



International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2020; 8(3): 413-420

© 2020 IJFAS

www.fisheriesjournal.com

Received: 28-03-2020

Accepted: 30-04-2020

BK Baliarsingh

M.S. Swaminathan Research
Foundation, Jeypore, Koraput,
Odisha, India

SK Swain

Central Institute of Freshwater
Aquaculture, Bhubaneswar,
Odisha, India

Krishakumar K Navaladi

M.S. Swaminathan Research
Foundation, Jeypore, Koraput,
Odisha, India

B Rath

District Fishery Offices, Jeypore,
Koraput, Odisha, India

Corresponding Author:

BK Baliarsingh

M.S. Swaminathan Research
Foundation, Jeypore, Koraput,
Odisha, India

Fish fauna and habitat ecology of the water bodies of Puri district, Odisha

BK Baliarsingh, SK Swain, Krishakumar K Navaladi and B Rath

Abstract

A systematic checklist of fishes of Puri district of Odisha, India was provided. A total of 71 species of fishes under 46 genera, 27 families and 9 orders has been recorded. Highest species diversity was observed in the Cyprinidae (28.1%) followed by Bagridae (12.6%). The fish fauna includes 57 least concern (LC), 4 near threatened (NT), 2 data deficient (DD) and 8 not assessed (NA) as per IUCN. The fish fauna is a composite of primary freshwater fishes, estuarine fishes and widely distributed forms. The present finding indicates that Puri district is blessed with diverse fish fauna including numerous economically important food fishes and ornamental fishes. Fishery status shows existence of 48 species worth for capture fishery, 51 species for ornamental, 19 species for culture and 7 species worth for sports fishery. Water quality of the rivers and creek of the district are not contaminated as the value of pH and DO are within the tolerance limit of class 'D'. The water quality of the river is considered suitable for fish culture and wildlife propagation.

Keywords: Fish diversity, Puri, Odisha, physico-chemical characteristics

1. Introduction

The freshwater fish fauna of India is highly diverse in nature and constituting 1027 species^[1]. Odisha constitute about 13.92% to the freshwater fish fauna of India^[2]. Out of the 6 coastal districts of Odisha, Puri one of them^[3], which has a total area of 3,051 (km)². It is bounded by the Khordha district in the North, Bay of Bengal in the South, Jagatsinghpur district in the East and Ganjam district in the west^[4]. The people in the sea coast area like Satapada, Brahmagiri, Konark, Astaranga and Panasapada etc were mainly depend on fishing for their livelihood^[5]. The world famous place like Chilika, Satapada, Pipili, Konark, Puri and Brahmagiri are situated under Puri district.

The first over study on marine and freshwater fishes of Odisha were made by^[6]. Subsequently, freshwater fishes of Odisha have been studied and described by many other^[2, 7-22]. However no details investigation has been taken up so far on the fish diversity of Puri district of Odisha. In the present study a systematic check list of fishes of the district is prepared based on the research study and available literatures. Also the physico- chemical characteristics of rivers of Puri district of Odisha are provided.

2. Materials and Methods

2.1 Study area

Odisha State is the one of the coastal state in India extends from 17° 49' N to 22° 34' N latitude and 81° 27' E to 87° 11" longitude the eastern part of India. Puri district is one of the coastally located district in Odisha. It lies between 85° 9' to 86° 25' East Longitude and between 19° 28' to 20° 10' North Latitude (Map-1). It is blessed with numerous rivers namely Bhargavi, Daya, Kushabhadra, Kadua, Prachi and Devi rivers are the major rivers passes through Puri district, generally all rivers are tributaries of Mahanadi river.

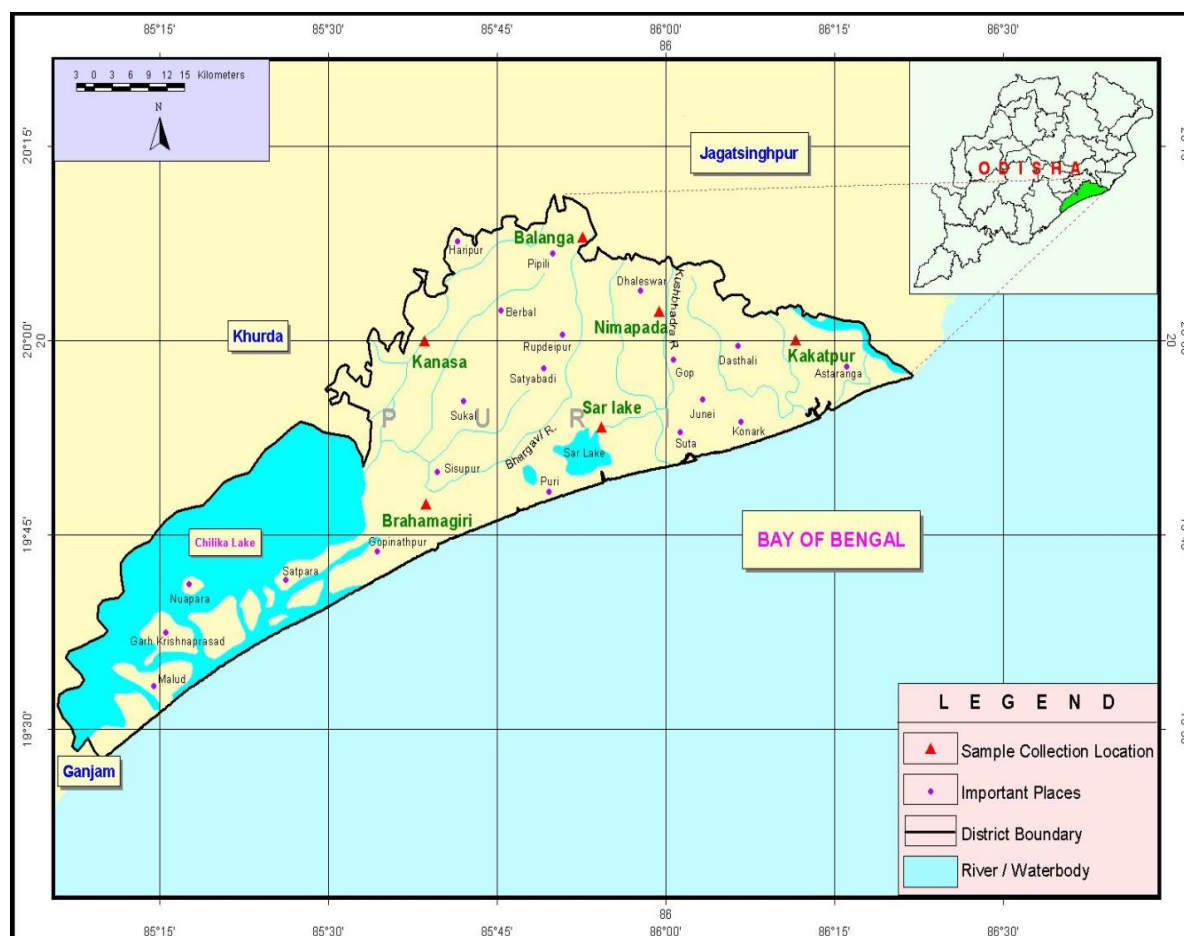
2.2 Methodology

2.2.1 Fish Sample Collection

Fishes and water samples were collected from 6 stations namely Nimapada, Balanga, Kakatapour, Sar lake, Brahmagiri and Kanasa during the study period May 2016 to April 2017 (Map-1 & Table-1) with the help of local fisher men using different types of nets namely gill net, cast net and dragnet. Some species were collected from landing centers and fish markets

of Penthakata, Nuagaon, Konark and Astaranga fish market. Immediately photographs were taken, small species were preserved in 10% formalin solution where as large fishes were

given one incision on the abdomen before they were fixed [23, 24]. The detailed identification and taxonomic analysis has been done at ZSI center Gopalpur and Kolkatta, West Bengal.



Map 1: Showing sampling sites in Puri district, Odisha

2.2.2 Fish Identification

The samples were identified based on keys for fishes of the Indian subcontinent and classification were carried out by consulting relevant standard literature. Fishes were preserved in 10% formalin and identified following by consulting relevant literatures [23, 24]. The families have been arranged phylogenetically and species under a genus followed alphabetic sequence. Relevant information like habitat, maximum size, fishery information, and IUCN conservation status against all fish species were obtained from Fishbase [23-25]. The list of cultivable fishes was prepared based on growth rate and maximum size of the species. The list of ornamental fishes was prepared based on Coloration pattern, shape and maximum size. Information on conservation status based on [26] is shown against each species (Table-2 & Figure-2).

2.2.3 Water Sample Collection

The physico-chemical parameters were analyzed following standard methods [27, 28]. The average of four samples for each parameters studied was considered as one reading. The water temperature ($^{\circ}\text{C}$) was measured by sensitive mercury thermometer ($1/10^{\circ}\text{C}$), dissolved oxygen (mg/l), and pH measured by ph meter, were determined in the field and inorganic Phosphorus, Carbon, Ammonia and Conductivity was analyzed in the research laboratory of Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar within 48 hours of collection.

3. Results

3.1 Species diversity

The fish diversity mainly based upon the biotic and abiotic factors and variety of the ecosystem, water level fluctuations, mean depth, morph-metric features, age of the water body, and bottom have great implications. The hydro biological features also play an effective role in fisheries output of the collection centers to a greater extent. The classification of the freshwater fishes of Puri along with their habitat, maximum size, fishery information and IUCN conservation status has been illustrated. A list of the fish fauna of the Puri district of Odisha consist of 71 species of fish belonging to 46 genera and 27 families were identified in (Table 2 & 4). Highest diversity was observed in Cypriniformes (22 species, 12 genus and 2 families) followed by Perciformes (21 species, 14 genus and 12 families), Siluriformes (21 species, 13 genus and 7 families), Beloniformes (2 species, 2 genera and 1 family), where as Syprinidontiformes, Pluronectiformes, Osteoglossiformes, Tetraodontiformes and Synbranchiformes were represented by (1 species, 1 genus and 1 families) each (Table 2, 4 & Figure 1). Among the family highest species diversity was observed in the Cyprinidae (28.1%) followed by Bagridae (12.6%). Fishery status of freshwater fish fauna of Odisha revealed that existence of 51 species worth for Ornamental fishery, followed by 48 capture (food) fishery, 19 culture fisheries and 7 sports fishery (Table 2).

3.2 Physic-chemical parameters

The surface water temperature ranged from 22.0° to 35.2 °C with an average value of 29.2 °C. The pH value ranged from 7 to 8 with an average of 7.5. High concentration of dissolved oxygen was observed throughout the study period which ranged from 4.3 to 7.5 mg/l with an average value of 6.0 mg/l, which is within the permissible limit of ^[29]. However, level of CO₂ was slightly high which ranged from 4.0 to 13.0 mg/l with an average value of 8.7 mg/l. Dissolved inorganic phosphate phosphorus varied from 0.01 to 0.03 mg/l. with an average value of 0.02 mg/l, Ammonia varied from 0.01 to 0.08 mg/l with an average value of 0.04 mg/l and Conductivity varied from 0.121 to 0.950mho/cm with average value 0.442mho/cm, (Table 3). The eutrophic nature the water bodies may be attributed to inflow of fertilizers from the surrounding agricultural fields and human inferences.

4. 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 go a long way to protect the commercial fisheries. Out of the 71 species some species namely *Notopterus notopterus*, *Cirrhinus reba*, *Labeo calbasu*, *Labeo dero*, *Labeo rohita*, *Sperata aor*, *Sperata seenghala*, *Wallago attu*, *Clarias batrachus*, *Heteropneustes fossilis*, *Anabas testudineus*, *Liza tade*, *Channa striata*, *catla catla*, *P. sarana*, *Cirrhinus reba* are identified as commercially important food fishes which potential of culturing within the river. In the same time some species namely *p. ticto*, *p. sophore*, *Rasbora daniconius*, *Lepidosephalus guntia*, *Chaca chaca*, *Apolocheilus panchax*, *Chanda nama*, *Terapon jarbua*, *Badis badis*, *Scatophagus argus*, *Nandus nandus*, *Trichogaster fasciata* are identified as export value as ornamental fishes. As per ^[26] the fish fauna of study area includes 57 least concern, 4 near threatened, 2 data deficient and 8 not assessed (Table 2 & Figure 2). ^[30] reported that the fish species like *Cirrhinus reba*, *Salmostoma*, *Rasbora* and *Puntius* groups were more dominant. Therefore, the present investigation reveals that Cyprinid fishes are found to be the more dominant group than others which is supported by other studies also ^[31-34] reported the dominance of cyprinid fishes in south Asia. The present study of fish fauna in Puri district showed that most of the fish species recorded were widely distributed in the rivers and water bodies.

Puri is a coastal district, which harbors the brakish water species like, *Scatophagus argus*, *Terapon Jabua*, *Strongylura storgylura*, *Cyanoglossus puncticeps*, these fishes are abundantly found in Brahmagiri and Kakatapur collection point. Therefore, fauna of the district is a mixture of primary freshwater fishes, estuarine fishes and 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. Use of harmful fishing gear and methods, which is very common in coastal community ^[35] should strictly monitor and controlled.

The study indicates that fish diversity of the study area is reducing with the increase of water quality. The diversity of native species decreases the production of fish and creates extinction of several species. These situations eventually create instability in the socio-economic sector of the study area in terms of increased poverty of local fishermen. It reveals that, a rapid decline in fish diversity at discharged zone (polluted) of the River. Such observation has also been confirmed by ^[36].

The water temperature ranged between 22.0° to 35.2 °C. The maximum temperature was recorded during summer while minimum was recorded during January of the winter season. The pH of the water was recorded between a comfortable range of 7 to 8 being lowest during summer 7 and highest 8 during winter. DO values ranged from 4.3 to 7.5 mg/l. Minimum values of DO were recorded during summer season and maximum during winter months. Minimum DO in months may be due to high metabolic rate of organisms. Maximum DO may be due to low atmospheric temperature. Similar trends were made by ^[37, 38]. The water bodies of Puri district of Odisha are within the tolerance limits of class 'D' water prescribed by the ^[30] for fish culture and wild life propagation. The present finding indicates that Puri district is blessed with diverse fish fauna including numerous economically important food fishes. The water quality of the rivers and streams of the district are not contaminated as the value of pH and DO are within the tolerance limit of class 'D' water prescribed for fish culture and wild life propagation. Therefore, attempts may be made to introduce the in situ fish cultivation using scientific techniques for sustainable management of fish resources of the district.

Table 1: Details of Sampling sites of Puri district

Sampling sites	Position	Elevation (ft)	Habitat type
Nimapada	20° 07' 17.59" N 86° 00' 37.07" E	33	open river
Balanga	20° 07' 54.49" N 85° 52' 57.11" E	49	open river
Kakatapur	20° 00' 06.89" N 86° 11' 34.04" E	21	Canal & river
Sar Lake	19° 55' 38.27" N 85° 54' 47.59" E	6	Lake
Brahamagiri	19° 47' 26.27" N 85° 38' 45.97" E	31	Pond & Canals
Kanasa	20° 01' 18.24" N 85° .40' 28.24" E	16	small water bodies, canals, ponds etc

Table 2: A checklist of freshwater fishes known from the Puri district of Odisha with their IUCN status, habitat, maximum size & fishery information. LC= Least Concern; NT = Near Threatened; VU= Vulnerable; EN=Endangered; DD = Data Deficient.

Scientific Name	Habitat (1)	Max size (TL, cm) (2)	Fishery info (3)	IUCN status (4)	Local Names
Order: Osteoglossiformes , Family: Notopteridae					
1. <i>Notopterus notopterus</i> (Pallas, 1769)	F	25	C, CU, O, S	LC	Fali
Order : Cypriniformes, Family : Cyprinidae					
2. <i>Amblypharyngodon mola</i> (Hamilton, 1822)	F	20	O	LC	Mahuradi
3. <i>Brachydanio rerio</i> (Hamilton, 1822)	F, B	4.5	C, O	LC	Jaradi
4. <i>Catla catla</i> (Hamilton, 1822)	F, B	182	C, CU, S	LC	Bhakura
5. <i>Chela fasciata</i> (Silas, 1958)	F, B	6	O	LC	Jahala
6. <i>Chela labuca</i> (Hamilton, 1822)	F, B	6	C	LC	Jahala
7. <i>Cirrhinus reba</i> (Hamilton, 1822)	F	30	C, CU	LC	Reba
8. <i>Devario aequipinnatus</i> (McClelland, 1839)	F	15	O	LC	Bankuaso
9. <i>Esomus danricus</i> (McClelland, 1839)	F, B	13	C, O	LC	Minow
10. <i>Labeo calbasu</i> (Hamilton, 1822)	F, B	90	C, CU	LC	Kalabanisi
11. <i>Labeo dero</i> (Hamilton, 1822)	F	75	C, CU	LC	Laya
12. <i>Labeo fambriatus</i> (Bloch, 1795)	F	91	C, CU	LC	Perusi
13. <i>Labeo rohita</i> (Hamilton, 1822)	F, B	200	C, CU, S	LC	Rohu
14. <i>P. amphibius</i> (Hamilton, 1822)	F	20	O	LC	Kerandi
15. <i>P. conchoniis</i> (Hamilton, 1822)	F	14	O	LC	Pitakerandi
16. <i>P. punctatus</i> (Day, 1865)	F	7.5	O	LC	Kuji Kerandi
17. <i>P. sarana</i> (Hamilton, 1822)	F	31	C, CU, O	LC	Sarana
18. <i>P. sophore</i> (Hamilton, 1822)	F	8	O	LC	Patia keandi
19. <i>P. ticto</i> (Hamilton, 1822)	F, B	10	O	LC	Kutri
20. <i>Rasbora daniconius</i> (Hamilton, 1822)	F	10	O	LC	Jilo
21. <i>Salmostoma bacaila</i> (Hamilton, 1822)	F	18	C, O	LC	Baunsapatri
Family: Cobitidae					
22. <i>Lepidocephalichthys guntea</i> (Hamilton, 1822)	F, B	15	O	LC	Jimani
23. <i>Lepidocephalichthys thermalis</i> (Valenciennes, 1846)	F	12	O	LC	Bali Jimani
Order: Siluriformes, Family: Bagridae					
24. <i>Sperata aor</i> (Hamilton, 1822)	F	180	C, S	LC	Ardi, Katrang
25. <i>S. seenghala</i> (Sykes, 1839)	B, F	150	C, CU, S	LC	
26. <i>Mystus bleekeri</i> (Day, 1877)	F	15.5	C, O	LC	Kuji kantia
27. <i>M. cavasius</i> (Hamilton, 1822)	F, B	40(SL)	C	LC	Gagar, Guntia
28. <i>M. gulio</i> (Hamilton, 1822)	F, B	46(SL)	C	LC	Bai kantia
29. <i>M. menoda</i> (Hamilton, 1822)	F	45	C	LC	Bada Kantia
30. <i>M. vittatus</i> (Bloch, 1794)	B, F	21(SL)	C, O	LC	Kantia
31. <i>Rita chrysea</i> (Day, 1877)	F	19.5	C	LC	Kukia
32. <i>Rita rita</i> (Hamilton, 1822)	B, F	150	C	LC	Mussiari
Family: Siluridae					
33. <i>Ompok bimaculatus</i> (Bloch, 1794)	B, F	45(SL)	C, CU, O	NT	Pabda
34. <i>Ompok pabo</i> (Hamilton, 1822)	F	25	C	NT	Pabda
35. <i>Wallago attu</i> (Bloch & Schneider, 1801)	B, F	240	C, S	NT	Baliah
Family: Schilbeidae					
36. <i>Alia coila</i> (Hamilton, 1822)	B, F	30	O	NT	Baunsapatri
37. <i>Clupisoma garua</i> (Hamilton, 1822)	F, B	60.9(SL)	C, O	LC	Pania, bacha
38. <i>Eutropiichthys murius</i> (Hamilton, 1822)	F	30	C, O	LC	Mundi bacha
39. <i>Eutropiichthys vacha</i> (Hamilton, 1822)	F, B	34	C, O	LC	Bachua
40. <i>Pseudentoproplus atherinoides</i> (Bloch, 1794)	B, F	25	C, O	LC	Bopotassi
Family: Erethistidae					
41. <i>Hara Hara</i> (Hamilton, 1822)	F	13	O	LC	Boda
Family: Claridae					
42. <i>Clarias batrachus</i> (Linnaeus, 1758)	F	47	C, CU, O	LC	Magura
Family: Heteropneustidae					
43. <i>Heteropneustes fossilis</i> (Bloch, 1794)	F, B	31	C, CU, O	LC	Singi
Family: Chacidae					
44. <i>Chaca chaca</i> (Hamilton, 1822)	B, F	20	O	LC	Curcurriah
Order: Beloniformes, Family :Belonidae					
45. <i>Strongylura strongylura</i> (van Hasselt, 1823)	B, F, M	40(SL)	C, O	NA	Gania
46. <i>Xenentodon cancila</i> (Hamilton, 1822)	B, F, M	40	C, O	LC	Gangeitodi
Order: Cyprinodontiformes, Family: Aplocheilidae					
47. <i>Apolocheilus panchax</i> (Hamilton, 1822)	F	6	O	LC	Kaurdia

Order: Synbranchiformes, Family: Synbranchidae	-				
48. <i>Monopterusuchia</i> (Hamilton, 1822)	F	60	C	LC	Kochia
Order: Perciformes, Family: Ambassidae					
49. <i>Ambassis gymnocephalus</i> (Lacepede, 1802)	F	10	O	NA	Chandi
50. <i>Chanda nama</i> (Hamilton, 1822)	B, F	11	O	LC	Chandee
Family :Teraponidae					
51. <i>Terapon jarbua</i> (Forsskal, 1775)	M, B, F	25	O	NA	Gahana
Family: Scatophagidae					
52. <i>Scatophagus argus</i> (Linnaeus, 1766)	M, B, F	30	O	NA	Kora chandi
Family : Nandidae					
53. <i>Nandus nandus</i> (Hamilton, 1822)	B, F	20	C, O	LC	Bodosi
Family: Badidae					
54. <i>Badis badis</i> (Hamilton, 1822)	B, F	20	O	LC	Kalipoee
Family : Cichlidae					
55. <i>Etioplos suratensis</i> (Bloch, 1790)	B, F	40	C, CU, O	LC	Kundala
Family: Mugilidae					
56. <i>Liza tade</i> (Forsskal, 1775)	M, B, F	47	C	NA	Bedanga
Family: Gobiidae					
57. <i>Glossogobius biocellatus</i> (Valenciennes, 1837)	M, B, F	12	C, CU, O	NA	Gola
58. <i>Glossogobius giuris</i> (Hamilton, 1822)	M, B, F	10	C, CU, O	LC	Baligarada
Family: Anabantidae					
59. <i>Anabas cobojius</i> (Hamilton, 1822)	F	30	C, O	DD	Kou
60. <i>Anabas testudineus</i> (Bloch, 1792)	F, B	25	C, CU, O	DD	Raja kou
Family: Belontiidae					
61. <i>Trichogaster fasciata</i> (Bloch & Schneider, 1801)	F	12	O	LC	Khaska
62. <i>Trichogaster lalius</i> (Hamilton, 1822)	F	5	O	LC	Khoskardi
Family: Channidae					
63. <i>Channa marulius</i> (Hamilton, 1822)	F	183	C, CU, O, S	LC	Sahala
64. <i>Channa orientalis</i> (Bloch & Schneider, 1801)	F, B	33	C, O	NA	Chenga
65. <i>Channa punctata</i> (Bloch, 1793)	F, B	31	C, CU, O	LC	Gadisa
66. <i>Channa striata</i> (Bloch, 1793)	F, B	100(SL)	C, CU, O	LC	Seulo
Family: Mastacembelidae					
67. <i>Macroglyptothorax aculeatus</i> (Bloch, 1786)	F, B	38	C, O	NA	Todi
68. <i>Mastacembelus armatus</i> (Lacepede, 1800)	F, B	90	C, O	LC	Gomi todi
69. <i>Mastacembelus pancalus</i> (Hamilton, 1822)	F, B	18	C	LC	Bomi
Order: Pleuronectiformes, Family: Cynoglossidae					
70. <i>Cyanoglossus puncticeps</i> (Richardson, 1846)	M, B, F	16	O	LC	Dudhapatia
Order: Tetraodontiformes, Family: Tetraodontidae					
71. <i>Tetraodon cutcutia</i> (Hamilton, 1822)	B, F	15	C	LC	Fula machha
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. C-Capture; Cu- Culture; O- Ornamental; S- Sport, as per Talwar and Jhinran (1991), Jayaram(2010) and Froese and pauly (2013)					
4. Local name as per Pati & Pati (2008), Baliarsingh (2014), Samal et. al (2015)					
5. LC= Least Concern; NT = Near Threatened; VU= Vulnerable; EN=Endangered; DD = Data Deficient; NA= Not assess, as per IUCN (2018)					

Table 3: Water quality characteristics of 6 water bodies of Puri 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					
	Nimapada Min-max (mean) ± sd	Balanga	Kakatpur	Sar lake	Brahamagiri	Kanasa
Temp(°C)	22.0-35.2 (29.21) ± 6.2	21.1-33 (26.3) ±4.56	21.2-34.1 (27.7) ±6.5	21.4-34.0 (27.8) ±5.9	21.1-35.1 (29.7) ±5.65	21.0-33.5 (27.8) ±5.8
DO (ppm)	4.3-7.5 (6.07) ±1.35	4.8-8.0 (6.4) ±0.95	4.5-6.0 (5.3) ±0.51	4.5-8.0 (6.06) ± 1.05	6.5-7.5 (6.9) ±0.35	4.8-8.1 (6.5) ±1.26
pH	7.0-8.0 (7.5) ±0.37	7.0-8.4 (7.5) ±0.55	7.0-8.0 (7.5) ± 0.38	6.0-8.0 (7.5) ±0.35	7.2-7.7 (7.3) ±0.17	7.1-8.0 (7.5) ±0.29
CO ₂ mg/l	4.0-13.0 (8.7) ±3.19	7.0-15.0 (10.5) ±2.8	6.0-9.0 (7.6) ±0.95	4.0-12.0 (7.3) ±2.6	12.0-18.0 (14.85) ± 2.39	2.0-11.0 (6.7) ±3.20
P ₂ O ₅ /mg	0.01-0.03 (0.02) ±0.007	0.01-0.026 (0.01) ±0.006	0.01-0.03 (0.01) ±0.008	0.01-0.09 (0.03) ±0.038	0.01-0.019 (0.01) ±0.003	0.01-0.08 (0.02) ±0.022
NH ₄ -n mg/l	0.01-0.08 (0.04) ±0.02	0.01-0.03 (0.02) ±0.007	0.01-0.02 (0.01) ±0.003	0.01-0.02 (0.015) ±0.003	0.01-0.02 (0.015) ±0.003	0.01-0.02 (0.015) ±0.003
NO ₃ -N mg/l	0.019-0.03 (0.023) ±0.004	0.01-0.04 (0.018) ±0.011	0.009-0.04 (0.02)±0.014	0.007-0.03 (0.019) ±0.015	0.0-0.02 (0.009) ±0.005	0.007-0.04 (0.021) ±0.013
Conductivity mho/cm	0.121-0.950 (0.442) ±0.039	0.109-0.209 (0.148) ±0.035	0.118-0.255 (0.18) ±0.04	0.132-0.254 (0.188) ±0.039	0.046-0.089 (0.05) ±0.013	0.119-0.221 (0.196) ±0.032

Table 4: Diversity of freshwater fishes of Puri district, Odisha

Order	Family	Genus	Species
Osteoglossiformes	Notopteridae	1	1
Cypriniformes	Cyprinidae	11	20
	Cobitidae	1	2
Siluriformes	Bagridae	3	9
	Siluridae	2	3
	Schilbeidae	4	5
	Erethistidae	1	1
	Claridae	1	1
	Heteropneustidae	1	1
	Chacidae	1	1
Beloniformes	Belontiidae	2	2
Cyprinodontiformes	Aplocheilidae	1	1
Synbranchiformes	Synbranchidae	1	1
Perciformes	Ambassidae	2	2
	Tetraodonidae	1	1
	Scatophagidae	1	1
	Nandidae	1	1
	Badidae	1	1
	Cichlidae	1	1
	Mugilidae	1	1
	Gobiidae	1	2
	Anabantidae	1	2
	Belontiidae	1	2
	Channidae	1	4
	Mastacembelidae	2	3
Pleuronectiformes	Cynoglossidae	1	1
Tetraodontiformes	Tetraodontidae	1	1
N=9	N=27	N=46	N=71

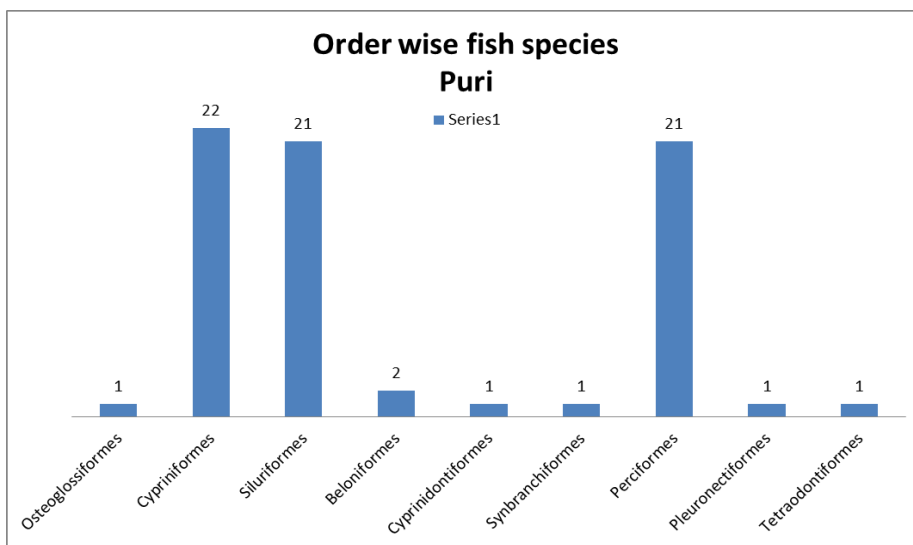


Fig 1: Order wise fish species of Puri district

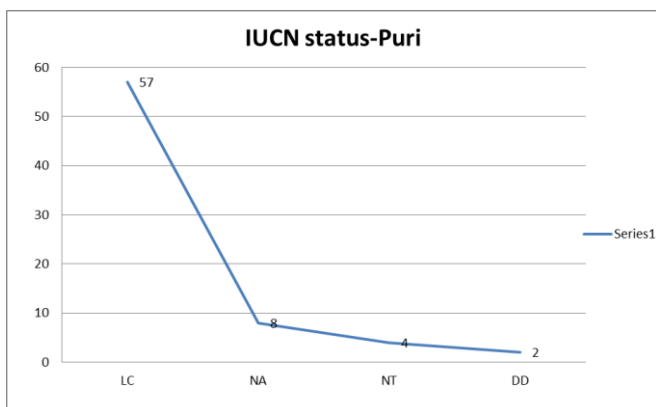


Fig 2: IUCN status of the fish species of Puri district.

4. Conclusion

The diversified freshwater fish fauna of Puri is really useful for their livelihood to the coastal community. The findings of present study may use as base line information for planning a conservational management of fish and fisheries resources of Odisha in future. The indigenous fishes should also be incorporated into the value systems of the society (sport, biological control, aesthetic, medicine etc). Fishes such as *Gambusia* sp. are effective in mosquito control. Similarly, there are several slanderously coloured native ornamental fishes [39] Checking the entry of exotic species coupled with more awareness on the indigenous species would go a long way in preserving our rich fish diversity. Also introduces in-situ & ex-situ cultivation techniques for conservation sustainable management of fish genetic resources.

5. Acknowledgement

We are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India for allowing us to identify some of the species collected from Puri 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. Mohan Barik, and Mr. Tapas for helping to catch fish during the research study.

6. Reference

- Gopi KC, Mishra SS, Kosygin L. Pisces. Chapter 33, pp. 527–570. In: Chandra K Gopi KC, Rao DV, Valarma- thi K and Alfred JRB (Eds) Current Status of Freshwater Faunal Diversity in India. Director, Zoological Survey of India, Kolkata, India. 2017, 624.
- Dutta AK, Kunda DK, Karmakar AK. Freshwater fishes. In: Director, Zoological Survey of India., State Fauna Series 1: Fauna of Orissa. 1993; 4:1-37.
- Pati S, Pati DK. Fishes and shellfishes of Orissa, Kitab Mahal Publication, Cuttack. 2008, 281.
- Odisha over view. <http://orissa.gov.in/e-magazine/Orissareview/2010/December/engpdf/92-95.pdf> Assessed on 1st February, 2018.
- Districts Profiles. http://www.ordistricts.nic.in/district_profile/aboutus.php Assessed on 1st February, 2018.
- Day F. On the fishes of Orissa. Proc. Zool. Soc., London, 1869, 369-387.
- Chauhan BS. Fish and Fisheries of the Patna State, Orissa. Record of Indian the Museum, 1947, 67-82.
- Jayaram KC, Majumdar N. On a collection of fish from the Mahanadi. Records of the Zoological Survey of India 1976; 69:305-323.
- Ramkrishna S, Sethy P, Das S. Faunal resources of Similpal Biosphere Reserve, Mayurbhanj, Orissa, Zoological Survey of India, Kolkata, 2006
- Pathak V, Shdvastava NP, Chakraborty PK, Das AK. Ecological status and production dynamics of river Mahanadi. Bulletin No. 149, Central Inland Fisheries Research Institute, Barrackpore, Kolkata 100120, India. 2007, 1-40.
- Karmakar AK, Das A, Banerjee PK. Fish Fauna of Submarekha River. Records of the Zoological Survey of India, Occasional 2008; 283:1-57.
- Das CR. Integrated sustainable environmental conservation and restoration of largest fresh water Ansupa Lake, a famous wetland of Orissa. Proceedings of 12th World Lake Conference, 28 October – 2 November 2007, Jaipur, Rajasthan, India. 2008; 1571–1577.
- Baliarsingh BK, Kosygin L, Swain SK, Nayak AK. Species diversity and habitat characteristics of freshwater fishes in the Similpal Biosphere Reserve, Odisha with Some New Records. Biological Forum – An International Journal, 2013, 64-70.
- Nayak L, Baliarsingh BK, Swain SK, Kosygin L. Fish diversity of Balasore District, Odisha. Environ & Sociobiol, 2013; 10(2):101-108.
- Mishra S, Raut D, Patnaik L. Fisheries and hydrography of Baitarini River at Jajpur, Odisha, east coast of India. International Journal of Scientific and Research Publications, 2013; 3(6):1-9.
- Singh TK, Charan GB, Swain SK. Review of the research on the fish diversity in the river Mahanadi and identifying the probable potential ornamental fishes among them with reference to threats and conservation measures. Research Journal of Animal, Veterinary and Fishery Sciences, 2013; 1(3):16-24.
- Baliarsingh BK, Kosygin L, Rout SD. Fish diversity and Physico-Chemical Characteristics of Rivers of Ganjam district, Odisha. Biological Forum – An International Journal, 2014, 13-18.
- Behera DP, Nayak L. A check list on distribution of ornamental fishes in Chilika Lagoon, east coast of India. Journal of FisheriesSciences.com, 2014, 52-60.
- Satapathy D, Misra SK. Fish diversity and conservation of fishery resources of the river Pilasalunki, Phulbani district, Asian Journal of Animal Science., 2014; 9(2):124-128.
- Singh TK. Diversity in selected stretch of the River Mahanadi in Odisha and the livelihood of inhabiting fisher community, International Research Journal of Biological Sciences, 2014; 3(8):98-104.
- Baliarsingh BK, Swain SK, Kosygin L, Nayak L. Fish diversity and Physico-Chemical Characteristics of Rivers of Bhadrak district, Odisha. e-planet, 2015, 71-76.
- Samal D, Sethy J, Sahu HK. Ichthyofauna diversity in relation to physico-chemical characteristics of Budhabalanga River, Baripada, Mayurbhanj, Odisha. International Journal of Fisheries and Aquatic Studies, 2016; 4(1):405–413.
- Jayaram KC. The freshwater fishes of the Indian Region. Narendra Publishing House. Delhi, 1999, 551.
- Talwar PK, Jhingran AG. Inland Fishes of India and Adjacent Countries, Oxford and IBH Publishing Co., New Delhi, India. 1991; 1(2):1158.
- Froese R, Pauly D, Fish Base. World Wide Web electronic publication. 2013, www.fishbase.org, Accessed in January, 2018.
- IUCN The IUCN Red List of Threatened Species. Version 2015.2. IUCN, Gland, Switzerland and Cambridge, UK, 2018, <http://www.iucnredlist.org>. Accessed in January, 2018.
- APHA, AWWA, WPCF. Standard methods for examination of waters and waste waters, 17th Edition, American Publication Health Association., INC. New York. 1989, 1193.
- Trivedy RK, Goel PK. Chemical and biological methods for water pollution studies, Environmental Publication, Karad, 1986, 248.
- ISI Indian standard: tolerance limit for inland surface waters subject to pollution (second revision). Indian Standards Institution publication, India, 1982, 18.
- Dandapat AK. Fish fauna study of Samuka River. MSc Thesis submitted to Orissa University of Agriculture and Technology, Bhubaneswar, Orissa, India. 2015, 35.
- Rajashekhar AV, Lingaiah A, Sathyanarayana Rao MS, Ravi Shankar Piska. Journal of Aquatic Biology. 2007; 22(1):118-122.
- Mohanty SK, Mishra SS, Khan M, Mohanty RK, Anil Mohapatra A, Pattnaik AK. Ichthyofaunal diversity of Chilika Lake, Odisha, India: an inventory, assessment of biodiversity status and comprehensive systematic checklist (1916–2014). Check List. 2015; 11(6):1-19.
- Sarkar SD, Ekka A, Sahoo AK, Roshith CM, Lianthuamluaia, Roychowdhury A. Role of floodplain wetlands in supporting livelihood: a case study of Ansupa

- Lake. *Journal of Environmental Science*, 2015; 4(3):819-826.
34. Das MK, Samanta S, Sajina AM, Sudheesan D, Naskar M, Bandopadhyay MK *et al.* Fish diversity, community structure and ecological integrity of river Brahmani. *Journal of the Inland Fisheries Society of India*, 2016; 48(1):1-13.
 35. Sultana N, Islam MN. Fishing gears and methods in the Chalan Beel, Bangladesh. *Journal of Fisheries*. 2016; 4(2):377-384.
 36. Koul T. Freshwater Biodiversity in Asia with special reference to fish. World Bank Technical Washington, 2000; 59:343.
 37. Adebisi BA. *Hydrobiologia*, 1991; 79(2):157-165.
 38. Deshmukh, Ambore. *Journal of Aquatic Biolgy*, 2006; 21(2):93-96.
 39. Harishanker AJ, Bijukumar A. *Aquarium Fishes (A Colourful Profile)*. B.R. Publication Co., Delhi, 1998, 108.