Diversity and Threat to Cold-Water Fishes of the Torsa River at the Terai Region of West Bengal, India

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Abstract

Rivers are the lifeline of mankind and provide livelihood to the riparian. Biodiversity is an important issue for environmental and biological stability. Biodiversity totally depends on climate, temperature, and natural resources. A huge diversity of flora and fauna are present in Terai and Duars regions of North Bengal, India. The Terai region of West Bengal has the Torsa River as a perennial river with a total length of 358 km. Its origin is from the Chumbi Valley in Tibet, which later joins Kaljani at Balarampur, North Bengal, India, and finally meets with the Brahmaputra by the name of Kaljani in Bangladesh. The Torsa receives a tributary of the Raidak River 29 km southeast of Koch Bihar. More than 100 ichthyofaunal diversities are recorded from this stretch. *Cyprinidae*, *Bagridae*, *Sisoridae*, and *Cobitidae* are the dominating families in Torsa River and its tributaries. However, there are several threats encountered to destroy the fish diversity and their environment. Some of the natural factors like alteration of river flow and sedimentation and anthropogenic factors like water pollution, overfishing, and use of nonconventional fishing gear indicate that the ecosystem is at risk. According to IUCN, 22 species are categorized under the "rare" or "very rare" category. There is an urgent need to investigate further the declining trend of fish species for their conservation. Nevertheless, socioeconomic development is

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P. K. Pandey et al. (eds.), *Fisheries and Aquaculture of the Temperate Himalayas*,
https://doi.org/10.1007/978-981-19-8303-0_5

nearly absent in this area. It is also marked by the accumulation of varied natural resources like forest, water (both surface and subsurface areas), medicinal plants, ferns and fodders, etc., including human resources. The present chapter explores the possibilities of optimum utilization of resources toward the fulfillment of fishery management and rapid economic upliftment of the people residing in and around.

Keywords

Fish diversity · Riverine fishery · Torsa River · Fishing methods · Conservation

5.1 Introduction

Riverine fishery resources in India provide ample food supply and livelihood security to millions of people, especially in rural areas. The country is bestowed with rich riverine resources having 14 major rivers covering 83% of the drainage basin and contributing 85% of surface flow (Das et al. 2012). The Indian rivers support one of the richest biodiversity reserves in the world (Vass et al. 2011), and the checklist showed that the primary freshwater fish species were 1035 in number (Froese and Pauly 2021). Identification and documentation of fish diversity and its population structure are very important in estimating the fishery potential of the river. The fish species diversity in the rivers mainly depends on various ecological variables, viz., size of the river, surface area, mean annual river discharge, temperature, depth, water movement, channel morphology, substrate, and climate (Welcomme 2002; Bunn and Arthington 2002; Proff and Zimmerman 2010). For the last few decades, riverine ecosystems have suffered the most due to human interventions that have resulted in water quality degradation and habitat loss; consequently, several fish species have become endangered (Lakra et al. 2010). Besides, Indian rivers are under severe threat due to excessive erosion, deposition, shifting of riverbanks (Resmi et al. 2019), and anthropogenic exploitation of fish resources, as is noticed in Torsa River (Sarkar et al. 2015). Inland water resources of Asian countries are heavily exploited due to the rapid growth of populations, increasing demands for irrigation, exploitation of fish, transportation, and industrial development (Dubey et al. 2012). For this, a sustainable river management plan must be carried out comprehensively (Boon 2000). The riverine capture fishery resources showed a declining trend in recent years due to anthropogenic stress resulting from water obstruction, increased sedimentation in the riverbed, environmental degradation due to industrial and domestic effluents, the introduction of exotics, indiscriminate fishing, pollution, and climate change (Boopendranath et al. 2002; Vass et al. 2011; Das et al. 2012, 2013).

Torsa is one of the most important transboundary rivers traversing through hills in Bhutan into the Terai region of North Bengal and ultimately flowing into the Brahmaputra drainage system in Bangladesh. It rises from the Chumbi Valley in Tibet, known as Machu. It flows into Bhutan, where it is known as the Amo Chu, and

Fig. 5.1 A view of Torsa River in Koch Bihar, the Terai region of West Bengal

finally, it flows into West Bengal, India, and Bangladesh, where it is called Torsa. The river is a glacier-fed perennial ecosystem exhibiting fast-flowing mesohabitat in its higher reaches and moderately flowing shallow to deep run along lower stretches. This basin area comprises mainly three blocks which are Cooch Behar-I, Cooch Behar-II, and Mathabhanga-II. All those blocks in this basin area provide huge possibilities for applied geomorphological and hydrological investigation, which have attracted many intellectuals from different fields of knowledge.

This varying degree of longitudinal mesohabitat distribution supports a rich diversity of fishes, many of which are typically associated with cold-water habitat, thus, forming important recreational as well as subsistence-level fishery along the Terai region of North Bengal (Fig. 5.1). The high degree of species richness of fishes has been a subject of study since many decades, viz., Shaw and Shebbeare (1937), Hora and Gupta (1941), Menon (1954), Jha et al. (2004), Chakraborty and Bhattyacharjee (2008), Sarkar and Pal (2008, 2018), Acharjee & Barat (2014), Patra and Datta (2010); Das (2015); Debnath (2015), Dey et al. (2015), and Sarkar (2018). Sarkar et al. (2015) did a rapid survey on ornamental fish diversity of Torsa River and listed 24 indigenous ornamental fish species, belonging to 8 orders, 12 families, and 19 genera. Recently from the river, 53 fish species were reported by the researchers; out of that, 37 species belonged to small indigenous fish species. However, most of these studies had focused on diversity rather than a little on the fishery. The information on the most basic fishery level traits, viz., catches per unit hour, catch composition, and length-weight relationship, could be beneficial for the management of the fisheries sector not only in the Torsa River but also in other ecologically similar riverine stretches of the Brahmaputra drainage system. There is a big threat to indigenous cold-water fishes due to the introduction of exotic fishes. A large number of exotic fishes are recorded by Singh and Lakra (2011).

5.2 Experimental Survey of the Torsa River

The study was conducted to document the status of fish diversity, environmental threat, and socioeconomic parameters covering the representative stream reaches with three sampling stations across the 100-km-long main channel of the Torsa River, located in West Bengal, India (Fig. 5.2), from December 2014 to February 2016. The spatial stratification of the study design was based on the hydrological dynamics, geomorphology, and published literature. The upper stretch of the river is highly rocky and scattered with cobbles and boulders in some parts, while the lower stretch is mainly sandy with dispersed pebbles. The temporal stratification in the study design was based on river basin seasonal hydrology. The selection of stations was based on river geomorphic (stream order, sinuosity), hydro-ecology (intermittent or regular riverine stretch), basin geomorphology, accessibility, and availability of published literature on riverine fishes. These sampling stations were Jaldapara (Site-S1), Kachuban (Site-S2), and Tufanganj (Site-S3) (Fig. 5.1). The station code S1 represents the upper, S2 represents the middle, and S3 represents the lower stretch of the river.

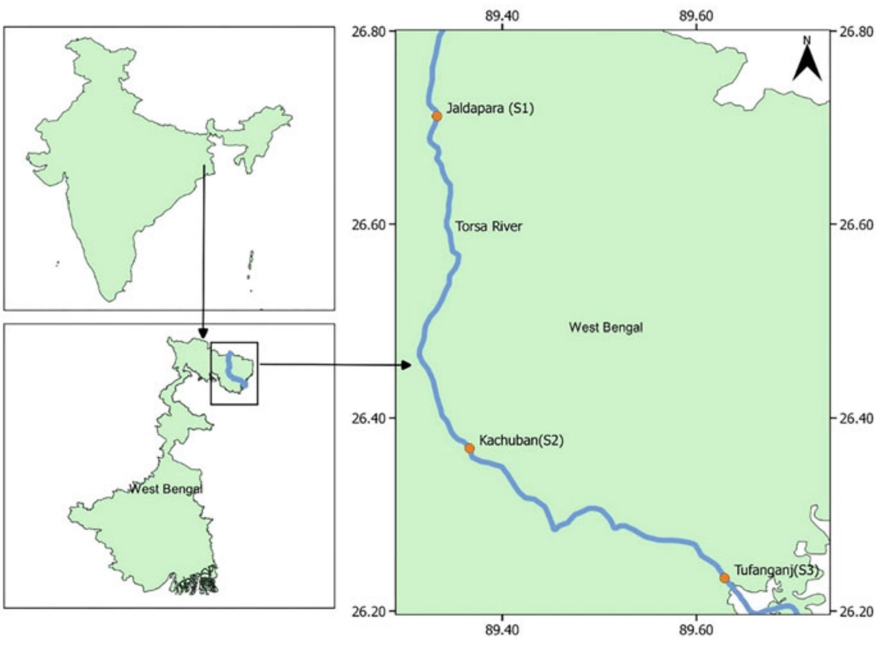


Fig. 5.2 Study area map of Torsa River, West Bengal, India

The sampling strategy adopted ad hoc use of multiple gears of various mesh sizes, viz., gill nets (10–120 mm), scoop net (0 mm), cast net (10–30 mm), deploying hook and lines (no. 25 to no. 10), local traps, etc. to ensure finfish representation across all available habitat guilds. The collected samples consisted of fish specimens caught through diurnal experimental fishing operations employing experienced fishers. Phenotypically distinct fish specimens were identified at the field. The rest of the specimens were fixed in 10% formaldehyde solution and brought back to the laboratory at ICAR-CIFRI, Barrackpore, for taxonomic identification using standard taxonomic keys (Talwar and Jhingran 1991; Jayaram 1981, 2010). The fishes were classified following Van der Laan et al. (2022). The identification and quantification of planktonic community was carried out in laboratory using standard literature.

The station-specific relative abundance (RA) of fish species was calculated using the following formula:

RA = Number of specimens of species (n) × 100/Total number of samples (N).

The fish diversity indices were calculated as per the standard method of Shannon (1948):

$$H = \sum_{i=1}^{n} \left(\mathrm{Log} \left(\frac{n_i}{N} \right) \right)$$

where H = Shannon index of diversity; n_i = total numbers of individuals of species; and N = total number of individuals of all species.

Simpson's dominance index (Harper 1999) was used for assessing the biodiversity of habitat toward the number of species and abundance of each species, and the formula used for that was as follows: $D = \frac{\sum n(n-1)}{N(N-1)}$.

where n and N represent the number of individuals in each species and the total number of individuals, respectively. The Simpson index of diversity is measured by subtracting the value of D from 1 and denoted as $1 - D$. Evenness (Harper 1999) was used to measure the relative abundance of different species comprising of the richness of an area and calculated by the following formula:

$$E = \mathrm{e}^{\mathrm{H}'/\mathrm{S}}$$

The Margalef index (d) (Margalef 1968) was used to measure the species richness by the formula $d = (S - 1/\mathrm{Ln}\, N)$, where S is the total number of species and N is the number of individuals in the sample.

5.3 Composition, Abundance, and Diversity of Phytoplankton

The present study recorded the presence of only 25 genera of phytoplankton. The generic diversity was the highest for class Bacillariophyceae (10) followed by Chlorophyceae (7), Myxophyceae (3), Xanthophyceae (2), and Coscinodiscophyceae (2). The lowest species diversity was observed in class Hydrodictyaceae (1). Compositions of six major algal classes represented

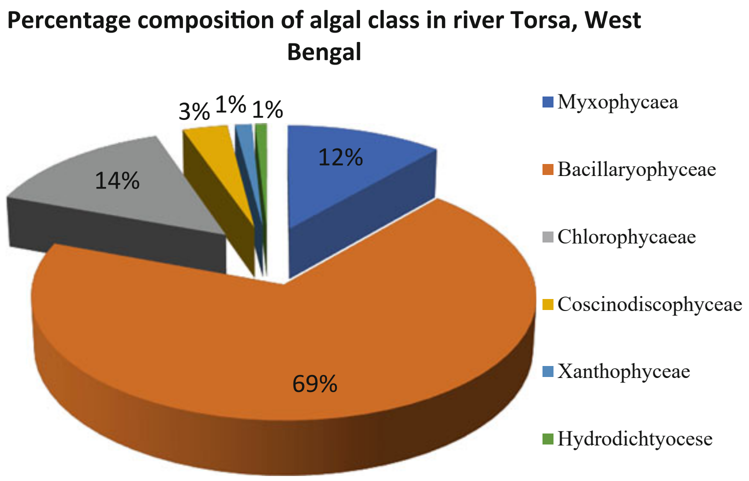


Fig. 5.3 Compositions of algal class in Torsa River, West Bengal, India

(Fig. 5.2) Bacillariophyceae (69.16%), Chlorophyceae (14%), Myxophyceae (12%), Coscinodiscophyceae (3.2%), Xanthophyceae (1.2%), and Hydrodictyaceae (0.8%). The phytoplankton under Bacillariophyceae showed the highest dominance across seasons in terms of abundance and diversity in Torsa River. Among diatoms on a generic level, *Fragilaria*, *Synedra*, *Cymbella*, *Nitzschia*, *Navicula*, and *Gomphonema* had been recorded as dominant taxa from this river. Euryhaline *Coscinodiscus* sp. is recorded only at S3 (Tufanganj) during winter (December). Green algae (Chlorophyceae) comprised of mainly *Spirogyra*, *Chlorella*, *Cladophora*, and *Oedogonium* were found to be common in all stations. Myxophyceae represented by *Oscillatoria*, *Anabaena*, and *Spirulina* were found to be very common during monsoon and post-monsoon season in all stations. *Hydrodictyon* sp. commonly known as “water net” was recorded at S2 (Kachuban) during pre-monsoon (Fig. 5.3).

The phytoplankton community showed varied abundance in different seasons during the study period. The mean quantitative abundance of phytoplankton ranged from 0.54 to 4.9 × 10^3 L^{-1}. Seasonal abundance revealed peak in post-monsoon (1.3–4.9 × 10^3 L^{-1}) and the lowest in monsoon season (0.54 × 10^3 L^{-1} to 2.1 × 10^3 L^{-1}). During post-monsoon, the highest abundance was recorded at S2 followed by S3. The lowest plankton abundance was recorded at S1 in both post-monsoon and monsoon season. Species diversity index (H′), dominance index (D), species richness index (d), and evenness index (J) values showed spatial and temporal variations. Analysis revealed that all stations showed richness and diversity index >1.0 that indicated moderate diversity in total study period. Shannon-Wiener diversity index was found to be the highest at S2 (2.1) and the lowest at S1 (1.2).

Table 5.1 Checklist of fishes recorded from the Torsa River stretch

Sl no.	Fish species	Conservation status (IUCN Red List, 2022)
Order: Cypriniformes; family: Cyprinidae		
1	*Chagunius chagunio*	LC
2	*Labeo catla*	LC
3	*Cirrhinus mrigala*	LC
4	*C. reba*	LC
5	*L. boga*	LC
6	*L. calbasu*	LC
7	*L. dyocheilus*	LC
8	*L. pangusia*	NT
9	*T. putitora*	EN
10	*Garra nasuta*	LC
11	*Tariqilabeo latius*	LC
12	*C. semiplotum*	VU
13	*Oreichthys crenuchoides*	DD
14	*Pethia conchonius*	LC
15	*P. Ticto*	LC
16	*Puntius sophore*	LC
17	*Systomus sarana*	LC
Family: Danionidae		
18	*Salmostoma boopis*	LC
19	*Cabdio jaya*	LC
20	*C. Morar*	LC
21	*Opsarius barna*	LC
22	*Barilius bendelisis*	LC
23	*B. Torsai*	NE
24	*Devario devario*	LC
Family: Cobitidae		
25	*Lepidocephalichthys guntea*	LC
Family: Nemacheilidae		
26	*Paracanthocobitis botia*	LC
27	*Aborichthys elongatus*	LC
28	*Schistura beavani*	LC
Family: Botiidae		
29	*Botia birdi*	NE
Order: Siluriformes; family: Amblycipitidae		
30	*Amblyceps apangi*	LC
Family: Sisoridae		
31	*Pseudecheneis sirenica*	VU
32	*Glyptothorax indicus*	LC
33	*Pseudolaguvia ribeiroi*	LC
34	*Pseudolaguvia foveolata*	DD
35	*Gagata cenia*	LC

(continued)

Table 5.1 (continued)

Sl no.	Fish species	Conservation status (IUCN Red List, 2022)
Family: Ailiidae		
36	*Ailia coila*	NT
Family: Siluridae		
37	*Ompok pabda*	NT
Family: Bagridae		
38	*Batasio merianiensis*	DD
39	*B. batasio*	LC
40	*Mystus cavasius*	LC
41	*M. tengra*	LC
42	*Sperata aor*	LC
43	*Rita rita*	LC
Order: Beloniformes; Family: Belonidae		
44	*Xenentodon cancila*	LC
Order: Gobiiformes; Family: Gobiidae		
45	*Glossogobius giuris*	LC
Order: Mugiliformes; Family: Mugilidae		
46	*Rhinomugil corsula*	LC
Order: Perciformes; Family: Ambassidae		
47	*Chanda nama*	LC
48	*Parambassis ranga*	LC
Order: Anabantiformes; Family: Nandidae		
49	*Nandus nandus*	LC
Order: Anabantiformes, Family: Channidae		
50	*Channa gachua*	LC
51	*C. punctata*	LC
Order: Synbranchiformes; Family: Mastacembelidae		
52	*Macrognathus pancalus*	LC
53	*M. aral*	LC

LC least concern, *NT* not threatened, *EN* endangered, *VU* vulnerable

5.4 Fish Diversity, Conservation Status, and Threats

The survey conducted under the present study recorded 53 fish species under 8 orders and 17 families (Table 5.1) at 3 stations, viz., S1, S2, and S3, during the study period. A taxon-based comparison showed that the catch composition of fishes was dominated by Cypriniformes (29 species) and Siluriformes (14 species). Among family-wise comparisons, Cyprinidae (17 species), Danionidae (7 species), Bagridae (6 species), and Sisoridae (5 species) were recorded as the most dominant in fish catches (Figs. 5.4 and 5.5). The indices-based assessment of fish diversity of Torsa River revealed high diversity along the studied stations S1, S2, and S3 (Shannon H;

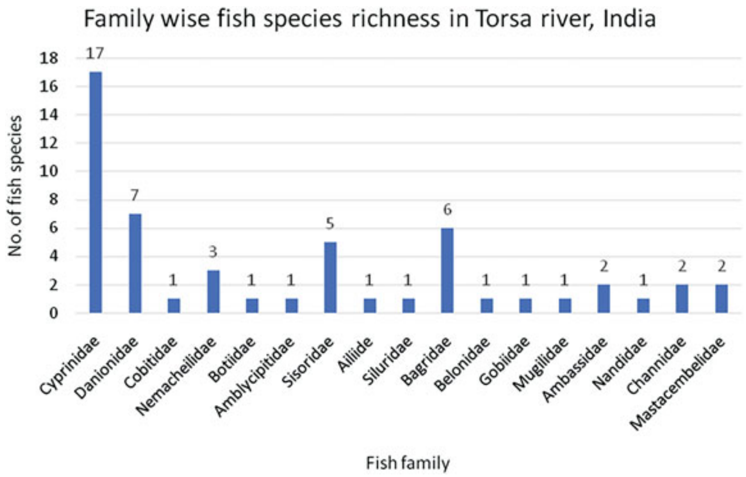
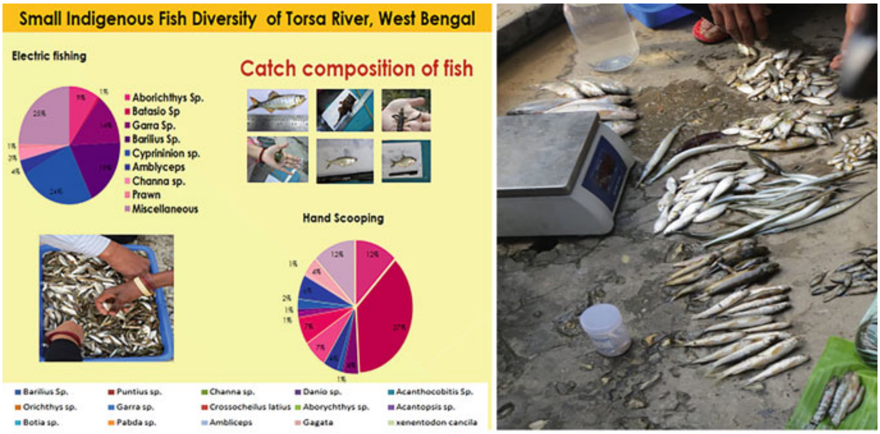


Fig. 5.4 Family-wise fish species richness in the Torsa River, West Bengal

3.294–3.424). The results in Table 5.2 also depicted a high degree of evenness among the fish community across S1, S2, and S3. The present study could record only about half of the cumulative fish diversity as reported by the previous studies (Dey et al. 2015; Sarkar 2021). Menon (1962) recorded 218 cold-water fish species in the whole Himalayas. A total of 218 cold-water fish species were found by Ali (2010) in Assam, 121 in Manipur, 68 in Nagaland, 167 in Arunachal Pradesh, 134 in Tripura, 165 in Meghalaya, and 48 in Mizoram. Recently, Sarkar (2021) has reported presence of 66 cold-water fish species from Torsa River.

The present study indicated that more than two-thirds of the reported fish diversity, i.e., 42 species, were categorized as Least Concern under IUCN Red List criteria 2022 (Fig. 5.4). Among the three fishes identified as threatened, *Tor putitora* is categorized as Endangered (EN), while *Cyprinion semiplotum* and *Pseudecheneis sirenica* as Vulnerable (VU). Despite a large number of the fishes categorized as the Least Concern (LC), the regional fishery managers need to monitor and enforce responsible fishery practices as a review of potential impact of anthropogenic aberrations on fish habitat and its dynamics (Sarkar et al. 2012; Hamilton et al. 2017; Affandi and Ishak 2019) suggests that the fishes inhabiting Torsa River face threats from mining activity in upstream as well as peripheral areas. Construction of high walled cascades of cross river obstacles along the hilly region in Bhutan could, in turn, impact the potamodromous fishes such as *T. putitora* and *C. semiplotum* via altering river discharge dynamics in the downstream areas of Terai region. Also, long-term impact of the slow but progressive sedimentation along the channel basin needs detailed monitoring protocols to establish a mechanism in the fishery dynamics in Torsa River. Bhutan's illegal dolomite mining has severely harmed the Dooars region's rivers. Another potential threat could be from land runoff carrying agricultural chemicals progressively driven by increased deforestation and erosion in the region. Deforestation of mountains has increased soil



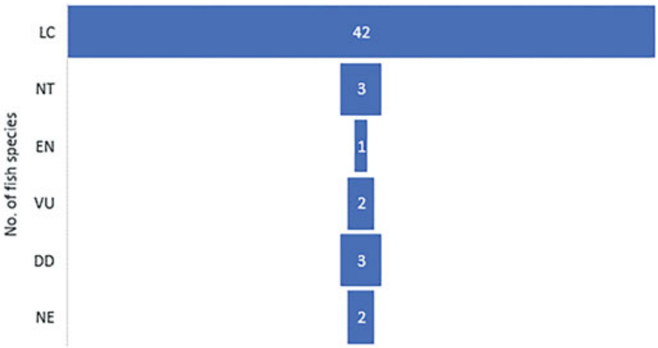


Fig. 5.5 Conservation status of fishes in the Torsa River, India

Table 5.2 Indices-based fish diversity in Torsa River, West Bengal, India

	Jaldapara (S1)	Kachuban (S2)	Tufanganj (S3)
Taxa_S	40	35	32
Individuals	667	561	492
Dominance_D	0.04867	0.0363	0.0423
Simpson_1-D	0.9513	0.9637	0.9577
Shannon_H	3.334	3.424	3.294
Evenness_e^H/S	0.7009	0.8768	0.8423
Margalef	5.997	5.371	5.001
Equitability_J	0.9037	0.963	0.9505

erosion, which has resulted in high siltation of rivers and streams and compromised this fish's basic ecological needs. Further, population size declines because of overfishing or indiscriminate fishing (Sarkar et al. 2008) which has posed as a threat

A. *Barilius torsai*: lateral aspect of holotype, 71.41 mm SL

B. *Barilius torsai :* lateral aspect of paratype, 74.56 mm SL

Fig. 5.6 (**a**) and (**b**) *Barilius torsai*, a new species reported from Torsa River

to the biodiversity in Torsa River. Indiscriminate fishing methods like electrofishing, among others, result in the widespread extinction of fish species and a sharp decline in population size. These methods are posing a risk to the fish recruitment of seasonally migrating potamodromous fishes in the river channel. The risk from invasive species introduction in the river system has also been identified in the Torsa River (Koushlesh et al. 2018; Sarkar 2021). Two new species of fishes *Channa quinquefasciata* (Praveenraj et al. 2018) and *Barilius torsai* (Kumari et al. 2019) were recorded for the river (Fig. 5.6).

5.5 Small Indigenous Fish (SIF) Catch Analysis

Catch composition of small indigenous fishes during winter by cast net, gill net, and lift net was 100%, 33–94%, and 90.4%, respectively, whereas during monsoon, catch composition by gill net and cast net was 44–58% and 48%, respectively (Fig. 5.7).

5.6 Electrofishing in the River

There are several destructive fishing methods due to which the fish diversity is declining in the Torsa River of the Terai region in North Bengal. Electrofishing is one of the methods used as destructive fishing. As this method kills almost complete fish diversity, including live food of the area where electrofishing is operative, it is banned by the Fisheries Department of West Bengal. Even after the ban on such fishing methods, due to its destructive nature, electrofishing is being practiced by the local fishers illegally in the Torsa River, around the Jaldapara National Park

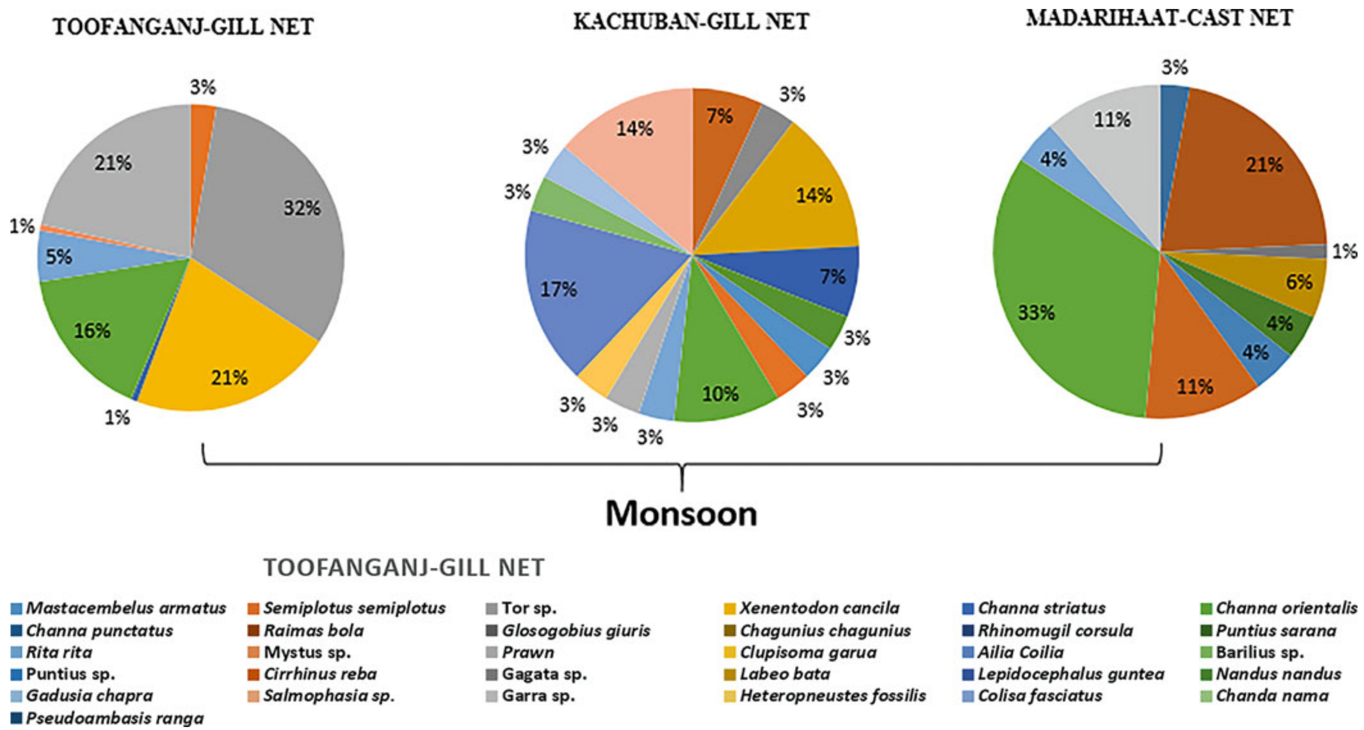


Fig. 5.7 Fish catch composition of Torsa River during monsoon and winter

Fig. 5.8 Electrofishing and fish catch

Complex. Local fishers usually use a battery of a motor car or bike as a source of power for the electrofishing which is usually operated by two men: one man stuns the fishes by providing electric shock, while the other one collects the stunned fishes flowing with water by putting a triangular scoop net downstream. It was observed that, during an hour of electrofishing operations, around 1 kg of small indigenous fishes were caught which were in alive conditions for a certain time (Fig. 5.8). The fish species caught in this process are from different families and orders dominating with *O. pabda*, *C. stewartii*, *Crossocheilus latius*, *Garra lamta*, *Systomus sarana*, *T. putitora*, *Opsarius bendelisis*, *Neolissochilus hexagonolepis*, *Macrognathus pancalus*, etc. Putitora mahseer, *T. putitora* (Hamilton, 1822), an Endangered (EN) species, are also recorded by the researchers in the catch. The method is of course cost-effective, but it is highly destructive and against the sustainable fisheries development. There is a need to make people residing around the river bank aware to protect the wealth for the new generation. Research institutes and government organizations should develop conservation sites for the declining fisheries of the area.

5.7 Assessment of Livelihood Support and Community Knowledge Related to Fishes

In the Terai region, the major problem faced by the fishers was the decline in fish production in the Torsa River, and major reason, as perceived by the fishers, was the use of destructive fishing methods, viz., electric shock, use of poison, and use of dynamites in the river. Use of havoc chemical pesticides in tea gardens was perceived as another reason by the fishers for the decline in fish production from the Torsa River. Use of small meshed fishing nets, siltation, and erratic rainfall were yet other reasons as perceived by the fishers for declining fish production. Tribal population, viz., Rajbansi, Oraon, Rava, and Toto, is quite dominating in the Torsa River stretch area. They harvest fish from the Torsa River by using several indigenous traps like Tapai, Burung, Chapua, Jhakoi, Bonas, Thusi, etc.

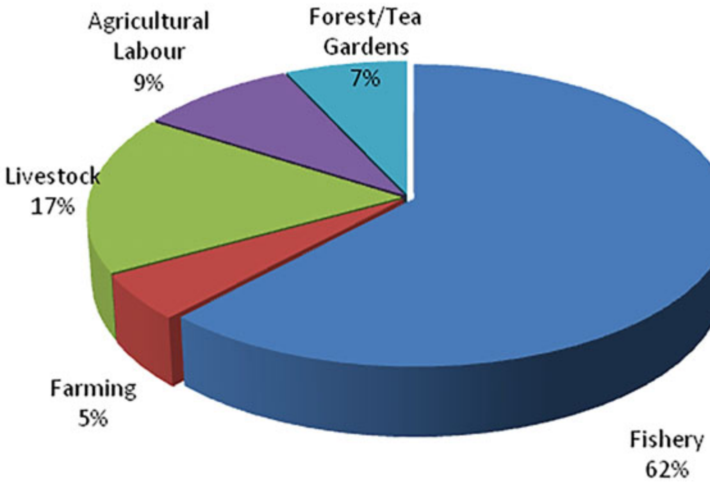


Fig. 5.9 Contribution of livelihood activities in family income

5.8 Gender Desegregation for Activities Performed by Men and Women

In the Torsa River area, particularly in upper stretch from Totopara to Madarihat, women involvement in fishing activities was prevalent. It was found that about 52% of women of fishermen community had high involvement in fish catching, whereas 48% of them had high involvement in fish marketing. Moreover, women were involved in other livelihood activities like livestock rearing and livestock selling and as tea garden laborer. But, the educational status of women was really poor than that of their male counterparts of the fishermen community of Torsa region. Among the women, 50% illiteracy was found (Fig. 5.9). The average annual income of the female-headed family was Rs. 37,250 (~US$ 465) which is lower than the average income of male-headed family, i.e., Rs. 53,100 (~US$ 662). Fish harvest from Torsa river had highest contribution i.e. 62% in the average family income of a fishermen family, followed by livestock rearing (17%), agricultural labourer (9%), tea garden/ forest (7%) and from farming 7%. The expenditure pattern of the fisherfolk was also assessed, and it was found that their maximum expenditure was on food items (59%) and they utilized almost 16% for the education of their children.

5.9 Women's Access and Control over Resources

Women's equal access to and control over resources, i.e., land, capital, knowledge, is critical for the achievement of gender equality and empowerment of women and for equitable and sustainable economic growth and development. Gender equality in the distribution of economic and financial resources has positive multiplier effects for a range of key development goals, including poverty reduction and the welfare of children. But, in Torsa River region, fisherwomen do not have equal access and control over resources. The inability of the fisherwomen to have access to productive resources such as land and capital is the major cause of persistence of chronic poverty among potentially productive groups. Women's access over financial resources is almost nil in Torsa areas; only short-term access is noticed. But, 41% of women have absolute control on housing; that is because in the Torsa River area, the tribal population is also dominant, and in the sampled population, the fisherwomen belonging to tribal community have absolute control over housing.

5.10 Fishery: A Sociocultural Attribute of the Rabha Tribes—A Case Study

The Rabhas belong to the Indo-Mongoloid group and have similarities with other members of the Bodo group, such as Garos, Kachari, Mech, Koch, Hajong, and others. Rabhas are found in 13 states in India, but significant numbers are found in Assam (352,000), followed by Meghalaya (37,000), West Bengal (23,000), Arunachal Pradesh (3300), Nagaland (2700), and Mizoram (200). Rabhas are a unique community, having rich sociocultural inheritance (Roy et al. 2018). According to the rule of lineage, Rabhas belong to the matrilineal family. Rabhas are divided into five Gotras, namely, Rangdania, Pati, Daori, Maytori, and Koch, and after marriage, the Gotras of the women do not change.

Fig. 5.10 Rabhas in traditional fishing dance costume

Fig. 5.11 Dry fish powder prepared by Rabhas

The primary source of livelihood adopted by the Rabhas is agriculture. Jhum, or shifting cultivation, was prevalent earlier. However, nowadays, they cultivate rice, different pulse seed, mustard seed, and other vegetables. In addition to agriculture, considerable sections of the Rabhas are engaged in fishing too. Generally, they are involved in fishing activities in rivers, streams, rivulets, and wetlands for their livelihood. Females are involved in community fishing with handmade traps named as Jhakoi. Other than Jhakoi, the Rabha people use various types of traps like Tapai, Thusi, Burung, etc. for harvesting of fishes.

Fishing is an important activity in the life of the Rabha people, and it is assimilated in their culture in the form of dance, which is performed by the women-folk of the Rabha community for depicting their daily lives. Rabha tribes perform dance with melodious music wearing colorful costumes. Fishing dance (Fig. 5.10) is one of the important dances performed by the Rabha women among the other dances like welcome dance, celebration dance, and war dance. The Rabhas are fond of small indigenous fishes and prawns. They also prepare dried fishes for future consumption (Fig. 5.11). The dried fish powder known as "Nishuchepa" is often taken by the Rabha people, and it is made from the dried prawn or small fishes.

5.11 Conclusion

The riverine stretch of Torsa traversing through West Bengal, India, harbors rich fish diversity throughout its longitudinal reach, thus offering support to subsistence-level fishery activity in the Terai region. Despite many of the fishes categorized as not threatened as per IUCN Red List, it supports endangered *Tor putitora* and vulnerable *C. semiplotum* and *P. sirenia* which highlights its importance as fish refuge and potential for supporting recreational fishery along its periphery. But, channel migration with a varying nature during different time spans is reported continuously. Therefore, the changes in the river course needs to be studied carefully in order to predict the future possibilities which are crucial in understanding the vulnerability potential of a certain region. The cold-water fishery in the Terai region of North Bengal is under threat due to introduction of exotic fishes, overfishing, destructive method of fishing, pollution, climate change, etc. It is, therefore, mandatory to demarcate natural regime as any further encroachment on fluvial regime to escalate the degree of vulnerability of fish diversity for environmental planning with sustainable approach. Public awareness and conservation management of cold-water fishes in the rivers of North Bengal are the need of the day.

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