



Biodiversity and Conservation Status of Fishes of River Sarada, Visakhapatnam District, Andhra Pradesh, India

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Available online at: www.isca.in, www.isca.me

Received 22nd October 2013, revised 19th January 2014, accepted 18th February 2014

Abstract

A survey was conducted on biodiversity of fish fauna and their conservation status of a freshwater river, Sarada in Visakhapatnam District of Andhra Pradesh, India with an objective to make a complete inventory of freshwater fishes and assess their conservation status. Regular bi-monthly sampling was conducted from January, 2011 to December, 2012 by using different nets with the help of artisanal fishermen. Fishes were also collected from local fish markets. We have collected 66 fish species belonging to 9 orders, 22 families and 38 genera. Order Cypriniformes was the dominant group with 26 species followed by Siluriformes and Mugiliformes each with 11 species, Perciformes with 7 species, Anguilliformes, Cyprinodontiformes and Mastacembeliformes each with 3 species and Osteoglossiformes and Elopiformes each with 1 species. Out of 66 species, 3 species are near threatened, 3 vulnerable, 4 at lower risk near threatened, 1 at lower risk least concern, 37 least concern, 15 not evaluated and for 3 species data is deficient as per IUCN (2013) Red List category. According to CAMP (1998) conservation status, 4 species are endangered, 13 vulnerable, 24 at lower risk near threatened, 2 at lower risk least concern, 22 not evaluated and for 1 species data is deficient.

Keywords: Biodiversity, CAMP, conservation, IUCN, Sarada River.

Introduction

Fish are an integral component of aquatic ecosystems. In addition to being a desired resource for users of the aquatic habitat, they play important role in energy flow, cycling of nutrients and maintaining community balance in the ecosystem. They form an important element in the economy of many nations as they have long been a staple item in the diet of many people. They constitute slightly more than one-half of total number approximately 54, 711 recognized living vertebrate species; there are descriptions of an estimated 27, 977 valid species of fishes¹. Our country is endowed with vast and varied resources possessing river ecological heritage and rich biodiversity. India is one of the mega biodiversity countries in the world and occupies the ninth position in terms of freshwater mega biodiversity². Biodiversity is essential for stabilization of ecosystem, protection of overall environmental quality for understanding intrinsic worth of all species on the earth³. Fish biodiversity of river essentially represents the fish faunal diversity and their abundance. Rivers conserve a rich variety of fish species which support to the commercial fisheries. There is an increasing concern worldwide for the loss of aquatic ecosystems and associated biodiversity⁴, particularly for riverine landscapes⁵.

Over the last century, riverine ecosystems have suffered from intense human intervention resulting in habitat loss and degradation and as a consequence, many fish species have become highly endangered, particular in rivers where heavy demand is placed on freshwaters. The main causes behind the

loss of biodiversity in freshwater are degradation and defragmentation of habitats⁶, water abstraction, industries and private use⁷, introduction of exotic species⁸, pollution⁹ and global climate change impacts^{10, 11}. Freshwater fish are one of the most threatened taxonomic groups¹² because of their high sensitivity to the quantitative and qualitative alteration of aquatic habits^{13, 14, 15}. For harnessing the aquatic resources, a scientific understanding of the fish species with respect to their morphological, biological and adaptive characters along with their natural distribution is imperative to back up their optimum exploitation. In this context it is aimed at assessment and documentation of the biodiversity of fish fauna of River Sarada, a freshwater river located in Visakhapatnam District (AP), India and thereby evaluating the conservation status of fish species, taking into consideration riverine health and makes the people more aware about their local environment and its conservation for their existence.

Material and Methods

Study area: River Sarada (17° 25' to 18° 17' N and 82° 32' to 83° 06' E) is located in Visakhapatnam District of Andhra Pradesh. It is a medium-sized river and has a catchment area of about 2,665 km². It rises at an elevation of 1,000 meters in the Eastern Ghats. It runs eastwards for a distance 122 km and joins the Bay of Bengal. The basin is surrounded by River Nagavali in the north, River Gosthani, Gambiramedda, Megadrigedda in the east Bay of Bengal in the South and Machhkund sub-basin of the River Godavari in the west.

Sampling: Sampling involved collection from various stations with the help of fishermen using indigenous fishing methods and by using different types of nets namely gill nets, cast nets and dragnets. Fishes were also purchased from the fishermen on the spot. We also visited local fish markets located on the banks of the river to monitor and look for the presence of any species which were not available during our experimental fishing. Immediately photographs were taken prior to preservation since formalin decolorizes the fish colour on long preservation. The specimens were preserved in 10% formalin and brought to the laboratory. They were fixed in formalin solution based on their size in separate jars. Smaller ones are placed directly while the larger ones were preserved after giving an incision on the abdomen before they were fixed in the formalin solution. Fishes were identified by using standard taxonomic keys for fishes of the Indian subcontinent^{16, 17, 18, 19}. Classification was done on lines of Day²⁰, Jayaram²¹, Nelson²² and Jayaram¹⁷. The fishes were labeled giving serial number, date of collection, place of collection, systematic position and common name on each jar. Conservation status of each fish was given based on the report on Conservation Assessment and Management Plan (CAMP) for freshwater fishes of India by Molur and Walker²³ and IUCN²⁴ Red List of Threatened Species.

Results and Discussion

Biodiversity reflects the number, variety and variability of living organisms as well as how these change from one habitat to another and over time. In view of global deterioration of environment, documentation of fish fauna from all the ecosystems has become important to know their present biodiversity status. During the two year study period we have recorded 66 species from 9 orders, 22 families and 38 genera. List of fish including common names and their conservational status were given in table 1. Cypriniformes with 26 (39.39%) species followed by siluriformes and mugiliformes each with 11 (16.66%), perciformes with 7 (10.60%), anguilliformes, cyprinodontiformes and mastacembeliformes each with 3 (4.54%) and osteoglossiformes and elopiformes each with 1 (1.51%) species were recorded. Among the families, cyprinidae with 26 (39.39%) species, bagridae with 4 (6.06%), siluridae, cichlidae, belontiidae, channidae and mastacembelidae each with 3 (4.54%), anguillidae, clariidae, ambassidae, nandidae, gobiidae and anabantidae each with 2 (3.03%) and notopteridae, megalopidae, moringuidae, schilbeidae, heteropneustidae, belonidae, oryziidae, aplocheilidae and mugilidae each with 1 (1.51%) species were recorded. Number and per cent contribution of different families, genera and species under various orders were shown in table 2 and figures 1 and 2. Order siluriformes and elopiformes each contributed 5 families followed by cyprinodontiformes and perciformes each 3, Anguilliformes 2 and osteoglossiformes, elopiformes, cypriniformes and mastacembeliformes each 1 family. Among the genera, *Puntius* with 8 species, followed by *Labeo* with 5, *Mystus* with 4, *Ompok*, *Colisa* and *Channa* each with 3, *Anguilla*, *Cirrhinus*, *Chela*, *Esomus*, *Clarias*, *Etroplus*, *Anabas*

and *Mastacembelus* each with 2 and remaining all genera each with 1 species were recorded.

In our present investigation, cypriniformes was the most dominant group with 26 species. Dominance of cypriniformes was also reported by several workers^{25, 26, 27, 28, 29}. Among the families, dominance of cyprinidae as seen during the present study is in accordance with the observations of Das and Sharma³⁰, Senthil Murugan and Prabakaran³¹, Das and Sabitry³², Choubey and Qureshi³³ and Acharjee and Barat³⁴.

Introduced or exotic species recorded from our study are *Oreochromis mossambicus*, *Osphronemus goramy*, *Cyprinus carpio*, *Clarias gariepinus*, *Ctenopharyngodon idella*. Among the exotic species, we found *Oreochromis mossambica* to be quite frequent. Invasiveness of *Cyprinus carpio* and *Oreochromis mossambica* in lotic systems seem to be a serious threat to other native fishes³⁵. *Clarias gariepinus* which is a carnivore and voracious feeder established itself in this river and become very serious threat to the smaller indigenous fish species. Studies suggest that native fish fauna is severely threatened by the introduction of alien species with regard to predation, competition for food and other resources, and also with the introduction of new pathogens³⁶⁻³⁹.

Mystus armatus, *Puntius conchoniensis*, *P. gelius*, *P. ticto*, *Labeo boga*, *Chanda nama*, *Cyprinus carpio*, *Oreochromis mossambica*, *Channa punctatus*, *Channa gachua*, *Heteropneustes fossilis*, *Catla catla*, *Cirrhinus mrigala*, *Labeo rohita* and *Labeo calbasu* are some of the important food fishes. Predatory fish recorded in our study are *Heteropneustes fossilis*, *Wallago attu*, *Mystus cavasius*, *Channa punctatus*, *Channa gachua*, and *Glossogobius giurinus* etc.

Present study revealed the occurrence of 53 species of ornamental fish. Some of the commercially important species are *Notopterus notopterus*, *Chela laubuca*, *Danio devario*, *Esomus danricus*, *Amblypharyngodon mola*, *Puntius chola*, *P. conchoniensis*, *P. gelius*, *P. sophore*, *P. terio*, *P. ticto*, *Osteobrama cotio*, *Mystus vittatus*, *Mystus cavasius*, *Pseudotropius atherinoides*, *Clarias batrachus*, *Heteropneustes fossilis*, *Xenontodon cancila*, *Aplocheilus panchax*, *Chanda nama*, *Badis badis*, *Nandus nandus*, *Glossogobius giurinus*, *Anabas testudineus*, *Colisa fasciatus*, *Colisa lalia*, *C. punctatus*, *Macrognathus aral*, *M. pancalus*, *Mastacembelus armatus* etc.

Out of sixty six species, species having high economic value are *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Walago attu*, *Ompok bimaculatus* and *Channa marulius*, and others have moderate economic value. The air breathing fishes such as *Clarias*, *Channa*, *Mastacembelus* and *Heteropneustes* fetch good market value as live fish. *Labeo calbasu* found to be rare species in our study.

According to the IUCN red list of threatened species, 4.54% (3) species are near threatened, 4.54% (3) vulnerable, 6.08% (4) at

lower risk near threatened, 1.51% (1) at lower risk least concern, 56.06% (37) least concern, 22.72% (15) are not evaluated and for 4.54% (3) species data is deficient. Out of 66 species recorded from the river, 6.06% (4) species are endangered, 19.69% (13) vulnerable, 36.36% (24) at lower risk near threatened, 3.03% (2) at lower risk least concern, 33.33% (22) are not evaluated and for 1 species data is deficient (Figure 3). *Anguilla bengalensis*, *Ompok bimaculatus*, *O. pabda* and

Pseudotropius atherinoides are the endangered species according to CAMP report whereas *Ompok bimaculatus*, *O. pabda* and *O. pabo* are near threatened species. *Catla catla*, *Cirrhinus reba*, *Puntius chola*, *P. sarana*, *P. vittatus*, *Mystus bleekeri*, *M. vittatus*, *Clarias batrachus*, *Heteropneustes fossilis*, *Anabas cobojus*, *A. testudineus*, *Channa gachua* and *Mastecembelus armatus* are vulnerable.

Table-1
Diversity and Conservation status of fish fauna recorded from Sarada River

S.No	Order	Family	Species	Common Name	IUCN Status	CAMP Status
1	Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Grey feather back	LC	LRnt
2	Elopiformes	Megalopidae	<i>Megalops cyprinoides</i>	Indo-Pacific Tarpon	DD	NE
3	Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i>	Indian Long fin eel	LC	EN
4			<i>Anguilla bicolor</i>	Short fin eel	LC	NE
5		Moringuidae	<i>Moringua raitaborua</i>	Purple spaghetti eel	NE	NE
6	Cypriniformes	Cyprinidae	<i>Catla catla</i>	Common carp	NE	VU
7			<i>Cirrhinus mrigala</i>	Mrigal	LC	LRnt
8			<i>Cirrhinus reba</i>	Reba carp	VU	VU
9			<i>Ctenopharyngodon idella</i>	Grass carp	NE	NE
10			<i>Cyprinus carpio</i>	Common carp	NE	NE
11			<i>Labeo bata</i>	Minor carp	LC	LRnt
12			<i>Labeo boga</i>	Boga labeo	LC	LRnt
13			<i>Labeo calbasu</i>	Black rohu	LRnt	LRnt
14			<i>Labeo fimbriatus</i>	Fringed-lipped peninsular carp	LC	LRnt
15			<i>Labeo rohita</i>	Rohu	LC	LRnt
16			<i>Osteobrama cotio</i>	Cotio	NE	LRnt
17			<i>Puntius chola</i>	Swamp barb	LC	VU
18			<i>Puntius conchonius</i>	Rosy barb	LC	LRnt
19			<i>Puntius gelius</i>	Golden dwarf barb	LC	NE
20			<i>Puntius sarana</i>	Olive barb	LC	VU
21			<i>Puntius sophore</i>	Spot fin swamp barb	LC	LRnt
22			<i>Puntius terio</i>	One spot barb	LC	LRnt
23			<i>Puntius ticto</i>	Two spot / Fire fin barb	LC	LRnt
24			<i>Puntius vittatus</i>	Green Stripe Barb	LC	VU
25			<i>Chela cachius</i>	Silver hatchet chela	LC	NE
26			<i>Chela laubuca</i>	Indian glass barb	LC	LRlc
27			<i>Amblypharyngodon mola</i>	Pale/Mola carplet	LC	LRlc
28	<i>Danio devario</i>	Bengal Danio	LC	LRnt		
29	<i>Esomus barbatus</i>	South Indian Flying barb	LC	NE		
30	<i>Esomus danricus</i>	Flying barb	LC	LRnt		
31	<i>Rasbora daniconius</i>	Black line rasbora	NE	LRnt		
32	Siluriformes	Bagridae	<i>Mystus bleekeri</i>	Day's mystus	LC	VU
33			<i>Mystus cavasius</i>	Gangetic mystus	LC	LRnt
34			<i>Mystus gulio</i>	Long whiskered catfish	NE	NE
35			<i>Mystus vittatus</i>	Striped dwarf catfish	LC	VU
36		Siluridae	<i>Ompok bimaculatus</i>	Indian butter fish	NT	EN

37			<i>Ompok pabda</i>	Butter catfish	NT	EN	
38			<i>Ompok pabo</i>	Pabdah fish	NT	NE	
39		Schilbeidae	<i>Pseudeutropius atherinoides</i>	Indian potasi	NE	EN	
40		Clariidae	<i>Clarias batrachus</i>	Walking catfish/Magur	VU	VU	
41			<i>Clarias gariepinus</i>		NE	NE	
42		Heteropneustidae	<i>Heteropneustes fossilis</i>	Stinging catfish	VU	VU	
43	Cyprinodontiformes	Belontiidae	<i>Xenentodon cancila</i>	Freshwater garfish	LC	LRnt	
44		Oryziidae	<i>Oryzias dancena</i>	Indian rice fish	LC	NE	
45		Aplocheilidae	<i>Aplocheilus panchax</i>	Panchax minnow	LC	DD	
46	Perciformes	Ambassidae	<i>Chanda nama</i>	Elongate glass perchlet	LC	NE	
47			<i>Parambassis ranga</i>	Indian glassy fish	LC	NE	
48		Nandidae	<i>Nandus nandus</i>	Mottled nandus	LRnt	LRnt	
49			<i>Badis badis</i>	Dwarf chameleon fish	LC	NE	
50		Cichlidae	<i>Etroplus maculatus</i>	Ornate chromid	LC	NE	
51			<i>Etroplus suratensis</i>	Green chromid	LC	NE	
52			<i>Oreochromis mossambica</i>	Mozambique tilapia	NE	NE	
53		Mugiliformes	Mugilidae	<i>Mugil cephalus</i>	Grey / Flat head mullet	LC	NE
54	Gobiidae		<i>Glossogobius giuris</i>	Tank/Bar-eyed goby	LC	LRnt	
55			<i>Gobiopsis macrostoma</i>		NE	NE	
56	Anabantidae		<i>Anabas cobojuis</i>		DD	VU	
57			<i>Anabas testudineus</i>	Climbing perch	DD	VU	
58	Belontiidae		<i>Colisa fasciatus</i>	Banded gaurami	LRnt	LRnt	
59			<i>Colisa labiosus</i>	Thick lip gaurami	NE	NE	
60			<i>Colisa lalia</i>	Dwarf gaurami	NE	NE	
61	Channidae		<i>Channa gachua</i>	Dwarf snakehead	LC	VU	
62			<i>Channa punctatus</i>	Spotted snakehead	LRnt	LRnt	
63			<i>Channa striatus</i>	Banded snakehead	LRlc	LRnt	
64	Mastacembeliformes		Mastacembelidae	<i>Macrognathus aral</i>	One striped spiny eel	LC	LRnt
65				<i>Macrognathus pancalus</i>	Barred spiny eel	NE	LRnt
66		<i>Mastacembelus armatus</i>		Zig zag spiny eel	NE	VU	
* EN – Endangered; NT – Near Threatened; VU – Vulnerable; LRnt – Lower Risk near threatened; LRlc – Lower Risk least concern, LC – Least Concern, DD – Data Deficient; NE – Not Evaluated							

Table-2
Number and percent composition of families, genera and species under various orders

S.No	Order	Families	Genera	Species	% of families in an order	% of genera in an order	% of species in an order
1	Osteoglossiformes	1	1	1	4.54	2.63	1.51
2	Elopiformes	1	1	1	4.54	2.63	1.51
3	Anguilliformes	2	2	3	9.09	5.26	4.54
4	Cypriniformes	1	12	26	4.54	31.57	39.39
5	Siluriformes	5	5	11	22.72	13.15	16.66
6	Cyprinodontiformes	3	3	3	13.63	7.89	4.54
7	Perciformes	3	6	7	13.63	15.78	10.60
8	Mugiliformes	5	6	11	22.72	15.78	16.66
9	Mastacembeliformes	1	2	3	4.54	5.26	4.54

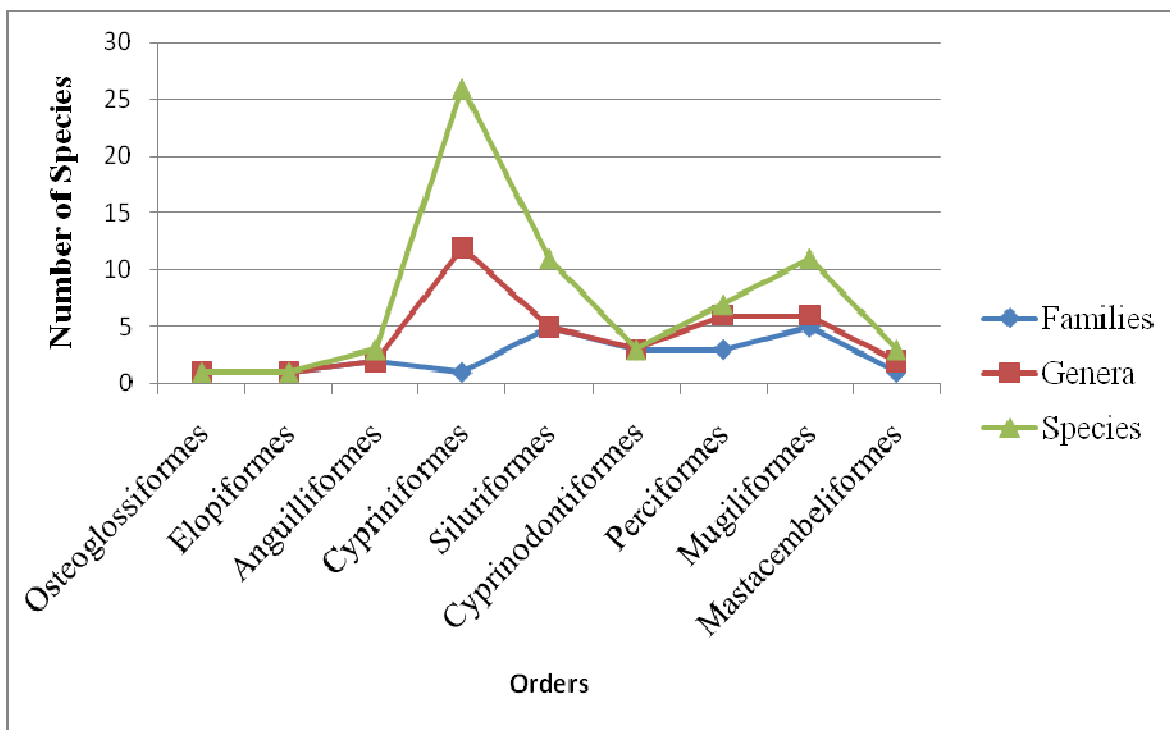


Figure-1
 Number of families, genera and species under various orders

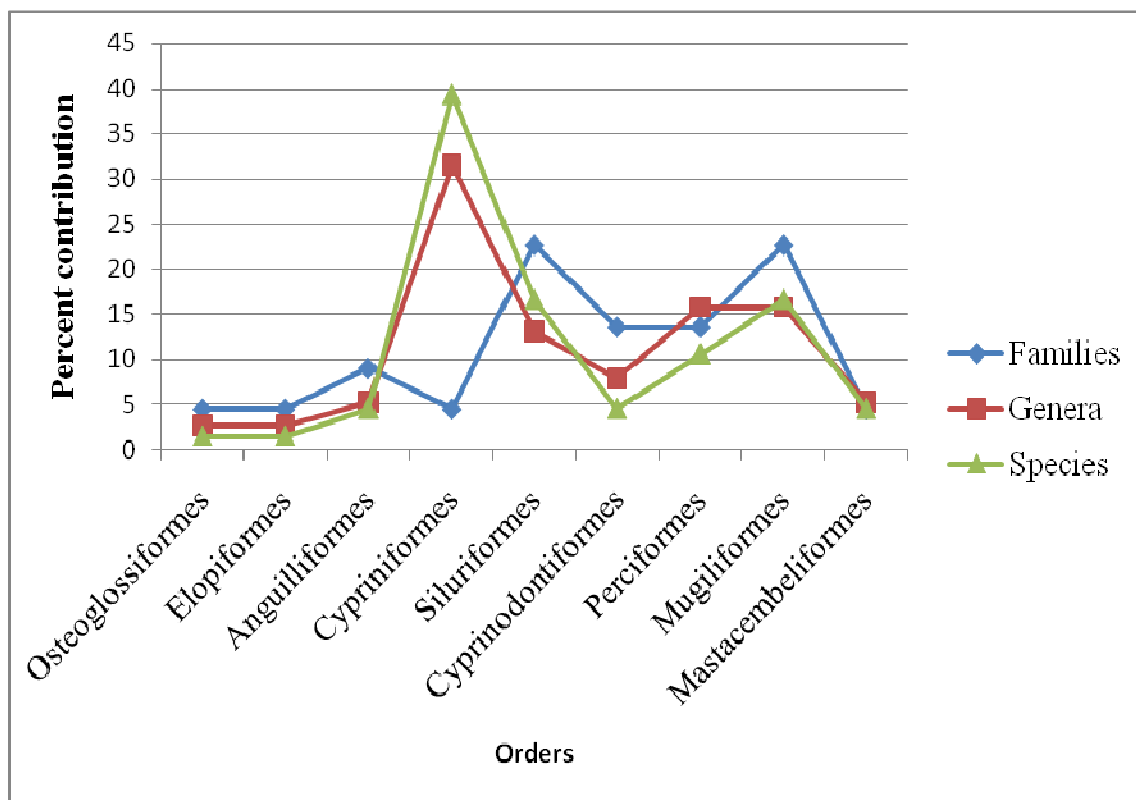


Figure-2
 Percent contribution of families, genera and species under various orders

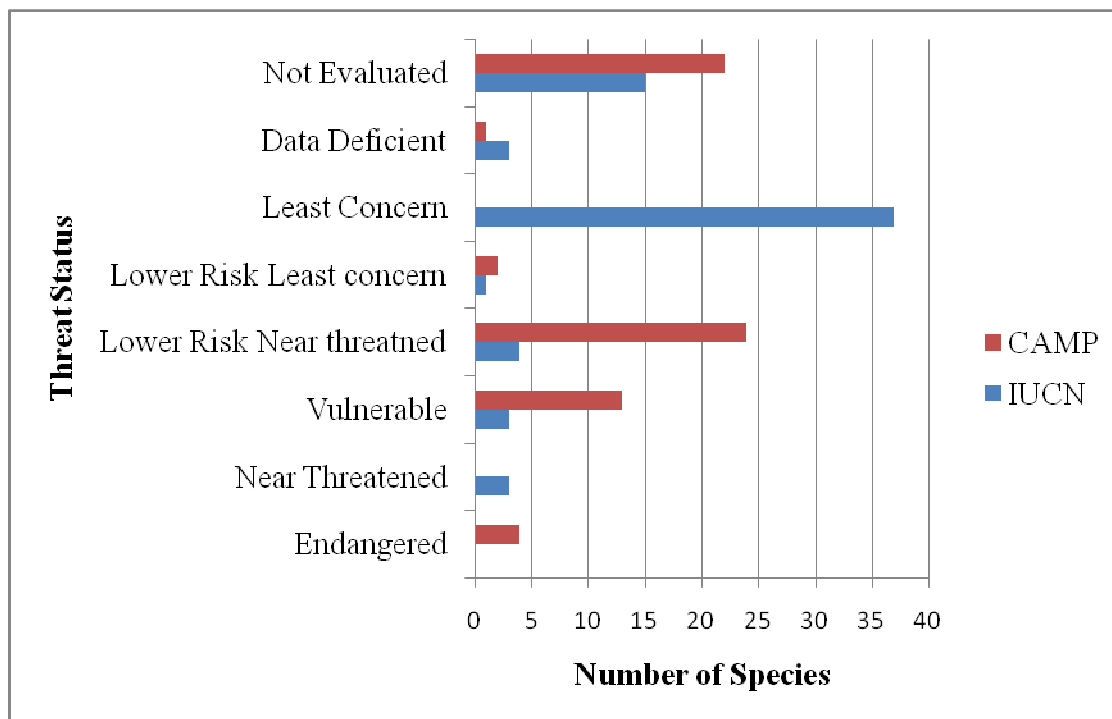


Figure-3
 Number of species under different categories of threat as per CAMP and IUCN

Conclusion

River Sarada hosts a number of freshwater fish species including globally threatened species. The fish fauna of the river is under threat due to several anthropogenic factors. Introduced species present in the river have been suggested as possible threats to the indigenous fish fauna. Other anthropogenic factors such as siltation, recreational activities are common in most of the stretches of the river. We have identified sand mining to be the most destructive threat to freshwater fishes of this river. These practices seem to have caused severe habitat destruction and decline of many important native food fishes. The fish fauna of this river is also subjected to over fishing. The large scale industrialization and the consequent effluent discharge are making the river almost lifeless or dead. Inorganic pollution of the river due to industrial activities is another important threat to the fish fauna. Since the fish fauna in this region also supports the livelihood of several economic classes there is an urgent need to understand the conservation priorities and to design and implement conservation action plans.

The conservation measures suggested in this river area include strict regulation and control over sand mining, controlling pollution and minimizing the threats caused by the increasing number of exotic species. Declaration of some portion of the river area as “fish sanctuary” could be the welcome step for conservation of threatened species. The most important conservational aspect of biodiversity conservation of this river is to be building up to create awareness in stake holders through

communication, cooperation and education. The present study is the first ever documentation of fish fauna of river Sarada in Visakhapatnam district, Andhra Pradesh. Our paper thus provides the basic step for detailed research on the freshwater fish fauna of riverine system mainly with regards to taxonomic, ecological and conservation studies.

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