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A study on the icthyofaunal diversity of Chippaleru mangroves of A.P, India

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Abstract

The study area is a mangrove on the coast of Bay of Bengal, Nellore District, A.P, India. The study period was between January 2019 - December 2021. During the investigation, fin fish fauna of 11 orders and 20 families were found. The most abundant of the orders were Clupeiformes, Gobiformes, Perciformes and Acanthuriformes. The study recorded the total of 23 species of fin fish. As per the report of the native fishermen, the area of the mangrove has been shrinking with the increasing activity of aqua-farming. Therefore, it requires suitable interventions for conservation of finfish diversity of this brackish-water ecosystem with the reclamation efforts.

Key words: Chippaleru. Aqua-farming. fin-fish. Reclamation. H index.

Introduction

The mangrove ecosystems are important coastal ecosystems that provide umpteen ecosystem services and essential ecological functions **(Kauffman et al .2017)**. These are complex ecosystems with a great wealth of resources in the form of nutrients and organisms (**Contente, R.F et al. 2011)**. They provide natural food for many fish species. Therefore, it is a natural breeding ground, spawning ground and feeding ground for many commercially important species of fish. These ecosystems, also, support recreationally important fisheries **(Odum et.al. 1982).**

So many studies have been carried out on the fish faunal diversity of mangrove ecosystems across the globe. These ecosystems are sources for the seed of various kinds of fish for aquaculture. The research on domestication of commercially important fishes relies on these ecosystems for brood-stock. Brood fish are abundantly available in these ecosystems. Given the fact that these ecosystems are habitats for breeding, spawning and growth of juveniles, they are very precious habitats. These ecosystems provide support for important nearshore fisheries. This is because; they provide conditions of high food availability; low predation risk and protection from extreme weather conditions.

The present study aims at studying the composition, distribution and abundance of fish in this mangrove ecosystem. The diversity indicators are calculated for the temporal and spatial comparison. This comparison may help the governments, ecologists, conservation experts in devising policies and strategies for the sustenance of the biodiversity in such ecosystems as the one under study as these are facing degradation. The impact from expanding aquaculture, habitat degradation, pollution from the surrounding areas etc can be assessed making use of the data of the present study.

The survival lies in diversity. For the maintenance of sustainable development and stability of ecosystem, diversity is essential. This necessitates surveillance of biodiversity of water bodies is needed. With the increasing exploitation of fishery resources, there is a threat for the depletion of those resources. Therefore, the assessment of fish faunal diversity is carried out often for various aquatic ecosystems.

Methodology

The present investigation on ichthyofauna was carried out on Chippaleru Mangrove ecosystem located on the coast of Lakshmipuram, Kavali Mandal, Nellore District of Andhra Pradesh. The study was done between January, 2017 and December, 2019. The location of the study area is found in the coordinates: 14°49'25.94"N, 80°04'37.34" E. The swamps of the mangrove are about 1 km to the east of Lakshmipuram, a fishermen hamlet in Annagaripalem Panchayat of Kavali Mandal.

The fishes from the swamp were collected with the help of the local fishermen. The collection of fishes was done in different seasons of the study period to ensure all the species of fishes are caught. All the collected fishes at each time of sampling were labeled and such fishes were brought to the laboratory for identification. The fishes, before being brought to the laboratory, were fixed in 5% formalin and cleaned with rectified spirit. Subsequently, the fishes were preserved in 10% formalin.

The fish specimen were identified for their taxonomic status by Day (1878); Jayram (1981); Talwar and Jingram (1991) and Jingram (2005). Species diversity (Species richness) and Relative abundance (Evenness) were computed using **Shannon-Wiener Diversity Index (H).**

$$H=\sum [(pi)\times \ln(pi)]$$

Where −

Pi= proportion of total sample represented by species i. Divide no. of individuals of species i by total number of samples.

S = number of species = species richness

Hmax=ln(S) = Maximum diversity possible

E = Evenness which represents how close each species is in number with other species in the ecosystem.

Fig.1: Research Area Map

Coordinates: 14°49'25.94''N, 80°04'37.34'' E.

Result and Discussion

Table. 1: Taxonomic list of fish orders occurring in the mangrove study sites of Chippaleru

S.No	Name of the fish	Phylogenetic group	Vernacular name	IUCN Red List category
1	*Strophidon sathete(Hamilton)*	*Anguilliformes*	Marbled moray	LC
2	*Pisodonophis boro(Hamilton)*	*Anguilliformes*	Bengal Snake eel	LC
3	*Pisodonophis cancrivorus(Richardson)*	*Anguilliformes*	Long fin Snake eel	LC
4	*Muraenesox bagio(Hamilton)*	*Anguilliformes*	Common pike conger	LC
5	*Anodontostoma chacunda(Hamilton)*	*Clupeiformes*	Chacunda gizzard shad,Kome, Muddeeru	LC

6	*Escualosa thoracata(Valenciennes)*	*Clupeiformes*	White Sardine, Kavallu	LC
7	*Stolephorus baganensis (Hardenberg)*	*Clupeiformes*	Anchovy	LC
S.No	**Name of the fish**	**Phylogenetic group**	**Vernacular name**	**IUCN Red List category**
8	*Chanos chanos(Forsskål)*	*Gonorynchiformes*	Pallabontha, Polah-bontah, White mullet, milk fish	LC
9	*Mystus gulio(Hamilton)*	*Siluriformes*	Long Whiskered cat fishes	LC
10	*Platycephalus indicus(Linnaeus)*	*Scorpaeniforms*	Bartail flat head, Indian flathead, Irrwa	DD
11	*Ambassis nalua(Hamilton)*	*Perciformes*	Nalua chanda	LC
12	*Lates calcarifer(Bloch)*	*Carangiformes*	Pandu menu, Pandu kopah, Dadhara	LC
13	*Terapon jarbua (Forsskål)*	*Perciformes*	Kilipothu, Samudrakili,	LC
14	*Sillago sihama (Forsskål)*	*Perciformes*	Sand whiting, silver sillago, Whiting	LC
15	*Eubleekeria splendens (Cuvier)*	*Perciformes*	Jones ponyfish, Silver bellies, Splendid ponyfish	LC
16	*Lutjanus johnii (Bloch)*	*Perciformes*	John's Snapper, Snapper, Rangu	LC
17	*Gerres filamentosus (Cuvier)*	*Perciformes*	Jaggari	LC
18	*Drepane punctata(Linnaeus)*	*Perciformes*	Moon fish, Spotted ba tfish,Spotted drepane,Spotted Sickle fish	LC
19	*Mugil Cephalus(Linnaeus)*	*Perciformes*	Flathead grey mullet,Kathiparega	LC
20	*Oreochromis mossambicus (Peters)*	*Perciformes*	Tilapia	VU
21	*Boleophthalmus boddarti (Pallas)*	*Perciformes*	Mud skipper	LC
22	*Pseudapocryptes elongatus(Cuvier)*	*Perciformes*	Mud skipper	LC
23	*Psammogobius biocellatus(Valenciennes)*	*Perciformes*	Sleepy goby,two spot goby	LC
24	*Glossogobius giuris(Hamilton)*	*Perciformes*	Bar eyed goby, Tank goby, Isakee doondoo	LC
25	*Scatophagus argus(Linnaeus)*	*Perciformes*	Spotted butterfish	LC

Fig.2 : ***Boleophthalmus boddarti (Pallas)***

Fig.3 : ***Stolephorus baganensis (Hardenberg)***

Fig.4 Mystus gulio

Fig.5: Fish families with represented species

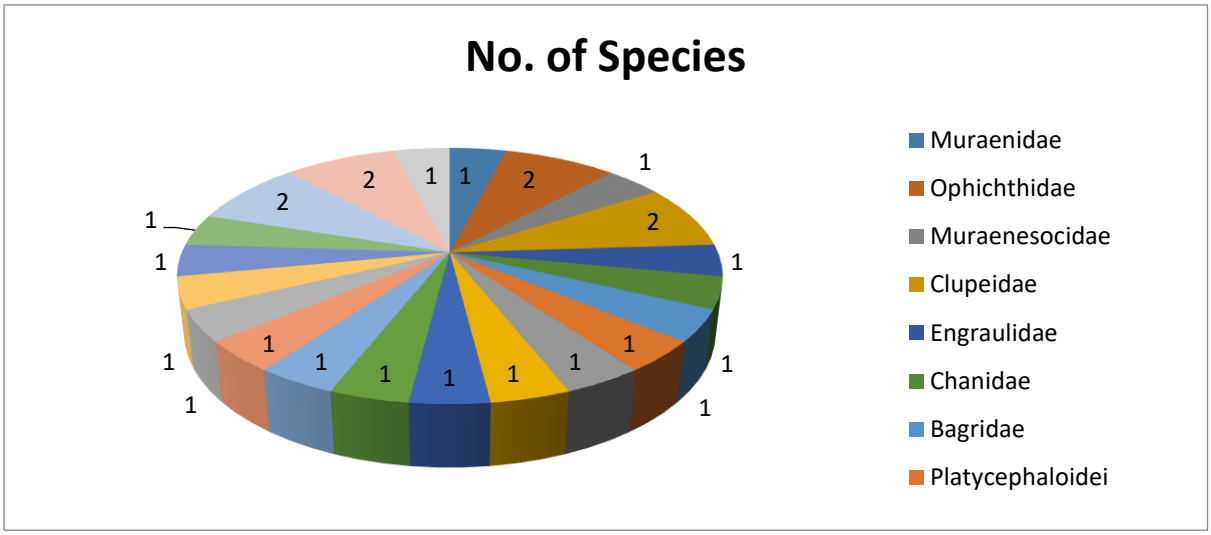
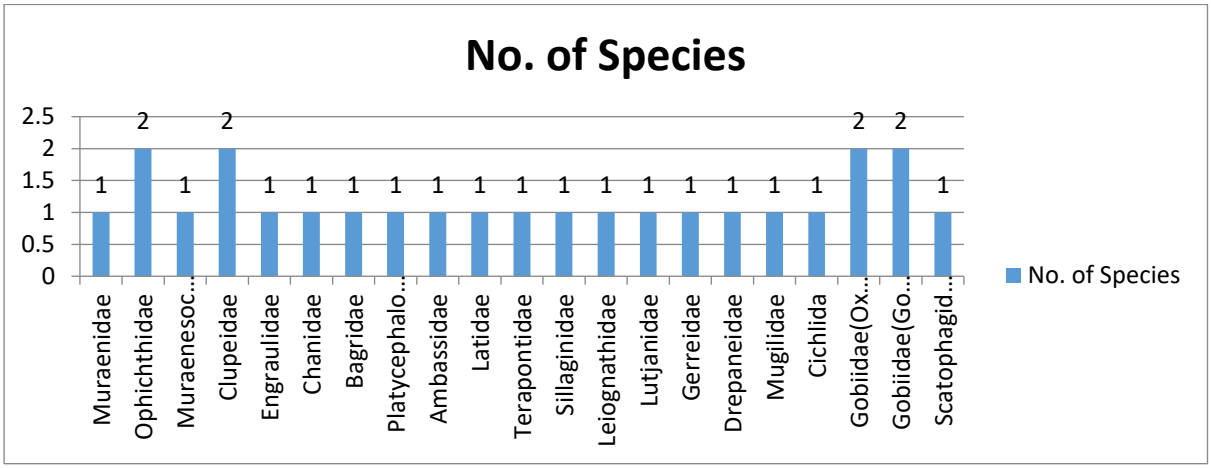


Fig.6: Graph showing the Families with species found



The samples collected at various seasons and 3 different stations represent 21 families (Fig.5 & 6). These 21 families belong to 7 orders (Table.1). Perciformes is the order which abundantly represents the fish fauna of the ecosystem with 14 different species. The IUCN (2021) status of all the species show that only one species comes under the vulnerable category and another represent the Data Deficient category. All the remaining 23 species have been categorized under Least Concerned (LC) category. Some of the fish are commercial such as milk fish (*Chanos chanos*); mullet (*Mugil cephalus*) and Asian sea bass (*Lates calcarifer*). Now the Asian sea bass has been domesticated and is being cultured across India.

Table.1: The Species Diversity Index for the whole Mangrove Ecosystem, Chippaleru

Species	No in Sample (ni)	Pi (ni/N)	ln Pi	Pi x ln Pi
Strophidon sathete(Hamilton)	6	0.0105	-4.556	-0.0478

Pisodonophis boro(Hamilton)	4	0.0069	-4.976	-0.0343
Pisodonophis cancrivorus(Richardson)	4	0.0069	-4.976	-0.0343
Muraenesox bagio(Hamilton)	8	0.0139	-4.275	-0.0594
Anodontostoma chacunda(Hamilton)	21	0.0367	-3.304	-0.1212
Escualosa thoracata(Valenciennes)	24	0.0419	-3.172	-0.1329
Stolephorus baganensis (Hardenberg)	23	0.0402	-3.314	-0.1332
Chanos chanos(Forsskål)	63	0.0110	-4.509	-0.0495
Mystus gulio(Hamilton)	32	0.0559	-2.884	-0.1612
Platycephalus indicus(Linnaeus)	8	0.0139	-4.275	-0.0594
Ambassis nalua(Hamilton)	12	0.0209	-3.868	-0.0808
Lates calcarifer(Bloch)	64	0.1118	-2.191	-0.2449
Terapon jarbua (Forsskål)	10	0.0175	-4.0455	-0.0707
Sillago sihama (Forsskål)	1	0.0017	-6.377	-0.0108
Eubleekeria splendens (Cuvier)	11	0.0192	-3.952	-0.0758
Lutjanus johnii (Bloch)	15	0.0262	-3.641	-0.0953
Gerres filamentosus (Cuvier)	12	0.0209	-3.868	-0.0808
Drepane punctata(Linnaeus)	13	0.0227	-3.785	-0.0859
Mugil Cephalus(Linnaeus)	41	0.0716	-2.636	-0.1887
Oreochromis mossambicus (Peters)	38	0.0664	-2.712	-0.1800
Boleophthalmus boddarti (Pallas)	12	0.0209	-3.868	-0.0808
Pseudapocryptes elongatus(Cuvier)	16	0.00279	-5.881	-0.0164
Psammogobius biocellatus(Valenciennes)	18	0.0314	-3.460	-0.1086
Glossogobius giuris(Hamilton)	17	0.0297	-3.516	-0.1044
Scatophagus argus(Linnaeus)	2	0.0034	-5.683	-0.0113
	N=572			**-2.2684**

H' = 2.2684

H_{max} = ln (S) = 3.2188

Evenness (J') = H/H_{max}
= 2.2684/3.2188
= 0.7047

During monsoon and winter, the H index value goes up given that the nutrients available during these periods are more. And the same value goes down during Summer for most of the fish leave the mangroves for sea. Hence the H index value was found to be low in this period (**H'= 1.62 vs. 2.2684** of the whole study period). This result corroborates with the findings of the study carried out by **Saud, M et al. (2021**).

When the aquatic environment upholds maintainable condition, then H' values could be higher than 3.5. **Castellanos-Galindo et al. (2013)**. Given the impact of aqua-farming and pollutant inflows from the human habitations, there seemed to be a stress on the fish fauna in the study area. That may be the reason why, the H' recorded for the whole habitat was lower. The mangrove fish assemblage composition in the tropical eastern Pacific Ocean was found to be with the H' values from 1.28 to 2.7. The H' values recorded in the present study coincide with the aforementioned H' values.

The H' index calculated for the whole mangrove ecosystem shows the moderate value showing that the species diversity in the ecosystem studied is moderate. The values of the H' coincide with the corresponding values obtained in the study of Sung sang Estuaries

which recorded a moderate species diversity (H' = 1.477 – 2.708), the number of individuals or species evenly distributed (J'= 0.616 – 0.876). The moderate H' value was also reported by **Kholis, N *et al* (2019)**.

Station 2 which is located seaward shows highest species richness in July month, evenness was highest in august.This may be due to the proximity of the sea to the station and availability of the nutrients due to the edge effect. Similarly, the Species diversity was recorded relatively higher in the months of North-West Monsoon due to the availability of the natural productivity during the period. **Pillai et al. (2014)** estimated the seasonal H' value in the range of 4.76 (Summer 2006)–5.59 (South-west monsoon 2008) with 32–52 crustacean species in the by catch of trawl fishery along the Chennai coast. These values are in disagreement with the present study as the present study showed that the H' values are lowest during Summer.

The study reported relatively higher than moderate H' values during the months of November to December. The North-East monsoons coincide with the higher amount of nutrients. This explains why there is a relatively higher amount of H'.The same rationale that the N-W monsoon brings in free and higher H' values reported were due to the increased inflows from the land and rivers during the period. The same was reported by **Kodeeswaran, P et al.(2020).**

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