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Fish Species Composition, Distribution, and Community Structure in the River Kankai, Eastern Nepal

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ABSTRACT
It is essential to track how fishing pressure affects the exploited fish population in the River Kankai to ensure resource development and sustainability. The current state of affairs in the River Kankai, situated in the eastern Nepalese districts of Ilam and Jhapa, continues to raise serious concerns among the general public. The purpose of this study is to determine trends in the fish communities in the River Kankai across time and location and to examine how physicochemical factors affect fish dispersal and abundance at six sites that were chosen based on operability and accessibility. Monthly fish samples were collected between January 2023 and December 2023. We used cast nets in different sizes, monofilament gill nets, fish baits, and local fish traps to collect the fish. Fish abundance and distribution were largely determined by water parameters like turbidity, total hardness, total alkalinity, conductivity, dissolved oxygen, biological oxygen demand, water temperature, and nitrate-N, according to an analysis of variance (ANOVA) on canonical correspondence analysis. Altogether, 94 species in 12 orders, 28 families, and 60 genera were gathered, of which 6 species represented Nearly Threatened (NT) and 3 species were found to be Vulnerable (VU) as per the IUCN red list categories of threatened species. The current study aims to improve the community structure and ichthyofaunal diversity in the River Kankai.

Key words: Freshwater, water parameters, fish ecology, fish distribution, CCA, Mahabharat range

INTRODUCTION

Ichthyofauna, comprising the largest number of vertebrate species globally; have total 36,179 valid species; with 18,290 of them inhabiting freshwater riverine and lacustrine habitats (Fricke et al. 2022). Fish are often utilised as indicator of ecological health of water bodies due to their position at the apex of aquatic food chains (Wu et al. 2011). However, despite their ecological importance, ichthyofauna faces considerable threats, with amphibians posing the greatest danger due to considerable overlap and conflict between them in the same habitat (Abell et al. 2011, Limbu et al. 2021). Freshwater habitats are particularly vulnerable, experiencing threats such as overexploitation, habitat alteration, pollution, hydropower development, electrofishing, and the introduction of invasive species, leading to significant impacts on biodiversity (Angeler et al. 2014, Collen et al. 2014, Limbu and Prasad 2020, Vagenas et al. 2022). Consequently, numerous endemic and characteristic fish species are now endangered or face a high risk of extinction (Hu et al. 2019). Understanding fish community structure and biodiversity is crucial for the conservation and management of fisheries (Kundu et al. 2022). Environmental variables significantly shape fish community structure, with fluctuations influencing the spatiotemporal dynamics of ichthyofaunal communities, particularly in response to environmental disturbances (Pool and Olden 2012, Limbu et al. 2021, Yi-Ron et al. 2022, Tumbahangfe et al. 2022).

The River Kankai, a principal river system in Nepal, flows through the districts of Ilam and Jhapa in Koshi Province, Nepal. Originating from the Mahabharat range, the River Kankai is characterised by its perennial and swift-flowing waters (Limbu et al. 2018). Due to its steep gradient, the upstream flow of the river is faster than that in the plains. The river serves multiple purposes, including drinking water supply, irrigation, hydropower generation, and the operation of water mills. Its climate ranges from tropical to subtropical and temperate. The River Kankai constitutes the primary freshwater ecosystem in the eastern region of Nepal and serves as a vital fish breeding ground. However, there is limited

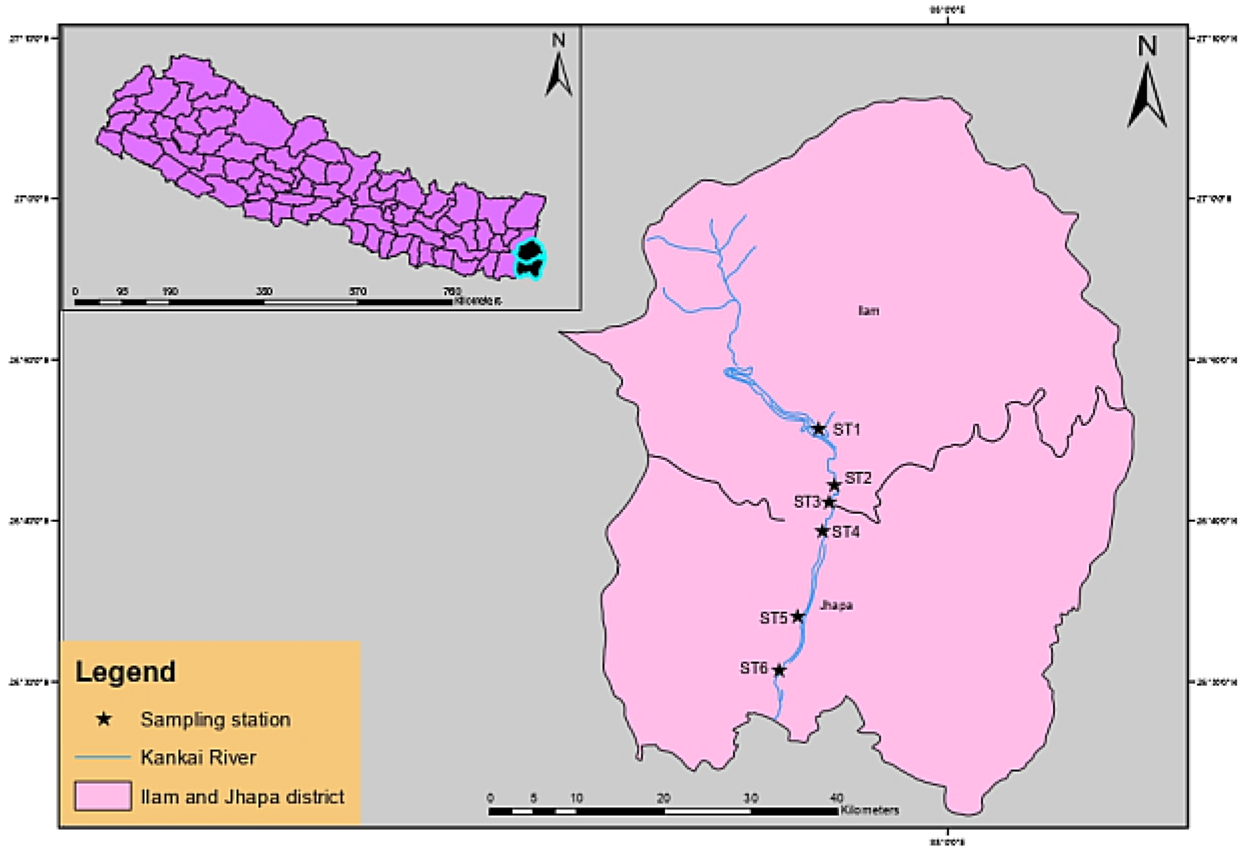

Figure 1. Map of study area showing sampling sites

research on the habitat, ecology, distribution, and community dynamics of fish at various temporal and spatial scales in this region.

MATERIALS AND METHODS

Study area

The study area (Fig. 1) encompasses the Kankai River, primarily originating from the Sandakpur mountain and coursing from north to south through the hills of Ilam district and the plains of Jhapa district. Subsequently, it enters the Bihar state of India, where it joins the River Ganga, covering a drainage area of approximately 1140 km^2 (Rai 2004). The primary tributaries of the River Kankai are Deu Mai, Puwa Mai, and Jog Mai, all stemming from the Ilam district. The landscape within the river valley exhibits notable variation. The Kankai basin serves as the natural habitat for diverse faunal and floral species and is revered as a holy river by Hindu devotees in Nepal. The Kankai Irrigation Project, initiated by the Nepal government, irrigates the southern regions of Jhapa, such as Shivaganj, Pachgachi, and Mahabhara. Various tourist destinations are situated along the River Kankai, including Maipokhari, Chepti, Dhanuskoti, and Domukha. During the monsoon season, the river often floods fertile plains in Jhapa, inundating thousands of hectares of land. Local fishermen can be found fishing in the river, while children often bathe in it during the hot season. Kankai and Shivasatakshi municipalities jointly organize an annual fair on January, the 1st week of Magh, as per the Nepalese calendar, known as Mai Mela, drawing thousands of people from eastern parts of Nepal and India to participate in religious activities and festivities. Additionally, the Kankai Aryaghat, located on both banks of the river, where local residents perform death rituals.

Data collection, identification and preservation

Fish sampling was done every month from January 2023 to December 2023; Six stations namely Mahamai (Station 1), Danawari (Station 2), Domukha (Station 3), Kankai Ghat (Station 4), Shivaganj (Station 5), and Gauriganj (Station 6), were selected for the sampling. The fish sampling was carried out between 12 noon to 2 p.m. using two cast nets of different sizes, one with a mesh size of 1 cm, a diameter of 5 m, and a weight of 4 kg, and another with a mesh size of 0.5 cm, a diameter of 3 m, and a weight of 2 kg. Cast netting was carried out, covering a distance of 150 to 200 m (Limbu et al. 2021) across each station. Furthermore, the mesh sizes of 3 and 5 cm monofilament gill nets were used to catch the fish. In each station, 5-gill nets were left late in the evening (5-6 p.m.) and taken out early in the morning (6–7 a.m.) in a sampling distance of 150-200 m (Tumbahangfe et al. 2021). The collected fish were photographed as much as possible in fresh condition and identified in the field; if not, the voucher specimens were preserved in 10% formalin and later transformed into 70% ethanol by making their caudal fin upright for long-term study and preservation. After the photography, the samples were released back to their natural habitat from where they were caught. The sampled fish were identified with the help of standard literature (Jayaram 2010, Shrestha 2019).

Along with the fish, various physicochemical parameters like water temperature, pH, water velocity, turbidity, conductivity, dissolved oxygen (DO), free carbon dioxide (fCO_2), alkalinity, total hardness, chloride, biological oxygen demand (BOD), nitrate-N, nitrite-N, ammonium-N, and phosphate-P were also examined during the field visit. Measurements included water temperature (°C) using a digital thermometer submerged at a depth of 1 foot, pH with a pH meter, water velocity (m/s) by the float method, turbidity by using a Secchi disc, and conductivity with an electrical conductivity meter. All the other parameters were analysed following the standard methods (Anonymous 2012). DO (mgL^{-1}) via the Winkler titrimetric method, free carbon dioxide (mgL^{-1}) using the titrimetric method, alkalinity (mgL^{-1}) via titration, total hardness (mgL^{-1}) using the EDTA titrimetric method, and chloride by 2500-B Argentometric titration method and BOD calculated through the azide modification method; Nitrate [1]N through ultraviolet spectrophotometric screening; Nitrite-N spectrophotometrically; Ammonium-N with the phenate method; and Phosphate-P via the ascorbic acid method.

Data analysis

A one-way analysis of variance (ANOVA) was used to calculate the physico-chemical parameters and differences between spatial and temporal spectra. A post hoc Tukey HSD test was used to find out the various diversity indices and whether they are significantly different or not at the 0.05 probability level (Spjøtvoll and Stoline 1973). The entire sample was used for multivariate analysis, and no environmental variables were excluded. Rare species that contributed less than 5% were excluded from the multivariate analysis (Edds 1993, Tumahanfe et al. 2021). Frequencies of fish collected and environmental variables determined were directly included in the multivariate analysis (Yan et al. 2010, Hossain et al. 2012, Vieira and Tejerina 2020). One-way multivariate permutation analysis of variance (perMANOVA) (Clarke 1993) was used to test for significant differences between the spatial and temporal scales of the collected fish data. Detrended correspondence analysis (Hill and Gouch 1980) was used to investigate the relationship between fish community structure and environmental variables. The eigenvalue (0.52) and axis length (3.17) obtained from DCA suggested that the linear model associated with CCA was more applicable. Therefore, a direct multivariate ordination method (Legendre and Legendre 1998) based on a linear response of species to environmental gradients was applied.

RESULTS

The present study sampling involved a total of 8,331 fish individuals collected during the 12 months of sampling and representing 94 species that belonged to 12 orders, 29 families, and 60 genera (Table 1). The three main orders, such as Cypriniformes (53 species), Siluriformes (19 species), and Anabantiformes (9 species), constituted 86.17% of the total species count, followed by Synbranchiformes (4 species), Perciformes (2 species), and Osteoglossiformes (2 species). The rest of the orders, like Synbranchiformes, Anguilliformes, Gobiiformes, Cyprinodontiformes, Clupeiformes, and Beloniformes were contributed by a single species of each. At family level, the Cyprinidae

Table1. Fish of the Kankai River by Order, family, and species

Order	Family	Code	Species	IUCN red list
Anabantiformes	Anabantidae	C1	*Anabas cobojius* (Hamilton 1822)	DD
	Badidae	C2	*Badis badis* (Hamilton 1822)	LC
	Channidae	C3	*Channa orientalis* (Bloch and Schneider1801)	VU
		C4	*Channa punctata* (Bloch 1793)	LC
		C5	*Channa stewartii* (Playfair 1867)	LC
		C6	*Pseudambasis ranga* (Hamilton 1822)	LC
	Nandidae	C7	*Nandus nandus* (Hamilton 1822)	LC
	Osphronemidae	C8	*Colisa faciatus* (Bloch and Schneider 1801)	LC
		C9	*Colisa lalius* (Hamilton 1822)	LC
Synbranchiformes	Mastacembelidae	C10	*Macrognathus zebrinus* (Blyth 1858)	LC
Beloniformes	Belonidae	C11	*Xenetodon cancila* (Hamilton 1822)	LC
Clupeiformes	Engraulidae	C12	*Setipinna phasa* (Hamilton 1822)	LC
Cypriniformes	Botiidae	C13	*Canthophrys gongota* (Hamilton 1822)	LC
	Cobitidae	C14	*Botia lohachata* (Chaudhuri 1912)	LC
		C15	*Botia dario* (Hamilton 1822)	LC
		C16	*Lepidocephalichthys guntea* (Hamilton 1822)	LC
		C17	*Schistura horai* (Menon 1952)	LC
		C18	*Schistura multifasciata* (Day 1878)	LC
		C19	*Schistura rupecula* (McClelland 183)	LC
		C20	*Schistura scaturigina* (McClelland 1839)	LC
		C21	*Schistura savona* (Hamilton 1822)	LC
	Cyprinidae	C22	*Amblypharyngodon* microlepis (Bleeker 1854)	LC
		C23	*Amblypharyngodon mola* (Hamilton 1822)	LC
		C24	*Aspidoparia jaya* (Hamilton 1822)	LC
		C25	*Aspidoparia morar* (Hamilton 1822)	LC
		C26	*Barilius barila* (Hamilton 1822)	LC
		C27	*Barilius barna* (Hamilton 1822)	LC
		C28	*Barilius bendelisis* (Hamilton 1822)	LC
		C29	*Barilius shacra* (Hamilton 1822)	LC
		C30	*Barilius vagra* (Hamilton 1822)	LC
		C31	*Catla catla* (Hamilton 1822)	LC
		C32	*Chela labuca* (Hamilton 1822)	NT
		C33	*Chagunius chagunio* (Hamilton 1822)	LC
		C34	*Chela cachius* (Hamilton 1822)	LC
		C35	*Cirrhinus mrigala* (Hamilton 1822)	LC
		C36	*Cirrhinus reba* (Hamilton 1822)	LC
		C37	*Crossocheilus latius* (Hamilton 1822)	LC
		C38	*Ctenopharyngodon idellus* (Valenciennes 1844)	LC
		C39	*Labeo boga* (Hamilton 1822)	LC
		C40	*Danio aequipinnatus* (McClelland 1839)	DD
		C41	*Danio devario* (Hamilton 1822)	LC
		C42	*Esomus danricus* (Hamilton 1822)	LC
		C43	*Garra gotyla* (Gray 1830)	LC
		C44	*Garra mullya* (Sykes 1839)	LC
		C45	*Garra lamta* (Hamilton 1822)	LC
		C46	*Labeo bata* (Hamilton 1822)	LC
		C47	*Cyprinus carpiocommunis* (1758)	VU
		C48	*Labeo caeruleus* (Day 1877)	LC

Order	Family	Code	Species	IUCN red list
	Cyprinidae	C49	*Labeo fimbriatus* (Bloch 1795)	LC
		C50	*Labeo gonius* (Hamilton 1822)	LC
		C51	*Pethia phutunio* (Hamilton 1822)	LC
		C52	*Labeo pangusia* (Hamilton 1822)	NT
		C53	*Puntius conchonius* (Hamilton 1822)	LC
		C54	*Puntius gonionotus* (Bleeker 1849)	LC
		C55	*Puntius sophore* (Hamilton, 1822)	LC
		C56	*Puntius ticto* (Hamilton, 1822)	LC
		C57	*Raiamas bola* (Hamilton 1822)	LC
		C58	*Raiamas guttatus* (Day 1870)	LC
		C59	*Salmostoma acinaces* (Valenciennes 1844)	LC
		C60	*Salmostoma bacaila* (Hamilton 1822)	LC
		C61	*Schizothoraichthys labiatus* (McClelland 1839)	NE
	Nemacheilidae	C62	*Parancanthocobitis botia* (Hamilton 1822)	LC
		C63	*Schistura scaturigina* (McClelland 1839)	LC
	Psilorhynchidae	C64	*Psilorhynchus balitora* (Hamilton 1822)	LC
		C65	*Psilorhynchus pseudecheneis* (Menon and Datta 1964)	LC
Cyprinodontiformes	Aplocheilidae	C66	*Aplocheilus panchax* (Hamilton 1822)	LC
Gobiiformes	Gobiidae	C67	*Glossogobius giuris* (Hamilton 1822)	LC
Osteoglossiformes	Notopteridae	C68	*Chitala chitala* (Hamilton 1822)	LC
		C69	*Notopterus notopterus* (Pallas 1769)	LC
Siluriformes	Ailiidae	C70	*Ailia coila* (Hamilton 1822)	NT
	Amblycipitidae	C71	*Amblyceps mangois* (Hamilton 1822)	LC
	Schilbeidae	C72	*Pachypterus atherinoides* (Bloch 1794)	LC
		C73	*Eutropiichthys vacha* (Hamilton 1822)	LC
		C74	*Eutropiichthys murius* (Hamilton 1822)	LC
		C75	*Silonia silondia* (Hamilton 1822)	LC
	Bagridae	C76	*Mystus cavasius* (Hamilton 1822)	LC
		C77	*Mystus vittatus* (Bloch 1794)	LC
		C78	*Sperata aor* (Hamilton 1822)	LC
	Clariidae	C79	*Clarias batrachus* (Linnaeus 1758)	LC
	Erethistidae	C80	*Pseudolaguvia kapuri* (Tilak and Husain 1975)	LC
	Heteropneustidae	C81	*Heteropneustes fossilis* (Bloch 1794)	LC
Anguilliformes	Anguillidae	C82	*Anguilla bengalensis* (Gray 1831)	NT
Siluriformes	Sisoridae	C83	*Glyptothorax pectinopterus* (McClelland 1842)	LC
		C84	*Gagata cenia* (Hamilton 1822)	LC
		C85	*Sisor rabdophorus* (Hamilton 1822)	LC
Perciformes	Ambassidae	C86	*Chanda nama* (Hamilton 1822)	LC
		C87	*Pseudambasis baculis* (Hamilton 1822)	LC
Synbranchiformes	Mastacembelidae	C88	*Macrognathus aral* (Bloch and Schneider 1801)	LC
		C89	*Mastacembelus armatus* (Lacepède 1800)	LC
	Synbranchidae	C90	*Monopterus cuchia* (Hamilton 1822)	LC
Siluriformes	Schilbeidae	C91	*Pseudeutropius atherinoides* (Bloch 1794)	LC
	Siluridae	C92	*Ompok bimaculatus* (Bloch 1794)	NT
		C93	*Ompok pabda* (Hamilton 1822)	NT
		C 94	*Wallago attu* (Bloch and Schneider 1801)	VU

family had the most species (40), followed by Cobitidae (8), Schilbeidae (5), Channidae (4), Mastacembelidae (3), Sisoridae (3), Bagridae (3), Osphronemidae (2), Psilorhynchidae (2), Nemacheilidae (2), Notopteridae (2), and Ambassidae (2). The remaining families, like Synbranchidae, Anguillidae, Erethistidae, Clariidae, Amblycipitidae, Ailiidae, Gobiidae, Aplocheilidae, Botiidae, Engraulidae, Belonidae, Nandidae, Badidae, and Anabantidae, were represented by a single species each.

Spatio temporal variation

The abundance of the fish was highest in July, followed by August, May, June, September, November, October, January, December, April, and February, and lowest in March (Fig. 2a). The ichthyodiversity in the study area was highest in June (79 species), followed by July (70 species), August (66 species), May (62 species), November (58 species), December (58 species), January (58 species), February (55 species), October (52 species), April (47 species), and March (43 species). Station-specific analysis revealed that the highest number of fish was found at Station 6, followed by Station 2, Station 3, Station 5, Station 4, and Station 1 (Fig. 2b). An analysis of similarity (ANOSIM) applied to the fish community structure indicated significant differences among months (P = 0.0001, R = 0.1051) and stations (P = 0.0002, R = 0.07713).

Fish community and environment

Using Canonical Correspondence Analysis (CCA) the relationship between physicochemical parameters and ichthyofauna was examined (Fig. 3). The first and second axes of the CCA explained 40 and 19% of the variance, respectively. Certain fish species, like C7, C14, C28, C24, and C27, showed positive correlations with conductivity, biological oxygen demand (BOD), water temperature, nitrate-N, nitrite-N, pH, and phosphorus while displaying negative correlations with total hardness, dissolved oxygen, total alkalinity, ammonium-N, and free carbon dioxide. Conversely, other species such as C1, C3, C8, C15, C16, C18, C25, C29, C30, C48, C59, and C60 exhibited positive relationships with total hardness, dissolved oxygen, total alkalinity, ammonium- N, and free carbon dioxide but negative associations with conductivity, BOD, water temperature, nitrite-N, nitrate-N, phosphorus, and pH. Additionally, some species coding with C4, C16, C19, C21, C23, and C32 were negatively correlated with turbidity and water velocity, whereas others like C2, C10, C36, C37, C43, and C58 displayed positive correlations with water velocity and turbidity. An analysis of variance (ANOVA) on the CCA indicated that turbidity, total hardness, total alkalinity, conductivity, dissolved oxygen, BOD, water temperature, and nitrate-N were significant influencing factors (P<0.05) in determining fish abundance and distribution.

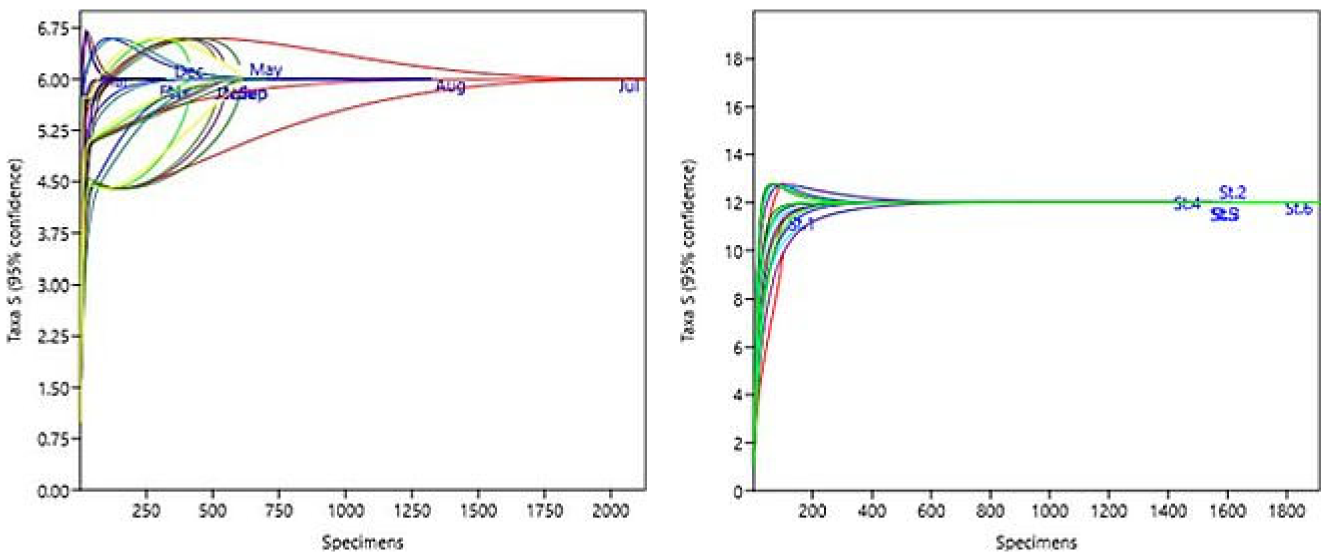

Figure 2. (a)Individual rarefaction analysis plot based on months; (b) Individual rarefaction analysis plot based on stations

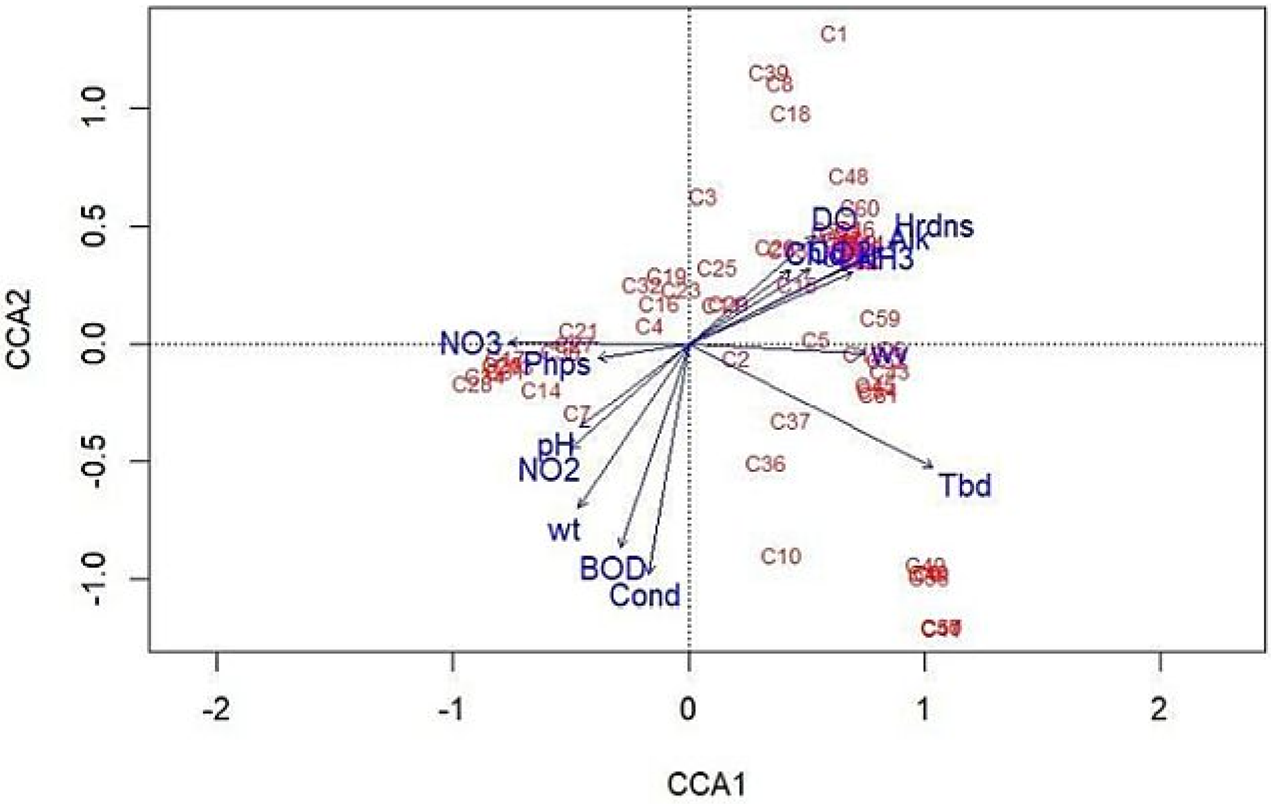

Figure 3. Biplot from canonical correspondence analysis (CCA) for the fish community in the River Kankai (species code as in Table 1)

Diversity status

The highest Shannon diversity index (2.288) was recorded at station 3 in March (1.718), whereas the lowest value (1.808) was observed at station 1 in November (1.453). Analysis of variance (ANOVA) for both temporal and spatial factors indicated no significant (P >0.05) difference among the six stations, but there was a significant (P<0.05) difference in the Shannon diversity index across the twelve months (Tables 2, 3). Similarly, the highest Simpson dominance index (0.879) was noted at station 3 in March (0.810), while the lowest value (0.784) occurred at station 1 in November (0.731). Significant differences (P <0.05) were found in the Simpson dominance index among the six sampling sites and months. Likewise, the highest Evenness index (0.821) was recorded at station 3 in March (0.928), while the lowest Evenness (0.508) was observed at station 1 in November (0.712). Significant differences (P <0.05) in the Evenness index were observed among the six stations and months. Conversely, the highest Margalef richness index was observed at station 1 (2.314) in February (0.920), while the lowest value was found at station 6 (1.454) in June (0.651). There was no significant (P >0.05) difference in the Margalef richness index across the six sampling stations, but there was a significant difference across the months.

DISCUSION

The present study examined 8,331 fish categorised across 94 species, spread across 12 orders, 28 families, and 60 genera. This indicates the significant role of the River Kankai in supporting the livelihoods and sustenance of fishermen and fishing communities reliant on its resources. The prevalence of Cypriniformes, Siluriformes, and Anabantiformes in this study aligns with findings from other rivers in Nepal like the Mechi River (Adhikari et al. 2021), Ratuwa River (Rajbanshi et al. 2021) and Phewa Khola (Limbu et al. 2021). Notably, the diversity observed in this study (94 species) surpasses that reported by Acharya et al. (2021) of 63 species in Mechi River. This disparity may stem from the narrower scope of previous investigations and the

Table 2. Month-wise diversity index

Indices	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Simpson	0.789	0.766	0.810	0.788	0.740	0.779	0.757	0.791	0.770	0.753	0.731	0.759
Shannon	1.593	1.591	1.718	1.661	1.459	1.572	1.520	1.617	1.536	1.493	1.453	1.527
Evennes	0.819	0.818	0.928	0.877	0.717	0.803	0.762	0.84	0.774	0.741	0.712	0.767
Margalef	0.870	0.920	0.860	0.760	0.777	0.651	0.695	0.779	0.797	0.7913	0.827	0.797

Table 3. Station-wise diversity index

Indices	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Simpson	0.784	0.877	0.879	0.88	0.822	0.795
Shannon	1.808	2.259	2.288	2.255	2.029	2.031
Evenness	0.508	0.797	0.821	0.794	0.633	0.635
Margalef	2.314	1.488	1.496	1.498	1.496	1.454

influence of fishing gear selectivity and survey methods on species diversity (Tumbahangfe et al. 2021).

The present study indicated that the highest abundance and variety of fish species were observed during the months of July, August, May, and June. These months coincide with the monsoon season, characterized by increased rainfall, rising water levels, and temperature changes, which stimulate spawning activity among fish species. Moreover, in certain regions with distinct seasonal patterns, like the northern parts of the River Kankai situated in mountainous areas, fish breeding might have occurred during the spring month of May, as water temperatures rose following the winter season. This discovery aligns with the findings of Aryani et al. (2020), who also noted peak abundance and diversity during June, July, and August. Factors such as river discharge and water temperature significantly influence fish abundance and diversity (Kriauciuniene et al. 2019). Human activities like overfishing, industrial discharges, and sand mining could have adversely affected fish populations and diversity in the River Kankai. Moreover, fluctuations in abiotic factors such as river discharge and water temperature can impact crucial aquatic ecosystem metrics like species richness and diversity indices (Parker et al. 2018, Crane and Apuscinski 2018).

Local fishermen report a notable decline in populations of various fish species, including *Channa orientalis, Chela labuca, Cyprinus carpio communis, Ailia coila, Anguilla bengalensis, Ompok bimaculatus,* and *Wallago attu,* with fewer than five indi-viduals observed per species over the study period. Numerous studies have implicated several factors in the reduction of Nepalese fish populations, including ongoing road development, river corridor engineering, dam construction, hydropower projects, water diversion, loss of aquatic habitat, fragmentation, deforestation, riparian degradation, overfishing, climate change, and direct discharge of industrial pollutants into water bodies (Limbu et al. 2021a, Tumbahangfe et al. 2021). Fluctuations in river flow seem to be influenced by climate change, water management practices, and fishing pressure (vanZweiten et al. 2011, Halls 2015). Monitoring the impact of fishing activity on exploited fish populations in the River Kankai is crucial for sustainable resource management. The current situation raises alarm and provokes significant concern among the public. As the biodiversity of freshwater fish continues to decline primarily due to human activities, there is a clear lack of scientific foundation and effective ecological measures for comprehensive river basin management (Li et al. 2012).

Understanding the relationship between environmental factors and the structure of fish communities is crucial for preserving and managing aquatic biodiversity in the face of anthropogenic challenges such as pollution and global climate change (Li et al. 2012, Limbu et al. 2020). Canonical

Correspondence Analysis (CCA) was employed to examine the impact of environmental variables on fish abundance, diversity, and distribution. Species identified through this analysis either exhibited weak associations with the parameters or were commonly found under average water parameter conditions. In this study, significant influencing factors ($P<0.05$) determining fish diversity, abundance, and distribution in the River Kankai included turbidity, total hardness, total alkalinity, conductivity, dissolved oxygen, biological oxygen demand, water temperature, and nitrate-N levels. Additionally, water velocity (Yu and Lee 2002, Yan et al. 2010, Adhikari et al. 2021), water temperature (Kadye et al. 2008, Avendano and Ramirez 2017, Temesgen and Temesgen 2021), total alkalinity (Edds1993, Pokharel et al. 2018), pH, and total hardness (Rajbanshi et al. 2021, Shrestha et al. 2021) were identified as influential factors shaping fish assemblage structure. Public awareness is crucial for river pollution control and revival; further study is needed to understand water quality and productivity (Majumder and Mondal 2023).

CONCLUSION

The River Kankai possesses a rich diversity of fish ichthyofauna, comprising 94 species from 12 orders, 28 families, and 62 genera. As per the IUCN Red List of Threatened Species, several species including *Chela labuca, Labeo pangusia, Ailia coila, Anguilla bengalensis, Ompok bimaculatus,* and *Ompok pabda* are categorized as Near Threatened (NT), while *Channa orientalis, Cyprinus carpiocommunis,* and *Wallago attu* are classified as Vulnerable (VU). Local fishermen report that these species were once abundant, suggesting a decline likely attributed to activities such as bouldering, mining, and unregulated fishing. Loss of habitat due to these activities has rendered many species vulnerable. It is imperative to minimize, monitor, and, if necessary, should prohibit activities like bouldering, direct discharge of industrial waste into water bodies, overfishing, and sand mining to safeguard the aquatic flora, fauna, and natural balance of the River Kankai. Furthermore, this study, combined with previous works, can serve as a reference for future studies of the River Kankai and other interconnected waterways.

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