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Research Article

FISHING GEARS AND PRACTICES IN THE AQUATIC SYSTEMS OF KANCHANPUR DISTRICT, NEPAL: ISSUE AND TRENDS

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ABSTRACT

Various types of fishing gears and fish catching methods have been used worldwide for harvesting fishes from natural water bodies since antiquity. The present work aims to elucidate the current fishing gears and practices and knowledge of indigenous people and others about the impact of overfishing on wild fisheries in the aquatic systems of Kanchanpur district, Nepal. Data and information on fishing gears, fishing methods and knowledge about the impact of overfishing were obtained through direct observation and interactions with the local fishers of all the municipalities and rural municipalities of the Kanchanpur district through structured questionnaires; annual reports and programs of governmental and non-governmental organizations from October 2022 to September 2023. Fifteen types of conventional fishing gears, four types of unconventional fishing practices and nine fishing techniques viz., netting, trapping, hand lining and long lining, fish barrier, dewatering and hand gathering, spearfishing, poisoning, electrofishing and blast fishing were found to be followed by the fishers in different seasons. Traditional fishing practices were used by 53% fishers while massive destructive fishing practices by remaining ones (47%). Statistically, there was significant difference in the use of fishing gears and devices by the fishers ($p < 0.05$). All the fishers were unaware about the impact of overfishing of wild fish resources. Use of indiscriminate massive destructive fishing techniques and small mesh sized nets, fish capturing during breeding seasons and lack of awareness on proper scientific fishing methods are the main challenges for the conservation of feral fishes in the aquatic bodies of district.

Keywords: Fishing gears, fishing techniques, natural water bodies, overfishing, wild fisheries

INTRODUCTION

Humans have relied on the natural water bodies since ancient times for subsistence (Hosseiny *et al*., 2021) by harvesting its abundance of fish and other resources to feed family and local communities (Boopendranath, 2008). Various types of fish catching gears and methods are used in different parts of the world depending up on the fish ecology, fish species, fish availability, seasonality and allocated fund for making and mending gears, recreational and commercial fisheries (Shrestha, 1990; Shrestha, 1994; Eyo & Akpati, 1995; Dienye & Olopade, 2017; Okwuosa *et al*., 2018). In order to supply Earth's rapidly increasing population, new technologies and practices are used to remove fish from the natural water bodies on a massive scale that have many detrimental environmental consequences (MSC, 2025). Overfishing and overexploitation have led threat of extinction to many fish species (Dienye & Olopade, 2017; Carneiro & Martins, 2021; Hill, 2025). So, the use of fishing gears and practices have become the subject of much research interest in recent years in developing countries like Nepal.

Kanchanpur district, where the present study was conducted, is inhabited by 25.8% Rana-Tharu and 3.8% Dalit people (Government of Nepal, 2021). The ethnic groups like Rana, Tharu, Suhana and others of low economic status residing along the belt of the major rivers of the district depend upon the natural water bodies of the district to capture fishes required in their birth, wedding and funeral ceremony (Bist & Bist, 2022; Kalauni, 2024). Nearly one metric tons of fish is harvested from the major rivers of the district, besides of 727.3 metric tons fish production per year in the district from the ponds (Government of Nepal, 2020). Some studies suggest that the diversity of fish species is gradually declining in the Mahakali River of the Kanchanpur district (Shrestha, 2002; Saund *et al*., 2013; Joshi & Joshi, 2021). Many water bodies of the district are still waiting for the faunal exploration. This paper aims to elucidate the current fishing gears and practices and knowledge of native and others (Dalit) people about the impact of overfishing on wild fisheries in the natural aquatic bodies of the Kanchanpur district, as means of fisheries management.

MATERIALS AND METHODS

Study area

Kanchanpur district is situated in the south-western terai part of Nepal between $80^0$03' E to $80^0$33' E longitude and $28^0$38' N to $29^0$08' N latitude. There are eight main rivers (Mahakali, Jobuda, Chaudhary, Mohana, Syal, Banhara, Sanbora, Doda) and seven lakes (Banda Lake, Bedkot Lake, Pyara Lake, Jhilmila Lake, Shova Lake, Suklaphanta Lake and Ranital) in the district. The present study was conducted among the fishers of ethnic groups (Rana, Tharu, Sunaha) and Dalit communities residing along the belt of the rivers and lakes of the Kanchanpur district, Nepal (Fig. 1). These communities were chosen purposively as they were directly or

indirectly dependent upon lentic and lotic water resources.

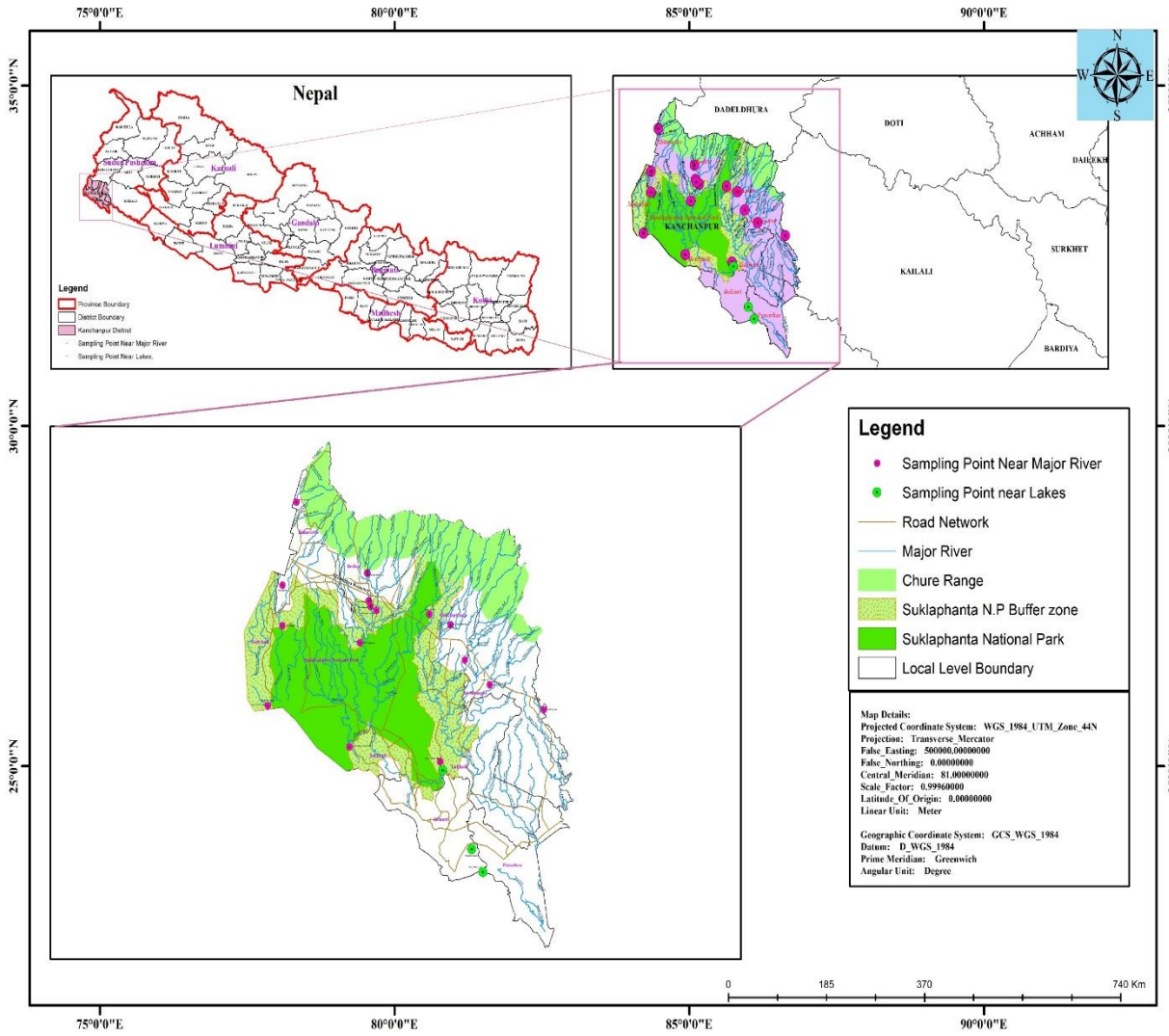

Figure 1. Map showing sampling areas near major rivers and lakes in Kanchanpur district

Sampling design, sample sizes and time schedule of the study

The sampling design was purposive probability sampling. Data and information on fishing gears, fishing methods and knowledge of native and Dalit people about the impact of overfishing on wild fisheries were obtained through direct observation and interaction with the local fishers of the all the seven municipalities and two rural municipalities of the Kanchanpur district through structured questionnaire and annual reports and programs of governmental and non-governmental organizations from October 2022 to September 2023. A total of 250 local fishers (150 ethnic and 100 non-ethnic group fishers) were interviewed. Field visit of major rivers (viz. Jogbuda, Mahakali, Chaudhary, Mohana, Syali, Sanbora, Banhara, Machheli- Doda, and Mohana) and three lakes (Shova Lake, Banda Lake, Pyara Lake), in every season, were carried during the study period. Other aquatic bodies of the district were not visited due to unsettlement of people, their location in the protected areas created by the government of Nepal and the religious sites where fishing is completely prohibited. The data were analyzed descriptively. The Chi-square test was computed using IBM SPSS Statistics Version 25.0 (IBM Corp, 2017) to analyze the statistically significant differences in the use of fishing gears and devices by fishers at 5% level of significance ($p \leq 0.05$).

RESULTS

Fifteen types of conventional fishing gears and four types of unconventional fishing practices were recorded to be used by the fishers in the aquatic bodies of the Kanchanpur district. The conventional fishing gears were eight nets, five traps, one hand line (handheld J-hook) and one drifting long line. The unconventional fishing practices were wounding gear (spear), poisons

(two poisons), electric current and explosives (dynamite). The particulars of different types of fishing gears are given in Table 1, Table 2, Fig. 2 and Fig. 3. The fishers of the district used composite fishing gears, devices and practices. Nets (gill net and cast net) were the main gears and contributed about 99% of the total fish catch. Statistically, there was also significant difference (χ^2 = 58.560, df = 10, $p < 0.05$) in the use of fishing gears and devices by the fishers indicating more preference on the conventional fishing gears, especially nets followed by traps than others.

Table 1. Types of fishing nets used by fishers in Kanchanpur district.

Name of fishing net	Local name of fishing net	Description				Nature of net	Fishing period
		Length (m)	Depth (m)	Mesh size (mm)	Materials used	Non-selective	
Cast net	Jaal	2.6	5	10×10	Nylon	Non-selective	Year round
Gill net	Mahajaal	1	15	25×25	Nylon	Non-selective	Year round
Hand operated umbrella lift net	Thathi	1.3	2.1	5×5	Nylon	Non-selective	Monsoon
Two sticked dip-net	Tapi	1.5	1.25	5×5	Nylon	Non-selective	Year round
Triangular dip-net	Pakhai	2	1.5	2×2	Nylon	Non-selective	Year round
Scoop net				2×2	Nylon	Non-selective	Year round
Mosquito drag-net				2×2	Nylon	Non-selective	Year round
Hand net	Hulka	0.7	0.8	5×5	Cotton	Non-selective	Year round

Table 2. Types of fishing traps used by fishers in Kanchanpur district.

Name of trap	Local name of trap	Description					Nature of trap	Fishing period
		Length (m)	Breath (m)	Height (m)	Mesh size (mm)	Materials used		
Basket trap	Dhadiya	1	0.25	0.55	5×5	Bamboo	Non-selective	Monsoon
Hut trap	Round Dhimari					Bamboo	Non-selective	monsoon
	Rectangular Dhimari	0.3	0.2	0.2	5×5	Bamboo	Non-selective	Round year
Gradient trap	Khong/ Khongya	1.4	0.15-0.25	-	5×5	Bamboo	Non-selective	Monsoon
Cover pot	Chhapariya	0.5	0.6	-	5×5	Bamboo	Non-selective	Round year
Vessel trap	Prataniya					Steel/brass	Non-selective	Round year

Nine fishing techniques viz., netting, trapping, hand lining (angling) and drifting long lining, fish barrier, dewatering and hand gathering, spearfishing, poisoning, electrofishing and blast fishing were found to follow by the fishers (Fig. 4). Traditional fishing practices (viz. netting, trapping, hand lining and long lining, fish barrier, dewatering and hand gathering, and spearfishing) were used by 53% fishers while massive destructive fishing practices (viz. poisoning by synthetic toxins– Endosulfan sulfate or Aluminium phosphide and ichthyotoxic herbs– raw extract of *Polygonum* species, electrofishing and blast fishing) by 47% fishers. Among the massive destructive fishing practicians, 35% used poisons (23% synthetic toxins, 6% ichthyotoxic substances, and 6% both the synthetic toxins and ichthyotoxic herbs); 6% electric current and 6% explosive devices (dynamites) for capturing the fish.

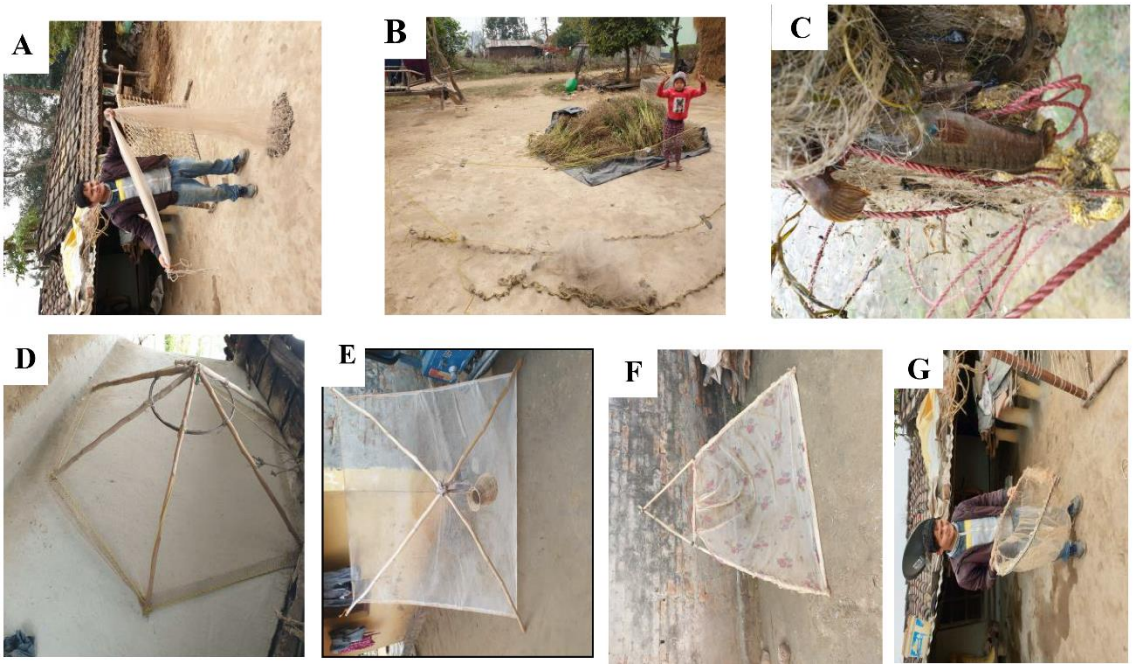

Figure 2. Fishing nets A–Cast net, B–Gill net, C–Fish Captured in gill net, D–Hand operated lift net, E–Two sticked dip net, F–Triangular dip net, G–Hand net.

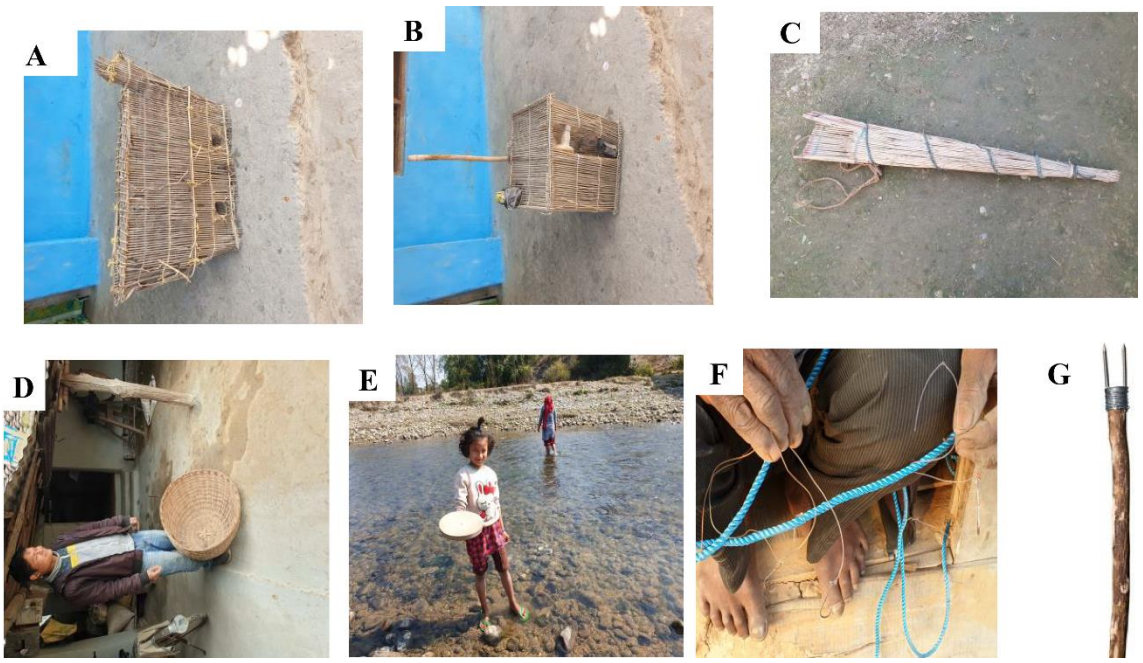

Figure 3. Fishing traps A–Basket trap, B–Hut trap, C–Gradient trap, D–Cover pot, E–Vessel trap, F–Long line, G–Spear.

Fishers of ethnic and non-ethnic groups harvested different aquatic bodies. The Fishing sites, season and time were varied with fishers. The rivers were harvested by 38% non-ethnic group fishers year-round both day and night, 4% ethnic group fishers during monsoon period and 4% year round on day and 4% ethnic group fishers year round day and night; wetlands streams and ditches were harvested by 2% non-ethnic group fishers and 4% ethnic group fishers during post-monsoon period on day time; all aquatic bodies (rivers, streams, ditches, lakes, wetlands, paddy fields) of the district were harvested by ethnic group fishers of 4% during monsoon period, 4% during post-monsoon period and 22% year round on day and 14% year round on both day and night

time (Fig. 5). All sized fish were captured by fishers mainly (82%) for food and partly (18%) both for food and business purposes.

None of the surveyed fishers were aware of the negative impact of overfishing on natural aquatic ecosystems and sustainable use of wild fisheries (Table 3).

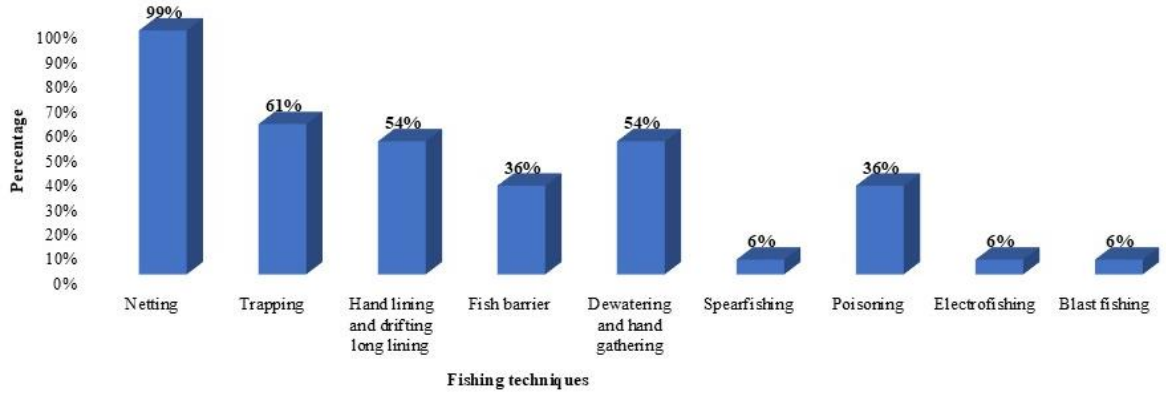

Figure 4. Fishing techniques used by fishers in Kanchanpur district

Table 3. Awareness of fishers about the impact of overfishing and fish conservation practices in Kanchanpur district

Characteristics	Caste of respondents	Age of respondents (Year)	Sex of respondents	Frequency of respondents	Total number of respondents
Aware about negative impact of overfishing in natural aquatic bodies, Nepal's "Aquatic animal protection act 2017" and fish conservation practices	Ethnic caste	-	-	-	-
	Dalit caste	-	-	-	-
Unaware about negative impact of overfishing in natural aquatic bodies, Nepal's "Aquatic animal protection act 2017" and fish conservation practices	Ethnic caste	Below 20	Male	5	150
		Below 20	Female	5	
		21-40	Male	30	
		21-40	Female	45	
		Above 40	Male	45	
		Above 40	Female	20	
	Dalit caste	Below 20	Male	5	100
		21-40	Male	55	
		Above 40	Male	40	

DISCUSSION

The demand for natural water bodies fish is increasing day by day. This demand can be met only if significant changes are made in wild fishery management (Ogutu-Ohwayo & Balirwa, 2006). Various types of active and passive fishing gears and methods are reported by researchers from different parts of the worlds with respect to their operation, structure design and economic efficacy (Mohan Rajan, 1993; Remesan, 2006; Remesan & Ramachandran, 2008; Pravin *et al.*, 2011; Kumar *et al.*, 2015; Nissa *et al.*, 2021;). In the present study, the use of different fishing gears, devices and methods varied with fishers, fishing seasons and fishing sites. The fishers of ethnic group used all types of conventional nets and traps for fishing during the monsoon period. In the rivers, having less macro-vegetation, fine mesh sized nylon gill nets, cast nets and mosquito drag nets were used but in rivers, streams and lakes having more macro-vegetation, cotton hand nets and cover pots were used during the last monsoon and post-monsoon period. Besides these conventional fishing gears, they were found also using spear and fishing by dewatering and hand gathering in shallow clear water. The professional male fishers used tube operated drag nets, drifting long lines and explosive devices in deep waters fishing while children used hand lines to catch small sized fishes. The fishers of non-ethnic group used cast nets, gill nets, tube operated drag nets, hooks and long lines for fishing during monsoon period and cast nets and gill nets throughout year. Nearly half (47%) of the fishers (both ethnic and non-ethnic people) still capture the fish by indiscriminate massive destructive methods in deep water during post-monsoon, spring and summer seasons. Similar types of fishing gears and methods are also reported in Niger Delta, Nigeria (Dienye & Olopade, 2017) and North Kerala (Remesan, 2006). The similarities in fishing gears and methods might be due to small scale fish catching in natural shallow waters by illiterate poor native people for family feeding and marketing and also economical for cost effectiveness (Ipinjolu *et al.*, 2005; Pravin *et al.*, 2011) and increased durability of the traditional fishing gears than

other prefabricated synthetic materials (Nissa *et al.*, 2021). Except poisons, electric current and explosive devices, the traditional fishing gears fabricated with indigenous materials and methods are also reported from North-East and South of India (Mohan Rajan, 1993; Remesan & Ramachandran, 2008; Pravin *et al.*, 2011; Nissa *et al.*, 2021); Igbedi Creek, Niger Delta (Kwen *et al.*, 2013) and Lower Taylor Creek Area, Bayelsa State, Nigeria (Kingdom & Kwen, 2009) and BSKL Beel, Bangladesh (Rahman *et al.*, 1999). The traditional fishing gears, small non-mechanized fishing crafts and mechanized boats are also used for fishing in some rivers, reservoirs and lakes of India (Srivastava & Srivastava, 2011; Joshi, 2012; Kumar *et al.*, 2015; Raveendar *et al.*, 2018) and are commonly employed in the Gangetic and the Brahmaputra systems (Dutta *et al.*, 2012; Singh & Agarwal, 2014). There are significant changes in fishing gears and fishing practices in other parts of the world (Baelde, 2001; Remesan, 2006). These differences in fishing gears and methods might be due to large scale fish catching for commercial purposes.

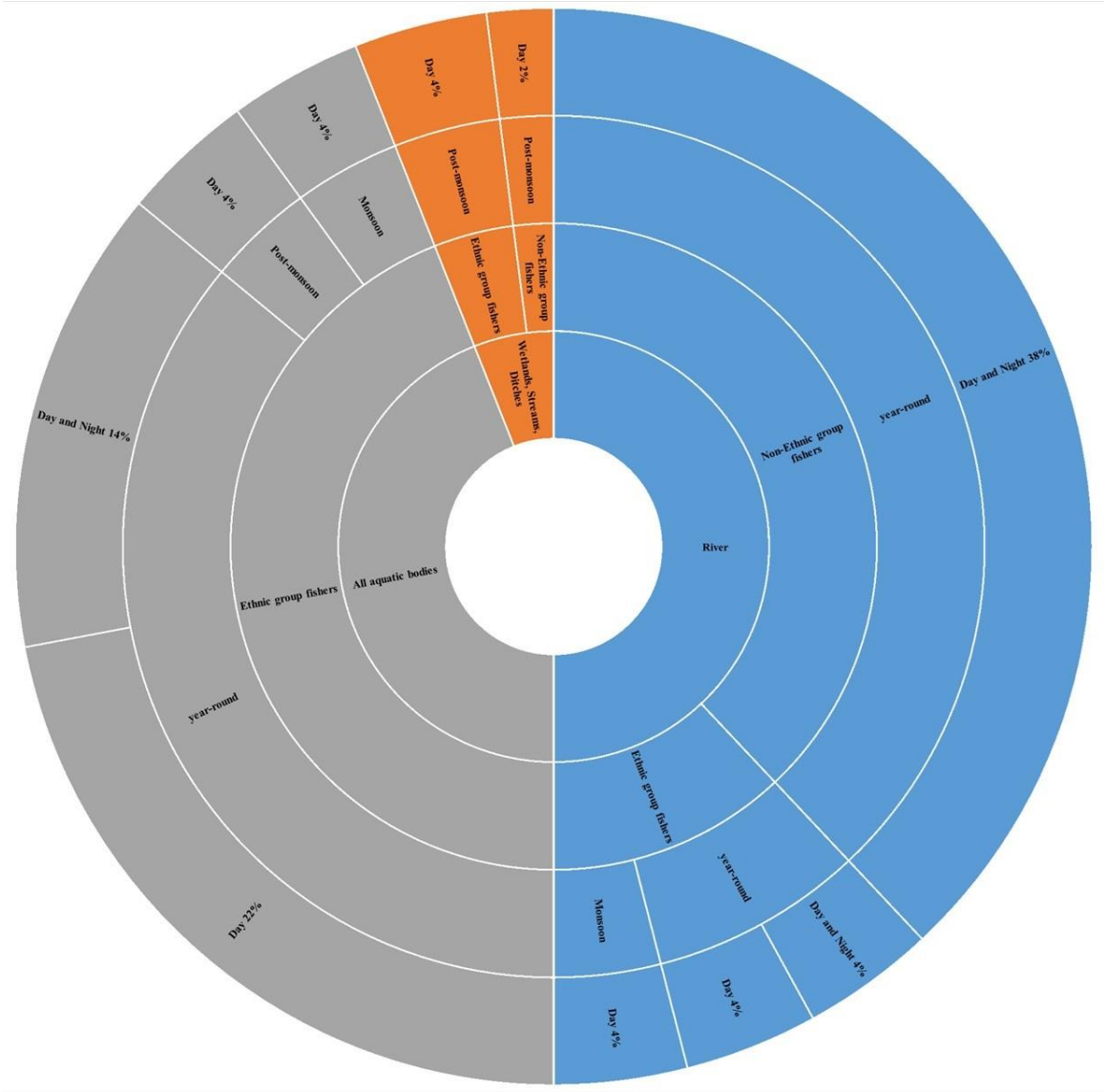

Figure 5. Fishing sites, fishers, fishing seasons and fishing time in Kanchanpur district

In the present study, nearly all the ethnic and non-ethnic group fishers, residing along the belts of rivers, streams and lakes of the Kanchanpur district, were found to capture the fishes from different water bodies year-round with the help of traditional hand operated fishing gears in the changing climate and fisheries scenarios. In the Beels of Bangladesh, the fishing starts from early monsoon (Rahman *et al.*, 1999). In certain estuaries of Goa, the fishing season is usually during the pre- and post-monsoon period (Mohanta & Subramanian, 2001). Ngasepam *et al.* (2015) also reported indiscriminate fishing year-round with traditional fishing gears in Pumlen lake, Manipur. Nissa *et al.* (2021) documented fishing during monsoon and post-monsoon seasons in

Meghalaya, Northeast India. These differences might be due to fluctuations of water levels in rivers, streams, reservoirs, low lying areas and flood plains based on season.

All sized fish, that were trapped in different mesh sized nets and other fishing gears and massive destructive methods, were captured by the fishers of the Kanchanpur district mainly for food. But large sized carp fish snatched the more attention of fishers compared to small fish in the Ganga River and 1.5 inch to 3.5 inch mesh size cast nets were used to capture them for market (Dwivedi *et al*., 2017).

In the present study, all the fishers of the Kanchanpur district were found unaware regarding the impact of overfishing of wild fish resources. There are no strict strategies and action plans for promoting aquaculture and awareness program on proper scientific fishing methods for all stakeholders (especially local fishers) utilizing the natural water bodies resources (Government of Sudurpashchim Province, 2021), except creating a fish conservation zone, especially Mahseer fish, in lower regimen of Mahakali River (NEEDS, 2019). Similar types of constraints were also reported in the management of freshwater fisheries in Africa (Ogutu-Ohwayo & Balirwa, 2006).

CONCLUSIONS

Different types of both active and passive traditional fishing gears, devices and methods are still followed by the fishers in the Kanchanpur district to capture the fish from natural aquatic ecosystems. Local diversion of rivers, use of massive destructive fishing practices (poisoning, electro fishing, blast fishing) and small mesh sized nets for fishing; fish capturing during breeding seasons and poor knowledge on proper scientific fishing methods are the main challenges faced by natural water bodies and will be the causes of decline of most food, game and ornamental fishes from the Kanchanpur district in the future. Training and awareness program should be organized on proper scientific fishing methods for all stakeholders (especially local fishers) utilizing the natural water bodies resources. Use of Less than 20 mm mesh size nets and stupefying devices and killing of brooders during breeding season should be strictly banned. Encouragement of fish-based communities for fish farming, initiatives of fish conservation by mobilizing local communities, especially women, and effective enforcement of law should be prioritized. Biodegradable and environmentally friendly materials of fishing gears, instead of nylon nets, should be suggested for fishing practices. Cooperation at all levels of government and from local communities to nations is essential for sustainable utilization of lentic and lotic water resources.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

DATA AVAILABILITY STATEMENT

All relevant data are within the manuscript. Supporting information is fully available at a reasonable request from the corresponding author.

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