varous study stations in Ondo bitumen belt (wet season)

		study stations									
Fish family	specie	station 1	station 2	station3	station4	station 5	station6	station7	station8	Total no of fish sampled	% Composition
1Ariidae	Aurius giga	2	1	0	0	0	0	2	3	8	0.3
2Anabantidae	Ctenopoma kingleye	38	36	4	4	3	24	56	57	222	8.31
3Bagridae	Chrysichthys nigrodigitatus	6	6	6	6	6	6	6	6	48	1.8
	Chrysichthys auratus	3	7	0	0	0	5	6	11	32	1.2
	Bagrus bayad	9	8	0	0	0	5	10	13	45	1.69
4Channidae	Parachanna obscura	22	19	0	0	0	18	22	28	109	4.08
5Characidae	Alestes nurse	22	30	0	0	0	5	30	33	120	4.5
	Alestes leusiscus	18	27	0	0	0	4	23	34	106	3.97
6Cichlidae	Hemichromis faciatus	34	32	10	11	12	24	29	43	195	7.3
	hemichromis bimaculatus	35	36	12	13	15	28	33	46	218	8.16
	Sarotherodon melaptheron	38	40	15	16	19	32	35	49	244	9.13
	Tilapia zillii	46	49	20	20	28	42	49	52	306	11.46
	Tilapia guineansis	42	46	18	19	21	38	41	47	272	10.19
7Clupeidae	Pellonula afzeliusi	12	11	0	0	0	0	15	21	59	2.21
	Sardinella maderensis	10	12	0	0	0	0	13	18	53	1.99
8Clariidae	Clarias angularis	22	25	6	8	13	22	27	32	155	5.81
	Clarias gariepinus	25	28	10	12	15	25	30	35	180	6.75
9Hepsetidae	Hepsetum odoe	3	4	1	2	2	2	3	5	22	0.82
10Mormmridae	Mormmyrus rume	15	21	0	7	6	15	18	20	102	3.82
	Mormmyrus tapirus	13	19	0	6	6	12	11	12	79	2.96
11Melapteridae	Melapterurus electricus	6	6	0	0	0	3	9	13	37	1.39
12Schilbidae	Schilbe mystus	3	4	1	2	2	2	3	5	22	0.82
	Eutropius niloticus	2	3	2	1	1	2	3	4	18	0.67
13Polypteridae	Polypterus senegalus	3	4	1	1	1	1	3	4	18	0.67
Total sample		429	474	106	128	150	315	477	591	2670	100

Table 3: Distribution of Ornamental fishes in varous study stations in Ondo bitumen belt (Dry season)

		Study stations									
Fish family	specie	station 1	station 2	station3	station4	station 5	station6	station7	station8	Total no of fish sampled	% Composition
1Ariidae	Aurius giga	36	39	2	2	6	11	16	28	140	3.06
2Anabantidae	Ctenopoma kingleye	3	4	0	0	0	0	3	5	15	0.33
3Bagridae	Chrysichthys nigrodigitatus	16	18	0	0	0	0	28	35	97	7.18
	Chrysichthys auratus	18	20	0	0	0	0	32	38	108	2.36
	Bagrus bayad	20	18	0	0	0	21	32	40	131	2.87
4Channidae	Parachanna obscura	30	26	15	14	20	24	32	43	204	4.46
5Characidae	Alestes nurse	51	57	3	2	8	30	65	68	284	6.21
	Alestes leusiscus	49	52	2	1	5	27	61	62	259	5.67
6Cichlidae	Hemichromis faciatus	63	79	13	21	22	26	74	79	377	8.24
	hemichromis bimaculatus	71	81	15	23	24	27	80	81	402	4.81
	Sarotherodon melaptheron	75	83	18	25	26	29	81	83	420	9.19
	Tilapia zillii	82	86	22	27	28	30	84	86	445	9.73
	Tilapia guineansis	79	81	20	25	27	29	82	84	427	9.34
7Clupeidae	Pellonula afzeliusi	14	18	0	0	0	2	28	30	92	2.01
	Sardinella maderensis	13	17	0	0	0	0	25	26	81	1.77
8Clariidae	Clarias angularis	42	51	23	0	0	0	22	24	162	3.55
	Clarias gariepinus	50	53	25	27	31	29	69	70	354	7.75
9Hepsetidae	Hepsetum odoe	6	8	2	4	4	5	8	10	47	1.028
10Mormmridae	Mormmyrus rume	20	30	15	20	17	15	34	36	187	4.091
	Mormmyrus tapirus	17	27	13	20	15	12	31	34	169	369
11 Melapteridae	Melapterurus electricus	6	10	0	1	2	2	6	18	45	0.984
12 Schilbidae	Schilbe mystus	7	8	4	6	5	6	7	8	51	1.116
	Eutropius niloticus	3	5	3	3	4	5	6	7	36	0.787
13 Polypteridae	Polypterus senegalus	5	6	0	0	4	5	8	9	37	0.81
Total sample		776	877	195	221	248	335	914	1004	4570	100

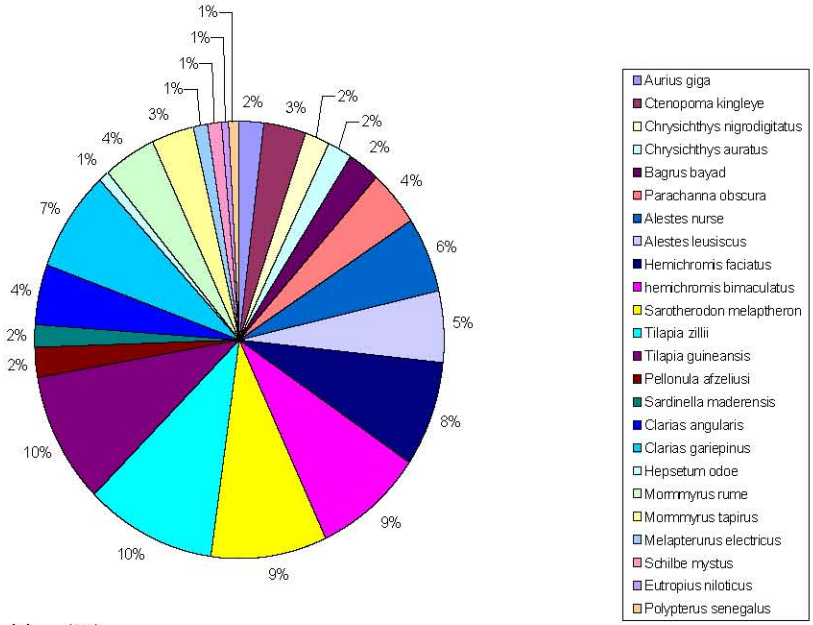

Fig. 2a: Fish specie composition (%)

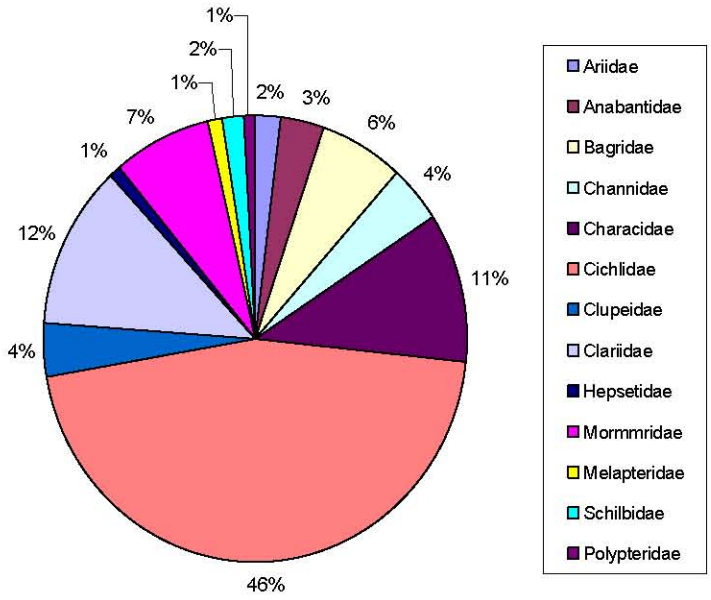

Fig. 2b: Fish composition by Family (%)

The fish species identified were found to possess economic and touristic values. The species fall into the following families: *Ariidae* (2.04%), *Anabantidae* (3.27%), *Bagridae* (6.36%), *Channidae* (4.32%) *Characidae* (10.62%) *Cichlidae* (45.65%) *Clupeidae* (3.94%), *Clariidae* (11.78%), *Hepsetidae* (0.95%), *Mormyridae* (7.42 %), *Melapteruridae* (1.13%), *Schilbiidae* (1.76%) and *Polypteridae* (0.76%). With family *Polypteridae* (0.76%) having the lowest while *Cichlidae* (45.65%) possessed the highest stock composition percentage(Fig2a&2b). The distribution pattern of fish species in the study area during the survey is shown in Tables 2, 3 and 4 with a higher fish specie diversity recorded in station 8, 7 (whereas bitumen contamination is lower offshore) and station 1,2 and 6 (where pollution is mild) .The lowest fish specie diversity was recorded at station 3,4,5 (whereas contamination from active bitumen seepage occurs).

Table 4: Relative Abundance of Species in the study area (%)

			Wet season	Dry season	Total	Mean(%)
1	Ariidae	Aurius giga	0.3	3.06	3.36	1.68
2	Anabantidae	Ctenopoma kingleye	8.31	0.33	8.64	4.323
	Bagridae	Chrysichthys nigrodigitatus	1.8	7.18	8.98	4.49
	Chrysichthys auratus		1.2	2.36	3.56	1.78
	Bagrus bayad		1.69	2.87	4.56	2.28
4	Channidae	Parachanna obscura	4.08	4.46	8.54	4.275
	Characidae	Alestes nurse	4.5	6.21	10.71	5.355
	Alestes leusiscus		3.97	5.67	9.64	4.82
6	Cichlidae	Hemichromis faciatus	7.3	8.24	15.54	7.77
	hemichromis bimaculatus		8.16	4.81	12.97	6.485
	Sarotherodon melaptheron		9.13	9.19	18.32	9.16
	Tilapia zillii		11.46	9.73	21.19	10.595
	Tilapia guineansis		10.19	9.34	19.53	9.765
7	Clupeidae	Pellonula afzeliusi	2.21	2.01	4.22	2.11
	Sardinella maderensis		1.99	1.77	3.76	1.88
8	Clariidae	Clarias angularis	5.81	3.55	9.36	4.68
	Clarias gariepinus		6.75	7.75	14.5	7.25
9	Hepsetidae	Hepsetum odoe	0.82	1.028	1.848	0.924
10	Mormmridae	Mormmyrus rume	3.82	4.091	7.911	3.9555
	Mormmyrus tapirus		2.96	369	371.96	185.98
11	Melapteridae	Melapterurus electricus	1.39	0.984	2.374	1.187
12	Schilbidae	Schilbe mystus	0.82	1.116	1.936	0.968
	Eutropius niloticus		0.67	0.787	1.457	0.7285
13	Polypteridae	Polypterus senegalus	0.67	0.81	1.48	0.74
	Total sample		100	100	200	100

Table 5: Water Quality of the Area in Comparison with FAO (1992), World Health Organization (WHO) and National Environmental Standard.

Water parameters	Present study	Mean Value	World health Organization(WHO 1998)	FAO (1992)	FEPA (1991) (Permissible limit for Aquatic life)
Temperature (OC)	26.5-30.1	28.3	15.0-29.4	25-30	20-33
Dissolved Oxygen (mg/l)	2.51-4.75	3.63	> 4.00	NS	4.0
pH	4.30-7.64	5.97	6.5-9.5	6.5-8.5	6.0-9.0
Alkalinity (mg/l)	18.89-87.47	53.18	<20	200	NS
TSS (mg/l)	0.25-7.07	3.66	<25.0	NS	NS
S04 (mg/l)	0.09-0.96	0.53	<0.025	NS	NS
Fe (mg/l)	0.08-2.233	1.16	-	NS	1.0
Cu (mg/l)	0.09-0.84	0.47	<0.0005	0.1	0.002-0.004
Zn (mg/l)	0.03-0.24	0.13	<0.03	2.0	NS
Ni (mg/l)	0.23-0.43	0.33	<0.025	<0.02	0.025-0.15
Cd (mg/l)	0.09-0.76	0.009	<0.002	0.002	0.0002-0.0018
Cr (mg/l)	0.04-0.24	0.003	-	NS	0.002-0.02
Pb (mg/l)	0.03-0.24	0.00035	<0.03	<0.02	0.0017

Water Quality Assessment: The water Quality parameters for the study area are listed in Table 5 with each parameter stated in range and mean values: The mean values for some of the parameters observed in the study sites, such as Copper (0.47mg/l), Zinc (0.13mg/l) Nickel (0.33ml/g), Cadmium (0.009mg/l) and Chromium (0.003mg/l) were not in conformity with the safety limit recommended by the standard guidelines of World Health Organization [6,7,8] for unpolluted environment and aquatic life.

DISCUSSION

This study showed that Ondo state bituminous wetlands are richly endowed with ornamental fisheries which are of a great touristic potential. Abundance of the *Cichlidae* family (*Oreochromis niloticus*) in this area during the period of study agreed with the finding of Olaniran [9] on Kainji lake and [10] on IITA lake. Olaniran [9] and Odiete, [11] attributed the abundance and dominance of this specie in tropical inland fresh

water to factors such as high fecundity, prolific nature of breeding, ability to utilize wide range of food, especially at all throphic level as well as high tolerance to a wide range of temperature, while shortage of some families such as *Polypteridae*, *Hepsetidae, Mormyridae, Melapteruridea* and *Schilbidae* could be traced to seasonality, fish morphological adaptation, Biological behavior as well as their response to tidal wave and ocean current.

The physicochemical analysis carried out in the study area shows that water samples are polluted with metallic ions such as chromium, Copper, Lead, Zinc, Nickel and Cadmium in quantities that are not compliant with environmental standards thus may pose a great threat to Man and Biodiversity. Presence of metallic ions in the ecosystem had been traced to anthropogenic sources such as oil seep [12].

In conclusion, wetlands of Ondo State bitumen belt have a great potential to become a breeding ground for economically viable fisheries which could be harnessed alongside with bitumen exploitation and also developed into an income generating eco tourism industry both by the state and Federal Government in future. Pollution of the area from bitumen seepage constitutes a potential threat to aquatic life in The study therefore recommend that environmentally friendly and Best Applicable Technologies (BAT) be adopted during bitumen exploitation projects in the area in near future in other to maintain the sustainability of aquatic fauna of this area.

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