Rec. zool. Surv. India: Vol. 120(4)/341–350, 2020
DOI: 10.26515/rzsi/v120/i4/2020/149942

ISSN (Online) : 2581-8686
ISSN (Print) : 0375-1511

First report on Ichthyofaunal Diversity of Purna Wildlife Sanctuary, Dang, Gujarat

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Abstract

Present manuscript describes ichthyofaunal diversity of the Purna Wildlife Sanctuary for the first time. A total of 16 species representing 4 orders, 7 families and 15 genera are recorded within the sanctuary. Cyprinidae is the family accounted for 6 species followed by the family Danionidae represented with 4 species and Mastacembelidae by 2 species, whereas Cobitidae, Nemacheilidae, Bagridae and Gobiidae each represented by 1 species.

Keywords: Biodiversity, Fish fauna, Gujarat, Purna, Wildlife Sanctuary

Introduction

Aquatic biodiversity plays a key role in the physical, chemical and biological processes of regional as well as of global change. Fishes are integral component of aquatic biodiversity and support the economy of many nations as they have been a staple item in the diet of majority of people. The Indian fish species represent about 8.9% of the known fish species of the world. Out of the total 2500 species from India, 930 species are freshwater inhabitants (Jayaram, 1999). (Gopi *et al.* 2017) have reported 1027 species of freshwater fishes from India. In India 65% of the total fish production during 2017-18 is from inland segment and about 50% of the total production is from culture fisheries and constitutes about 6.3% of the worldwide fish production (Anonymous, 2019).

Gujarat, the fifth largest Indian state, is located on the western coast of India with a coastline of 1,600 km – most of which lies on the Kathiawar peninsula. Gujarat state is well known for its diverse biodiversity due to its varied terrain. About 25,000 faunal species are found in Gujarat (Singh, 2014). A brief mention of Purna WL Sanctuary was given along with important vertebrates only excluding fish diversity by few researchers (Singh, 1998, 2001, 2014; Singh *et al.* 1999, 2000; Anonymous, 2001; Siliwal *et al.* 2003; Trivedi & Soni, 2006).

Purna Wildlife Sanctuary (161 km^2) lies between 20°51′N 73°32′E and 21°31′N 73°48′E and is in the Western Ghats Mountain range in two states of Gujarat and Maharashtra. In Gujarat, it lies in the south between Vyara, Tapi district and Ahwa, Dang district. It consists of southern Indian tropical moist deciduous forests, which can be further categorized into southern moist deciduous forests and southern dry deciduous forests (Singh *et al.* 2000; Anonymous, 2001). The sanctuary came into existence in July, 1990. Purna Wild-Life Sanctuary (PWLS) is well known for its unique biodiversity. The floral species found in sanctuary are *Pterocarpus marsupium*, *Bombax ceiba*, *Terminalia bellirica, Anogeissus latifolia, Dalbergia latifolia, Terminalia tomentosa, Lannea cormandlica, Madhuca indica, Tectona grandis, Lagerstroemia parviflora* and *Endrocalamus strictus*. Soil is deep on hills and slopes and mainly clayey, dominated by dry teak forest. The fauna of the Sanctuary is represented by 184 species of vertebrates (Anonymous, 2001).

The name Purna of the wildlife sanctuary is a derivative of the Purna River which flows through the sanctuary for about 32.25 kms and is the lifeline of the sanctuary. Topographic terrain of the sanctuary is uneven and hilly in nature with Gira and Purna Rivers meander through it. The northern area constitutes the catchment of Gira while southern area forms catchment of Purna. The climate is generally dry with typical southwest monsoon climate experiencing four clear seasons. The two major Rivers of Purna Wildlife Sanctuary, Gira and

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Article Received on: 30.12.2019 Accepted on: 01.04.2020

Purna, receive water from streams which originate from central east to west. The Purna River rises in Saputara Hill ranges in the Dang district and flows throw Chinchli, Mahal, Kalibel and Borigaontha. The River after leaving the boundary of Dang district flows through the Vyara taluka, Surat district and finally merges with Arabian Sea in Navsari district. The Gira River is situated in Dang district and flows from Malangdeo Otta on the north-east side of the sanctuary including Singana, Girmal, Dhulda and Bardipada villages before joining River Mindhola in Songadh taluka, Surat district. Besides, there are some stagnant water pools formed during summer in riverbeds.

Perusal of literature shows that very few studies have so far been made on fish diversity of the forest protected waters and their conservation potential with reference to freshwater ecosystem. Though the fishes form a source of livelihood and food of the local inhabitants in the Purna Wildlife Sanctuary but, still not worked out taxonomically. Fish samples were collected from different stretches of Purna and Gira Rivers to evaluate pattern of fish diversity, composition, abundance and habitat description within the sanctuary during 2019.This is the first record of fish faunal diversity from the Purna Wildlife Sanctuary.

Material and Methods

Survey of fish faunal diversity of the sanctuary was conducted during December, 2019. All the five ranges *viz.:* Bardipada, Kalibel, Bheskatri, Singana and Ahwa (W) were surveyed. Fishes were collected by cast nets, hand, scoop and drag net and fixation and preservation was doneusing 5-10% formalin. The fish species were identified after Talwar & Jhingran (1991), Jayaram (1999) and Froese and Pauly (2019) [FishBase, ver. 8/2019)]. Fishermen catch was also evaluated at few locations to establish the identity of species. All the materials used in this study were collected by S. Kumar, H.S. Banyal and Indu Sharma inside Purna WLS and measurements given are of Standard Length (SL).

Results

Fish faunal component of this unique protected area still needs detailed investigation to fill the existing gap. Due to good Monsoon in the year 2019 all the river wetlands particularly Gira and Purna were full of water. These rivers are the lifeline of the sanctuary as they contribute immensely to enhancing more diversity and higher density of biota in this ecosystem. The landscape was lush green with good cover of grasses (Figure 1&2).

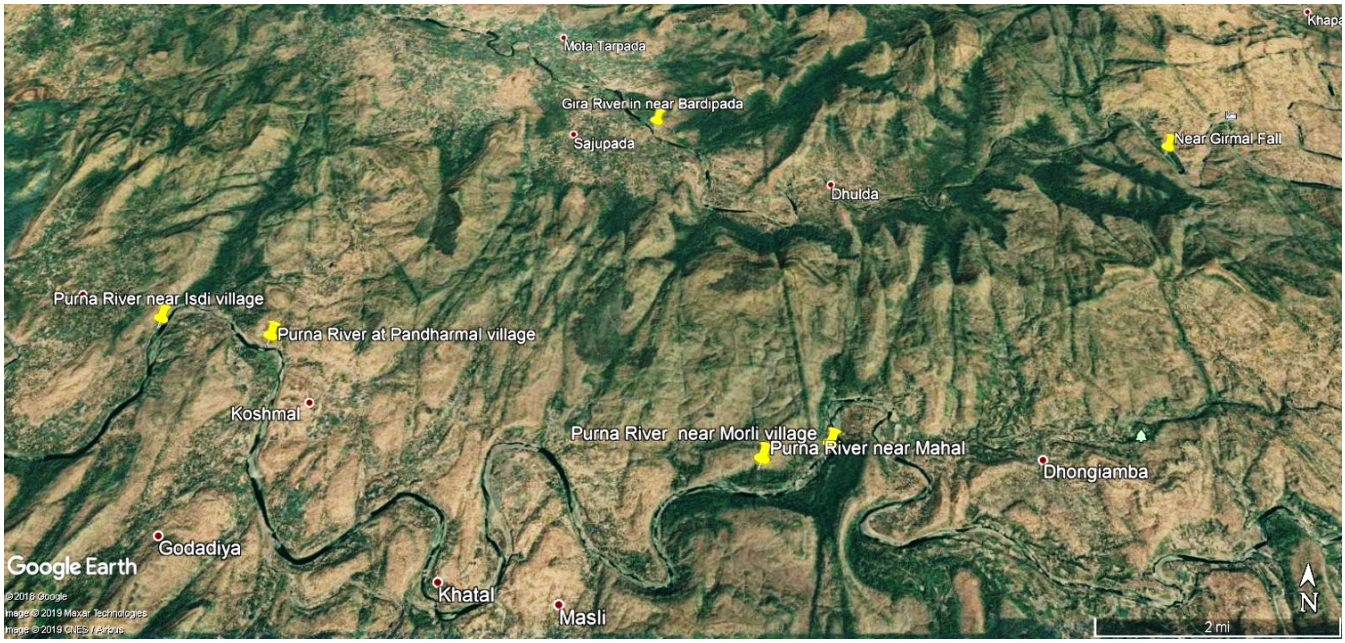

Figure 1. Satellite image depicting area of study.
Source: Google Earth

Figure 2. Area of study and methodology adopted for fish collection, **A**. Operation of gill net in Purna River, near Morli village; **B**. Operation of cast net in Purna River; **C.** View of Gira River in Bardipada range; **D**. View of Gira River in Singana rage.

This study was conducted mainly in the Purna and Gira River crossing the Sanctuary. Around the banks/catchment area dense tree cover primarily including teak, khair, sadad, bamboo, haldu, karanj, tanach, chopadi etc., with good grass cover was observed at most of the study point locations. Availability of water in both rivers is directly linked with the rainfall. Both the rivers are mainly ephemeral. During the survey, fair fish diversity was found in Purna River due to the presence of heterogeneous habitats in the form of riffles, pools and run with bed material mainly made up of rocks and boulders with few cobbles and undulating land around banks. Purna River at Mahal and Morali village offered best conditions for the fish fauna. Deep water pools were observed at both the locations. Nine spp. were recorded from the Mahal whereas eight from the Morali point location. These water pools as per information given by locals don't dry even in summer period, hence, are vital for continuation of fish diversity in the river. Gira River comparatively offered fewer ideal conditions for the fish fauna, only four fish species, comprising of minnows mainly were recorded from the river, owing to the presence of shallow water and less habitat heterogeneity.

A total of 16 species (Plate 1 & 2) representing 4 orders, 7 families and 15 genera are recorded within the sanctuary. Taxonomical details of all the species are given below:

Systematic Account

Phylum CHORDATA

Class ACTINOPTERYGII

Order CYPRINIFORMES

Family CYPRINIDAE Rafinesque, 1815

1. *Puntius sophore* (Hamilton, 1822) (Spotfin swamp barb, Pool barb)

1822. *Cyprinus sophore* Hamilton, *An account of the fishes found in the river Ganges*: 310, 389; pl. 19, fig. 86.

1999. *Puntius sophore*: Jayaram, *The Fresh Water Fishes of the Indian Region*: 114.

Material examined: V/4120, 4 ex, 5.4–6.0 cm, Purna River near Mahal village, 21.xi.2019.

Distribution: Throughout India including Gujarat.

Remarks: This gorgeously colored species with two black spots – one at base of dorsal fin rays and other at base of forked caudal fin, was equitably common in the Purna River. It is consumed as food by many birds observed in the sanctuary.

2. *Pethia ticto* (Hamilton, 1822) (Ticto Barb)

1822. *Cyprinus ticto* Hamilton, *An account of the fishes found in the river Ganges*: 314, 389, Pl. 8, fig. 87.

2012. *Pethia ticto*: Pethiyagoda *et al*., *Ichthyol. Explor. Freshwaters,* **23**(1): 81.

Material examined: V/4121, 5 ex, 4.0–4.5 cm, Purna River near Mahal village, 21.xi.2019.

Distribution: Widely distributed in India. Abundantly found in the Purna and Gira rivers.

Remarks: It is a popular aquarium barb, easily identified with a long slanting black blotch above the pectoral fin and another similar but with golden edges on caudal peduncle over the end of anal fin.

3. *Pethia phutunio* (Hamilton, 1822) (Cherry barb, Crimson carplet)

1822. *Cyprinus phutunio* Hamilton, *An account of the fishes found in the river Ganges*: 319, 390.

2015. *Pethia phutunio*: Katwate *et al., Zootaxa,* **3964**(4): 414.

Material examined: V/4142, 05 ex, 4.9 –5.0 cm, Purna River near Isdi village, compartment-82, Bheskatri Range, 24.xi.2019.

Distribution: Widely distributed in India, found in rivers and streams including muddy water.

Remarks: It is an extremely attractive small sized barb of Indian waters with flanks and belly marked with shining silver color, incomplete lateral line and fins reddish with dark edges.

4. *Systomus sarana* (Hamilton, 1822) (Olive barb)

1822. *Cyprinus sarana*: Hamilton, *An account of the fishes found in the river Ganges*: 307, 388.

2013. *Systomus sarana*: Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 166.

Material examined: V/4122, 2 ex, 8.7–11.2 cm, Purna River near Mahal village, 21.xi.2019; V/4131, 4 ex, 11.0–11.5 cm, Purna River near Morali village, 26.xi.2019; V/4147, 02 ex, 10.7–11.2 cm, Purna River near Pander village, 26.xi.2019.

Distribution: Widely distributed in India, found in rivers and streams, preferring deep pools.

Remarks: The population of this fish was abundant in Purna River. A dark blotch present on lateral line before caudal base in deep body.

5. *Garra mullya* (Sykes, 1839) (Mullya garra, Stone Sucker)

1841. *Chondrostoma mullya* Sykes, *Trans. Zool. Soc. London*, **2**: 359, pl. 62, fig. 3.

2019. *Garra mullya*: Shangningam *et al., Zootaxa,* **4695**(2): 153.

Material examined: V/4123, 6 ex, 9.5–14.5 cm, Purna River near Mahal village, 21.xi.2019; V/4129, 3 ex, 8.5–12.5 cm, Purna River near Morali village, 26.xi.2019; V/4139, 3 ex, 9.2–13.5 cm, Gira River in Compartment 52, Bardipada Range, 22.xi.2019; V/4140, 1 ex, Gira River near Girmal village, 23.xi.2019; V/4147, 2 ex, 9.5–14.4 cm, Purna River at Pander Village, Kalibel Range, 22.xi.2019.

Distribution: Widely distributed in India, found in rivers and streams with rocky substratum. This fish was very commonly noticed in Purna and Gira Rivers.

Remarks: This fish is most widely found species of *Garra* genus, probably progressively adapting the environment of torrent hill streams. Body coloration of the fish is darkish, dull white on abdomen; a black spot seen behind angle of operculum.

6. *Tor tor* (Hamilton, 1822) (Mahseer)

1822. *Cyprinus tor* Hamilton, *An account of the fishes found in the river Ganges*: 305, 388.

2013. *Tor tor*: Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 169.

Material examined: V/4130, 2 ex, 2.9–5.4 cm, Purna River near Morali village, 26.xi.2019; V/4144, 3 ex,

16.7–19.7 cm, Purna River at Pander Village, Kalibel Range, 22.xi.2019.

Distribution: Widely distributed in India, found in rivers and streams including muddy water.

Remarks: This big-headed greenish gold colored fish is greatly in demand due to its good flesh quality, known as Mahseer, this fish gives good fight to anglers. Very few specimens of this fish were collected during present research work.

Family DANIONIDAE Bleeker, 1863

7. *Rasbora daniconius* (Hamilton, 1822) (Blackline rasbora)

1822. *Cyprinus daniconius* Hamilton, *An account of the fishes found in the river Ganges*: 327, 391, Pl. 15. fig. 89.

2018. *Rasbora daniconius*: Bleher, *Indian Ornamental Fishes*, **1**: 748.

Material examined: V/4119, 05 ex, 5.5–9.4 cm, Purna River near Mahal village, 21.xi.2019.

Distribution: Extensively distributed in India. It was recorded in good numbers from Purna river.

Remarks: It offers food to many birds in this area. A blue black mid lateral streak outspreads from eye to base of caudal fin edged by a thin metallic golden line is a distinct morphological character of this species.

8. *Devario aequipinnatus* (McClelland, 1839) (Giant Danio)

1839. *Perilampus aequipinnatus* McClelland, *Asiat. Res*., **19**(2): 393, pl. 60, fig. 1.

2013. *Devario aequipinnatus*: *The Raffles Bulletin of Zoology,* Suppl. (27): 98.

Material examined: V/4124, 8 ex, 4.7–6.7 cm, Purna River near Mahal village, Purna WLS, 21.xi.2019; V/4144, 1 ex, Purna River at Pander Village, 26.xi.2019.

Distribution: Widely distributed in India, found in hill streams. This was quite common in Purna River.

Remarks: This beautiful brilliant blue colored fish with thin golden bands is an ideal aquarium fish due to its hardy nature.

9. Barilius bendelisis (Hamilton, 1807) (Hamilton's barila)

1807. *Cyprinius bendelisis* Hamilton, *Journey to Mysore*, **3**: 345.

1999. *Barilius bendelisis*: Jayaram, *The Fresh Water Fishes of the Indian Region*: 70.

Material examined: V/4128, 1 ex, 9.9 cm, Purna River near Morali village, 26.xi.2019,

Distribution: Widely distributed in India, found in rivers and streams.

Remarks: It is known for its well-marked sexual dimorphism. Each lateral line scale is having two black spots; fins yellowish with orange hue. It was rarely found in the water bodies of the Purna Wildlife Sanctuary.

10. *Opsarius barna* (Hamilton, 1822) (Barna baril)

1822. *Cyprinus (Barilius) barna* Hamilton, *An account of the fishes found in the river Ganges*: 268.

2013. *Opsarius barna*: Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 131.

Material examined: V/4138, 5 ex, 2.5–3.0cm, Gira River in Compartment 52, Bardipada Range, 22.xi.2019.

Distribution: Mainly found in the hill streams and large rivers of India. This fish was noticed very less in the Purna and Gira Rivers.

Remarks: It is very small sized fish with greenish silvery colour and seven to nine vertical bars; of no interest to fishermen.

Family COBITIDAE Swainson, 1838

11. *Lepidocephalichthys guntea* (Hamilton, 1822) (Guntea loach)

1822. *Cobitis guntea* Hamilton, *An account of the fishes found in the river Ganges*: 353, 394.

2013. *Lepidocephalichthys guntea*: Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 179.

Material examined: V/4136, 1 ex, 4.6 cm, Gira River in Compartment 52, Bardipada Range, 22.xi.2019.

Distribution: Widely distributed in India, found in rivers and streams with clear water.

Remarks: It is a small sized fish with round deep black blotch at base of caudal fin and 2-3 lateral bands along sides can be used as an aquarium fish.

Family NEMACHEILIDAE Regan, 1911

12. *Schistura denisoni* (Day, 1867) (Stone loach)

1867. *Nemacheilus denisoni* Day, *Proc. Zool. Soc. Lond*., **1867**: 287.

2012. *Schistura denisoni*: Kottelat, *Raffles Bulletin of Zoology*, Suppl. (26): 108.

Material examined: V/4127, 4 ex, 1.4–2.0 cm, Purna River near Mahal village, 21.xi.2019; V/4137, 2 ex, 1.6–2.5 cm, Gira River in compartment-52, Bardipada Range, 22.xi.2019; V/4141, 2 ex, 2.2–2.5 cm, Gira River near Girmal, Singana Range, 23.xi.2019; V/4143, 2 ex, 1.3–2.2 cm, Purna River near Isdi village, compartment-82, Bheskatri Range, 24.xi.2019; V/4148, 1 ex, Purna River at Pander village, 26.xi.2019.

Distribution: Mainly found in Peninsular India.

Remarks: This small sized fish with a black spot present at the base of origin of dorsal fin and varying rows of brownish spots on Dorsal and caudal fins is of no interest to fishermen. Population of this fish was quite good in the sanctuary.

Order SILURIFORMES

Family BAGRIDAE Bleeker, 1858

12. *Mystus bleekeri* (Day, 1877) (Day's Mystus)

1877. *Macrones bleekeri* Day, *The fishes of India*, (3): 451, pl. 101, fig. 1.

2019. *Mystus bleekeri*: Darshan *et al.*, *Zootaxa,* **4648**(3): 521.

Material examined: V/4132, 4 ex, 11.5–13.9 cm, Purna River near Morali village, 26.xi.2019.

Distribution: Widely distributed in India, found in rivers and lakes mainly.

Remarks: This fish with four pairs of barbels and a dark spot on shoulder is not in much demand. It was recorded at one-point location from the Purna River only.

Order SYNBRANCHIFORMES

Family MASTACEMBELIDAE Swainson, 1839

13. *Macrognathus pancalus* Hamilton, 1822 (One-stripe spiny-eel)

1822. *Macrognathus pancalus* Hamilton, *An account of the fishes found in the river Ganges*: 30, 364.

Material examined: V/4125, 1 ex, 9 cm, Purna River near Mahal village, 21.xi.2019; V/4133, 1 ex,13 cm, Purna River near Morali village, 26.xi.2019.

Distribution: Widely distributed in India, found in fresh and brackish waters. Rarely found in the waters of the sanctuary.

Remarks: This eel like fish with greenish-olive along back, yellowish on belly, with many yellowish white spots on flanks and often banded with dark brown vertical bands is considered as a nutritious food. Found in almost all the lowland aquatic habitats.

14. *Mastacembelus armatus* (Lacepede, 1800) (Tire-track spiny-eel)

1800. *Macrognathus armatus* Lacepede, *Hist. nat. poiss.,* **2**: 283, 286.

2013. *Mastacembelus armatus*: Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 312.

Material examined: V/4134, 2 ex., 23.5–27 cm, Purna River near Morali village, 26.xi.2019.

Distribution: Widely distributed in India, found in fresh and brackish waters of hills as well as plains. It is rarely recorded from the waters of the sanctuary.

Remarks: This dull brown colored fish with one to three darker, longitudinal zig-zag lines, constitutes incredibly good food. Greatly in demand in most parts of India.

Order GOBIIFORMES

Family GOBIIDAE Cuvier, 1816

15. *Glossogobius giuris* (Hamilton, 1822) (Tank goby)

1822. *Gobius giuris*: Hamilton, *An account of the fishes found in the river Ganges:* 51, 366, Pl. 33, fig. 15.

2013. *Glossogobius giuris:* Kottelat, *The Raffles Bulletin of Zoology,* Suppl. (27): 407.

Material examined: V/4126, 1 ex, 9.5 cm, Purna River near Mahal village, 21.xi.2019; V/4135, 1 ex., 7.7 cm, Purna River near Morali village, 26.xi.2019.

Distribution: Extensively distributed in India, found in freshwater and estuaries including sea. It was noticed rarely in Purna River.

Remarks: This brownish yellow colored fish with 5 to 6 dark and rounded spots on sides forms minor fishery and is of no interest.

Discussion

Ichthyofaunal diversity of the Purna Wildlife Sanctuary majorly comprises of seven families. The family Cyprinidae was accounted for 6 species followed by the family Danionidae, represented by 4 species and Mastacembelidae by 2 species, whereas Cobitidae, Nemaccheilidae, Bagridae and Gobiidae represented by one species each. *Garra mullya*, *Schistura denisoni, Pethia ticto* and *Puntius sophore*, were the most dominant species followed by subdominant *Devario aequipinnatus*, *Systomus sarana* and *Rasbora daniconius*, while *Glossogobius giuris*, *Tor tor*, *Mastacembelus armatus*, *Macrognathus pancalus*, *Opsarius barna*, *Mystus bleekeri*, *Pethia phutunio*, *Barilius bendelisis* and *Lepidocephalichthys guntea* were observed to be very less in the total fish catch.Species, such as *S. sarana, G. mullya*, *T. tor*, *M. armatus*, *M. pancalus, M. bleekeri* and *B. bendelisis,* are well known for their utility as preferred food fish, whereas, *S. denisoni, P. ticto, P. sophore*, *D. aequipinnatus, R. daniconius*, *O. barna*, *P. phutunio* and *L. guntea* provide an ideal option for their use as aquarium fishes due to their docile nature. *Glossogobius giuris* is a fish with little commercial importance.

According to IUCN (2019) status, except for *T. tor* and *D. aequipinnatus* which are included in Data Deficient (DD) category, remaining fish spp. are included in Least Concern (LC) category. Furthermore, it is revealed based on present study that minnows dominate total catch as compared to major carps and other important big sized fishes belonging to different fish orders. Most of the minnows like *G. mullya* and *S. denisoni* are found to flourish well in the rocky bed of these rivers due to presence of adhesive apparatus. Extensive use of explosive for killing fishes coupled with rampant and unregulated day and night illegal fishing with undersized mesh and, moreover, natives using mosquito nets for fishing out even the fries and fingerlings of different species found in said rivers. The ever-increasing human pressure has increased tremendously on these water bodies in the otherwise desolate environment of the sanctuary. Aforesaid anthropogenic activities are accounting for decrease in number of major fishes in total fish catch.

It is recommended to enhance habitat protection along with ensuring good water quality which can support rich diversity of aquatic faunal species including fishes. Furthermore, the protection of fish fauna of the said aquatic resources can be achieved by scientific study of elementary ecology, fish taxonomy, habitat preference of the fishes. Moreover, evaluation and assessment of anthropogenic and ecological factors along with safeguarding the breeding grounds, illegal fishing means should be strictly dealt with and prevention of environmental degradation, stocking of native fish yearlings in the rivers will be helpful for enhancing depleting population of these fish species. Stringent management strategies and awareness programme initiation must be increased towards conservation. It is essential to identify some appropriate segments of the rivers for declaring as protected zones, so that the population of native fish fauna may be conserved.

Acknowledgements

Authors are greatly thankful to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata, for providing opportunity and required facilities to undertake the present work. Our thanks are also due to Forest Department of Gujarat for necessary permission to conduct survey of the Purna Wildlife Sanctuary, Gujarat.

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Plate 1

Rasbora daniconius (Hamilton, 1822)

Puntius sophore (Hamilton, 1822)

Pethia ticto (Hamilton, 1822)

Tor tor (Hamilton, 1822)

Pethia phutunio (Hamilton, 1822)

Systomus sarana (Hamilton, 1822)

Devario aequipinnatus (McClelland, 1839)

Barilius bendelisis (Hamilton, 1807)

Plate 2

Lepidocephalichthys guntea (Hamilton, 1822)

Schistura denisoni (Day, 1867)

Mystus bleekeri (Day, 1877)

Glossogobius giuris (Hamilton, 1822)

Mastacembelus armatus (Lacepede, 1800)

Macrognathus pancalus (Hamilton, 1822)