Biological Forum – An International Journal **12(2): 44-50(2020)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Distribution and Status of Freshwater Fish Fauna and its Habitat in the Water bodies of Kendrapara District, Odisha, India

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(Received 01 July 2020, Accepted 27 October, 2020)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A study on freshwater fish fauna of Kendrapara district of Odisha, India was provided. A total of 63 species of fishes under 44 genera, 25 families and 8 orders has been recorded. Highest species diversity was observed in the Cyprinidae (33.3%) followed by Bagridae (7.9%). The fish fauna includes 49 least concern (LC), 5 near threatened (NT), 2 data deficient (DD) and 7 not assessed (NA) as per IUCN. The study shows that water bodies of kendrapara district including numerous economical importance food fishes as well as ornamental fishes belongs to freshwater, marine and brackish water habitat. In the study 44 species coming under capture fishery, 45 species has ornamental value, 21 species for culture and 10 species under sports fishery. Water quality of different water bodies are not contaminated as the study shows both the pH & DO are within the tolerance limit of class 'D'. So the water quality of the water bodies under Kendrapara district will be recommended for aquaculture and wild life propagation.

Keywords: Fish fauna distribution, Kendrapara, Odisha, water quality parameters.

INTRODUCTION

India constitutes about 1027 freshwater fish fauna, which is highly diverse in nature (Gopi *et al.,* 2017). Odisha contribute about 13.92% to the freshwater fish fauna of India (Dutta *et al.,* 1993). Out of the 6 coastal districts of Odisha, Kendrapara one of them (Pati & Pati, 2008), which has a total area of 2,546 $(km)^2$. The district lies between 20° 21′ to 20° 47′ N and 86° 14′ to 87°.83′ E. Kendrapara is surrounded by jagatsinghpur district in south, Cuttack district in west, Bhadrak district in north, and Bay of Bengal in east (Anonymous, 2010). It is blessed with numerous rivers namely Gobari, Dhani, Kapali, Reba, Kochila. Out of which Brahmani, Baitarini, Salandi, & Mahanadi is the major rivers passes through this district. The people in the sea coast area like Dangmala, Vitarkanika, Gahirmatha, Rajnagar, Rajkanika etc mainly depend on fishing for their livelihood (Anonymous, 2013).

The first over study on marine and freshwater fishes of Odisha were made by (Day, 1869). Subsequently, fish fauna of Odisha have been studied and described by many other, recently from (Baliarsingh *et al*., 2020; Samal *et al.,* 2016; Das *et al.,* 2016; Sarkar *et al.,* 2015; Mohanty *et al.,* 2015; Dandapat, 2015; Baliarsingh *et al*., 2015; Singh, 2014; Satpathy and Mishra, 2014; Behera and Nayak, 2014; Baliarsingh *et al.,* 2014; Singh *et al.,* 2013; Mishra *et al.,* 2013; Nayak *et al.,* 2013; Baliarsingh *et al.,* 2013; Das, 2008; Karmakar *et al.,* 2008; Pathak *et al.,* 2007; Ramakrishna *et al.,* 2006; Datta *et al.,* 1993; Jayaram and Majumdar, 1976; Chauhan, 1947). However no detail study has been taken up so far on the fish fauna of Kendrapara district of Odisha. In the present study a systematic data base of fishes has been prepared based on the research study and available literatures. Also the habitat characteristics of rivers of Kendrapara district of Odisha are provided.

MATERIALS AND METHODS

Study area

Odisha is one of the coastal state, which situated in eastern part of India extends from 17° 49′ N to 22° 34′ N latitude and 81° 27′ E to 87° 11″E longitude. Kendrapara District is one of the coastal district of Odisha. The District is bounded by four district, Jajpur & Cuttack in the West, Bhadrak District at its North, Jagatsinghpur District at its South, and Bay of Bengal at its East. Kendrapad District lies in 20° 20′ N to 20° 37′ N Latitude and 86° 14′ E to 87° 01′ E Longitude. There is a stretching of 48 km of Kendrapara coastline from Dhamara Muhana to Batighar (Fig. 1). The major rivers passes through Kendrapara district are Kharasrota, PaikaIt, Birupa, Kani, Hansua, Luna, Karandia, Gobari, and Baitarini. Except the river Chitroptala (a branch of Mahanadi) the other rivers are tributaries of Mahanadi river (GoO, 2015).

Table 1: Details of Sampling sites of Kendrapara district.

Sampling sites	Position	Elevation (ft)	Habitat type
Rajnagar	20° 34′ 19″ N 86° 42′ 24.52″ E	36	Open river
Gupti	20° 37′ 49.12″ N 86° 49′ 43.86″ E	12	Open river
Patamundai	20° 34′ 37.69″ N 86° 34′ 10.82″ E	49	Canal & river
Ratanpur	20° 28′ 24.53″ N 86° 38′ 26.28″ E	71	Lake
Nuagaon	20° 39′ 28.08″ N 86° 46′ 41.11″ E	63	Open river & pond
Rohio	20° 37′ 03.65″ N 86°.29′ 29.72″ E	16	Small water bodies, canals, ponds etc

Fish Sample Collection

Collection of Fishes and water samples were from 6 identified locations namely Rajnagar, Gupti, Patamundai, Ratanpur, and Nuagaon during May 2016-April 2017 (Fig. 1, Table 4). Fish species were collected using different types of net like gill net, cast net and dragnet by the help of local fishermen. Some species were collected from landing centres and fish markets of Rajnagar, Gupti, Kendrapara and Ali fish market and immediately photographs were taken, small species were preserved in 10% formalin solution where large fishes were preserved after given one incision on the abdomen and fixed (Jayaram, 1999), (Talwar and Jingran, 1991). The detailed identification and taxonomic analysis has been done at Zoological Survey of India (ZSI) Gopalpur and Kolkatta, West Bengal.

Fig. 1. Showing sampling sites in Kendrapara district, Odisha.

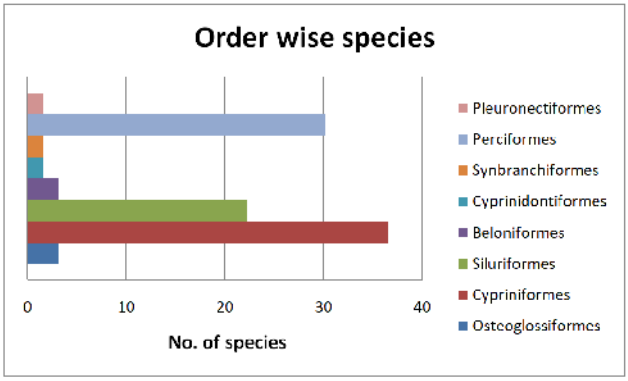

Fig. 2. Oder wise fish species.

Fish Identification

The identification and classification of fish species were carried out based on the keys for fishes of the Indian sub-continent and relevant standard literature. The preserved fishes in 10% formalin were identified following by consulting relevant literatures (Jayaram, 1999), (Talwar and Jingran, 1991). The phylogenetically arrangement of families and alphabetically arrangement of species under genus. Relevant information on habitat, maximum size, fishery information, and IUCN conservation status against all fish species were obtained from Fishbase (Froese and Pauly, 2013); (Jayaram, 1999); (Talwar and Jingran, 1991). Growth rate and maximum size of the fish determine to prepare the list of cultivable fishes. Shape, size and coloration pattern determine to prepare the list of ornamental fishes. Information on conservation status as per (IUCN, 2018) is shown against each species (Fig. 3).

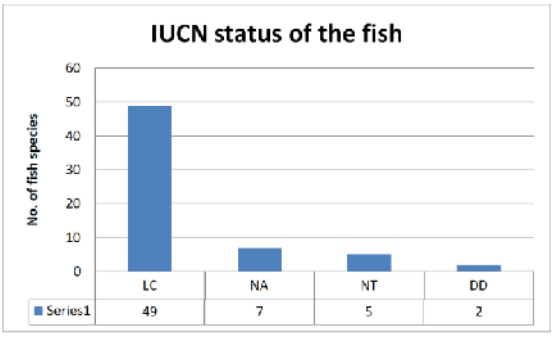

Fig. 3. IUCN status of the fishes.

Water Sample Collection

The water quality parameters were checked with following standard methods (APHA, 1989); (Trivedy and Goel, 1986). For each parameter, one reading is considered for average of four samples. The water temperature, dissolved oxygen, pH, were determined in the field whereas the inorganic Phosphorus, Carbon, and Conductivity was analyzed at CIFA research laboratory.

RESULTS

The classification of the freshwater fishes of Odisha along with their habitat, maximum size, fishery information and IUCN conservation status has been illustrated. In the present study, 63 identified species belongs to 44 genera and 25 families in (Table 2). The Order Cypriniformes consist of (3 families, 13 genus and 23 species), next to Perciformes (11 families, 13 genus and 19 species), Siluriformes (6 families, 11 genus and 14 species), Beloniformes and Osteoglossiformes (1 family, 2 genera and 2 species), where as Syprinidontiformes, Pluronectiformes and Synbranchiformes were represented by (1 families, 1 genus and 1 species) each, (Table 3 & Fig. 2). The study shows highest species diversity was observed in the Cyprinidae family (33.3%) followed by Bagridae (7.9%). Fishery status of freshwater fish fauna of Kendrapara revealed that existence of 45 species worth for Ornamental fishery, followed by 44 capture (food) fishery, 21 culture fisheries and 10 sports fishery (Table 2).

The minimum and maximum surface water temperature of different water bodies of the study locations from 20.4° to 34.0°C with an average value of 27.6°C. The pH from 7 to 8.2 with an average of 7.5. Dissolved oxygen was observed from 4.0 to 8.5 mg/l with an average value of 6.1 mg/l. However, level of CO_2 was little high as per (ISI, 1982) which ranged from 2.0 to 11.0 mg/l with an average value of 7.4 mg/l and dissolved inorganic phosphate phosphorus varied from 0.01 to 0.09 mg/l. with an average value of 0.02 mg/l, (Table 3).

DISCUSSION

The extinction of the fish species in a river conservation system and the rich variety of the species which support to the conservation. This will take a long period of time to protect the commercial fisheries. Out of the 63 species some species namely *Cirrhinus reba, P. sarana, Tor tor, Notopterus notopterus, Catla catla, Cirrhinus mrigala Chitala chitala, Cirrhinus reba, Labeo bata, Labeo calbasu, Labeo dero, Labeo rohita, Sperata aor, Sperata seenghala, Wallago attu, Clarias batrachus, Heteropneustes fossilis, Anabas testudineus, Channa striata, and Liza tade, a*re identified as commercially important food fishes which potential of culturing within the river. *Apolocheilus panchax, Danio rerio, p. ticto, p. sophore, Acanthocobitis botia, Lepidosephalus guntia, R. daniconius, Chaca chaca, Terapon jarbua, Badis badis, Scatophagus argus, Chanda nama, Nandus nandus, Trichogaster fasciata* are identified as export value as ornamental fishes. The study indicates the fish fauna includes 49 least concern, 7 not assessed, 5 near threatened, and 2 data deficient as per (IUCN, 2018), (Table 2 & Fig. 3). Dandapat, 2015; Mohanty *et al.*, 2015; Sarkar *et al.*, 2015; Das *et al.*, 2016; reported the dominance of cyprinid fishes in south Asia.

Species under Data Deficiency are often neglected in conservation program (Bland *et al*., 2015). It is possible that the partial distribution of some of the single location species is endemic and threatened as well as DD species might be underestimated owing to limitation in available data (Bini *et al.*, 2006). During the study four alien species like *Cyprinus carpio, Clarias batrachus, Poecialia reticulate* and *Oreochromis mossamaicus* which directly compete for food with the other indigenous species (Arun, 1999; Kurup *et al*., 2006).

Though Kendrapara is a coastal district, abundantly available of brackishwater fish in the water bodies of the study area. The most dominant brackish water fishes like, *Cyanoglossus puncticeps, Terapon Jabua, Scatophagus argus, Strongylura storgylura,* are abundantly found in Rajnagar, Gupti and Patamundai areas. Interestingly, hill stream fishes like *Acanthocobitis botia, Devario aequipinnatus, Tor tor,* etc. were also recorded from Ratanpur and Nuagaon of the study location.

Table 2: A systematic position of fish fauna from Kendrapara district of Odisha with their IUCN status, habitat, maximum size & fishery information.

Scientific Name	Habitat (1)	Max size (TL, cm) (2)	Fishery info(3)	IUCN status (4)
Order: Osteoglossiformes , Family: **Notopteridae**				
1.*Notopterus notopterus* (Pallas, 1769)	F	25	**C, CU, O, S**	LC
2. *Chitala chitala* (Hamilton, 1822)	F	90	**C, CU, O, S**	NT
Order : Cypriniformes, Family : **Cyprinidae**				
3. *Brachydanio rerio*(Hamilton, 1822)	B, F	4.5	**C, O**	LC
4. *Catla catla* (Hamilton, 1822)	B, F	182	**C, CU, S**	LC
5. *Chela labuca (*Hamilton, 1822)	B, F	6	**C**	LC
6. *Cirrhinus mrigala (Hamilton, 1822)*	F	99	**C, CU, S**	LC
7. *Cirrhinus reba* (Hamilton, 1822)	F	30	**C, CU**	LC
8. *Devario aequipinnatus* (McClelland, 1839)	F	15	**O**	LC
9. *Esomus danricus* (Hamilton, 1822)	B, F	13	**C, O**	LC
10. *Labeo bata* (Hamilton, 1822)	F	61	**C, CU**	LC
11. *Labeo boga* (Hamilton, 1822)	F	30	**C**	LC
12. *Labeo calbasu* (Hamilton, 1822)	B, F	90	**C, CU**	LC
13. *Labeo dero* (Hamilton, 1822)	B, F	75	**C, CU**	LC
14. *Labeo fambriatus* (Bloch, 1795)	F	91	**C, CU**	LC
15. *Labeo rohita (Hamilton, 1822)*	B, F	200	**C, CU, S**	LC
16. *P. amphibius* (Hamilton, 1822)	B, F	20	**O**	LC
17. *P. conchonius* (Hamilton, 1822)	B, F	14	**O**	LC
18. *P. punctatus* (Day, 1865)	F	7.5	**O**	LC
19. *P. sarana* (Hamilton, 1822)	B, F	31	**C, CU, O**	LC
20. *P. sophore* (Hamilton, 1822)	B, F	8	**O**	LC
21. *Rasbora daniconius* (Hamilton, 1822)	F	10	**O**	LC
22. *Salmostoma bacaila* (Hamilton, 1822)	F	18	**C, O**	LC
23. *Tor tor* (Hamilton, 1822)	F	200	**C, CU, S**	NT
Family: **Balitoridae**				
24. *Acanthocobitis botia* (Hamilton, 1822)	F	7	**O**	LC
Family: **Cobitidae**				
25. *Lepidocephalichthys guntea* (Hamilton, 1822)	B, F	15	**O**	LC
Order: Siluriformes, Family: **Bagridae**				
26. *Sperata aor* (Hamilton, 1822)	F	180	**C, S**	LC
27. *S. seenghala* (Sykes, 1839)	B, F	150	**C, CU, S**	LC
28. *Mystus bleekeri* (Day, 1877)	B, F	15.5	**C, O**	LC
29. *M. cavasius* (Hamilton, 1822)	B, F	40(SL)	**C**	LC
30. *M. vittatus* (Bloch, 1794)	B, F	21(SL)	**C, O**	LC
Family: **Siluridae**				
31. *Ompok bimaculatus* (Bloch, 1794)	B, F	45(SL)	**C, CU, O**	NT
32. Wallago attu (Bloch & Schneider, 1801)	B, F	240	**C, S**	NT
Family: **Schilbeidae**				
33. *Alia coila* (Hamilton, 1822)	B, F	30	**O**	NT
34. *Clupisoma garua* (Hamilton, 1822)	B, F	60.9(SL)	**C, O**	LC
35. *Eutropiichthys vacha* (Hamilton, 1822)	B, F	34	**C, O**	LC
36. *Psendeutroplus atherinoides* (Bloch, 1794)	B, F	25	**C, O**	LC
Family: **Claridae**				
37. *Clarias batrachus* (Linnaeus, 1758)	B, F	47	**C, CU, O**	LC
Family: **Heteropneustidae**				
38. *Heteropneustes fossilis* (Bloch, 1794)	B, F	31	**C, CU, O**	LC
Family: **Chacidae**				
39. *Chaca chaca* (Hamilton, 1822)	B, F	20	**O**	LC
Order: Beloniformes, Family :**Belonidae**				
40. *Strongylura strongylura* (van Hasselt, 1823)	B, F, M	40(SL)	**C, O**	NA
41. *Xenentodon cancila* (Hamilton, 1822)	B, F, M	40	**C, O**	LC
Order: Cyprinidontiformes, Family: **Aplocheilidae**				
42. *Apolocheilus panchax* (Hamilton, 1822)	F	6	**O**	LC
Order: Synbranchiformes, Family: **Synbranchidae**	-			
43. *Monopterus cuchia* (Hamilton, 1822)	F	60	**C**	LC
Order: Perciformes, Family: **Ambassidae**				
44. *Ambassis gymnocephalus* (Lacepede, 1802)	F	10	**O**	NA
45. *Chanda nama* (Hamilton, 1822)	B, F	11	**O**	LC
Family :**Teraponidae**				
46. *Terapon jarbua* (Forsskal, 1775)	M, B, F	25	**O**	NA
Family: **Scatophagidae**				

47. *Scatophagus argus* (Linnaeus, 1766)	M, B, F	30	**O**	NA
Family :**Nandidae**				
48. *Nandus nandus* (Hamilton, 1822)	B, F	20	**C, O**	LC
Family: **Badidae**				
49. *Badis badis* (Hamilton, 1822)	B, F	20	**O**	LC
Family: **Mugilidae**		-		
50. *Liza tade* (Forsskal, 1775)	M, B, F	47	**C**	NA
Family: **Gobiidae**				
51. Glossogobius giuris (Hamilton, 1822)	M, B, F	10	**C, CU, O**	LC
Family: **Anabantidae**				
52. *Anabas cobojius* (Hamilton, 1822)	F	30	**C, O**	DD
53. *Anabas testudineus* (Bloch, 1792)	B, F	25	**C, CU, O**	DD
Family: **Belontiidae**				
54. *Trichogaster fasciata* (Bloch & Schneider, 1801)	F	12	**O**	LC
55. *Trichogaster lalius* (Hamilton, 1822)	F	5	**O**	LC
Family: **Channidae**				
56. *Channa marulius* (Hamilton, 1822)	F	183	**C, CU, O, S**	LC
57. *Channa punctata* (Bloch, 1793)	B, F	31	**C, CU, O**	LC
58. *Channa striata* (Bloch, 1793)	B, F	100(SL)	**C, CU, O**	LC
59. *Channa orientalis* (Bloch & Schneider, 1801)	B, F	33	C, O	NA
Family: **Mastacembelidae**		-		
60. *Macrognathus aculeatus* (Bloch, 1786)	B, F	38	**C, O**	NA
61. *Mastacembelus armatus* (Lecepede, 1800)	B, F	90	**C, O**	LC
62. *Mastacembelus pancalus* (Hamilton, 1822)	B, F	18	**C**	LC
Ord: Pleuronectiformes, Family: **Cynoglossidae**				
63. *Cyanoglossus puncticeps* (Richardson, 1846)	M, B, F	16	**O**	LC

1 as per Talwar and Jhinran (1991), Jayaram (2010) and Froese and pauly (2013). B-Brackish; F- Freshwater; M-Marine
2 as per Talwar and Jhinran (1991), Jayaram (2010) and Froese and pauly (2013)
3 as per Talwar and Jhinran (1991), Jayaram (2010) and Froese and pauly (2013) C-Capture; Cu- Culture; O- Ornamental; S- Sport
4 as per IUCN (2018). LC= Least Concern; NT = Near Threatened; VU= Vulnerable; EN=Endangered; DD = Data Deficient; NA= Not assess

Table 3: A systematic list of fishes known from the Kendrapara district of Odisha.

Order	Family	Genus	Species
Osteoglossiformes	Notopteridae	2	2
Cypriniformes	Cyprinidae	11	21
	Balitoridae	1	1
	Cobitidae	1	1
Siluriformes	Bagridae	2	5
	Siluridae	2	2
	Schilbeidae	4	4
	Claridae	1	1
	Heteropneustidae	1	1
	Chacidae	1	1
Beloniformes	Belonidae	2	2
Cyprinidontiformes	Aplocheilidae	1	1
Synbranchiformes	Synbranchidae	1	1
Perciformes	Ambassidae	2	2
	Tetraponidae	1	1
	Scatophagidae	1	1
	Nandidae	1	1
	Badidae	1	1
	Mugilidae	1	1
	Gobiidae	1	1
	Anabantidae	1	2
	Belontidae	1	2
	Channidae	1	4
	Mastacembelidae	2	3
Pleuronectiformes	Cynoglossidae	1	1
N=8	N=25	N=44	N=63

Table 4: Water quality characteristics of 6 water bodies of Kendrapara District (April 2016 to March 2017). The total number of season studied = 4, the numbers of samples used for each season =2. Data are arranged as range (mean) ±sd.

Parameters	Stations					
	Rajnagar Min-max (mean) ± sd	**Gupti**	**Patamundai**	**Ratanpur**	**Nuagaon**	**Rohio**
Temp(°C)	21.1-33.8 (27.85) ± 6.0	21.5-33 (26.6) ±4.91	24.4-34.0 (27.83) ±6.07	22.0-33.8 (27.9) ±5.7	20.4-33.7 (27.6) ±6.2	21.3-33.8 (28.0) ±6.0
DO (ppm)	4.6-8.0 (6.2) ±1.26	4.0-8.5 (6.1) ±1.5	5.0-8.0 (6.1) ±1.15	4.9-8.3 (6.03) ± 1.2	4.0-8.0 (6.4) ±1.5	4.1-8.0 (6.1) ±1.3
pH	7.0-8.0 (7.5) ±0.38	7.0-8.2 (7.6) ±0.38	7.0-8.0 (7.6) ± 0.32	7.0-8.0 (7.5) ±0.4	7.1-8.0 (7.5) ±0.03	7.1-8.2 (7.6) ±0.38
CO_2 mg/l	6.0-11.0 (7.8) ±1.8	6.0-10.0 (7.7) ±1.3	5.0-10.0 (7.7) ±1.83	6.0-11.0 (8.0) ±1.8	2.0-9.0 (6.8) ± 2.6	5.0-9.0 (6.7) ±2.2
P_2O_5 /mg	0.01-0.09 (0.02) ±0.026	0.01-0.04 (0.035) ±0.031	0.01-0.08 (0.030) ±0.028	0.01-0.02 (0.01) ±0.004	0.01-0.03 (0.02) ±0.008	0.01-0.04 (0.01) ±0.01

The presence of hill stream fishes was really surprise the researcher. It needed further confirmation for availability of these species in brackish water areas. Therefore, fauna of the district is a mixture of primary freshwater and estuarine fishes in widely distributed forms. There should be need of appropriate management strategy for the threatened fishes; captive breeding, brood stock management and seed production and ranching of seed in natural water bodies might be considered in this aspect. There is a general lack of awareness of the local people for freshwater biodiversity in general (Abraham and Kelkar, 2012) Use of harmful fishing gear and methods, which is very common in coastal community (Sultan and Islam, 2016) should strictly monitor and controlled.

CONCLUSION

The fish fauna available in different water bodies of Kendrapara district is really useful for the coastal community as there livelihood. The results of the present study may use as base line information for planning a conservational management of fish and fisheries resources of Odisha in feature. Al so introduces in-situ & ex-situ cultivation techniques for conservation sustainable management of fish genetic resources.

ACKNOWLEDGEMENT

We are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India for allowing us to identify some of the species collected from Kendrapara district. The second author is indebted to the Director, Central Institute of Freshwater Aquaculture, Bhubaneswar for his support to do the research work. Also thankful of Mr. Akil Aktar for map designing, Mr. Bulu sahu, and Mr. Bapi patra for helping to catch fish during the research study.

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How to cite this article: Baliarsingh, B. K., Swain, S. K., Oliver King E.D., Nandi, D. and Rath, B. (2020). Distribution and Status of Freshwater Fish Fauna and its Habitat in the Water bodies of Kendrapara District, Odisha, India. *Biological Forum – An International Journal*, **12**(2): 44-50.