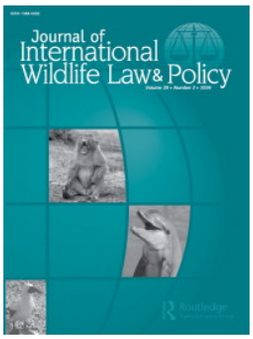

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Journal of International Wildlife Law & Policy

ISSN: 1388-0292 (Print) 1548-1476 (Online) Journal homepage: www.tandfonline.com/journals/uwlp20

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To cite this article: Prantik Das & Vilakkathala Vijayan Binoy (19 May 2026): From Attitudes to Actions: Bridging Conservation Planning Framework, Theory of Planned Behaviour and Social Values to Protect Charismatic Freshwater Fishes, the Mahseer, Journal of International Wildlife Law & Policy, DOI: 10.1080/13880292.2026.2666482

To link to this article: https://doi.org/10.1080/13880292.2026.2666482

Published online: 19 May 2026.

JOURNAL OF INTERNATIONAL WILDLIFE LAW & POLICY
https://doi.org/10.1080/13880292.2026.2666482

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From Attitudes to Actions: Bridging Conservation Planning Framework, Theory of Planned Behaviour and Social Values to Protect Charismatic Freshwater Fishes, the Mahseer

Prantik Das* and Vilakkathala Vijayan Binoy+

ABSTRACT

Mahseers are a group of iconic, freshwater fishes native to South, East, and South-East Asia, with varied significant ecological, socio-cultural, and livelihood values. The complex socio-ecological contexts in which their conservation unfolds demand an approach that integrates stakeholders' behavioural dimensions and the socio-cultural values associated with these fishes into conservation planning and implementation for effective outcomes. This study examined different facets of mahseer conservation across three environmentally, geographically, and socio-culturally distinct Indian states—Karnataka, Assam, and Uttarakhand—using a framework integrating a conservation planning framework (CPF) with the theory of planned behaviour (TPB) and social values (SV). Across all the focal states, the following three key themes were developed 'consensus between stakeholders,' 'communication and collaboration,' and 'values and moral responsibility.' Our analyses revealed that while shared ecological concerns created opportunities for collective conservation actions, a series of barriers was also apparent, namely, inter-stakeholder conflicts, communication gaps, hesitation to collaborate, top-down governance, and restricted decision-making autonomy for tribal and local communities. Stakeholders from all three states demonstrated strong pro-conservation attitudes, moral responsibility, perceived capability to implement the conservation plans, and culturally embedded value for mahseer, rooted in religious beliefs, tribal and local identities and recreational traditions. However, the on-ground analysis revealed low 'actual behavioural control' amongst many stakeholders, limiting the translation of the positive elements present in their attitudes and values into tangible conservation outcomes. Our results emphasise formalising community-based co-management, strengthening inter-departmental coordination, building conservation capacity, adopting socio-culturally grounded communication strategies, and repositioning community fishing events as socio-ecological heritage to ensure stakeholder compliance of the existing mahseer conservation plans and improve their success. Furthermore, aligning conservation planning with behavioural drivers and social values

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could offer critical insights for formulating inclusive strategies and policies to safeguard mahseer and manage their habitats.

1. Introduction

India is home to 22 of the 56 mahseer species found across the globe.[1] These iconic, freshwater fishes (with some species exceeding 30 kg in size—megafishes) are taxonomically classified into three genera: *Tor*, *Neolissochilus* and *Naziritor*.[2] Amongst these, two species are critically endangered, two are endangered, one is vulnerable, three are near threatened, one is of least concern, five are data deficient and the rest continues as status not evaluated.[3]

The cultural diversity showcased by India can be seen reflected also in the way in which mahseers are treated by the people in this nation. Evidence is available to show that mahseers enjoyed social significance from the time of the Indus Valley Civilisation.[4] In Indian states of Karnataka and Maharashtra and parts of Uttarakhand, these fishes hold a sacred status and are often referred to as 'God's Fish.'[5] Many communities from these regions consider killing and eating mahseers as inauspicious, and such activities may bring bad luck on those who do it.[6] Similarly, some tribal communities in the northeastern states of India also revere these fishes.[7] These beliefs can be seen translated into several

[1]R Fricke, WN Eschmeyer. and R Van der Laan, *Eschmeyer's Catalogue of Fishes: Genera, Species, References* <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>.

[2]Fricke, Eschmeyer and Vaan der Laan ibid; R Froese and D Pauly, *FishBase* <www.fishbase.org>.

[3]Froese and Pauly ibid.

[4]SL Hora, 'Fish Paintings of the Third Millennium BC from Nal (Baluchistan) and Their Zoogeographical Significance' (1956) 14 *Mem Indian Museum* 73; WR Belcher, *Fish Exploitation of the Baluchistan and Indus Valley Traditions: An Ethnoarchaeological Approach to the Study of Fish Remains* (PhD thesis, University of Wisconsin–Madison 1998); AC Pinder et al, 'Mahseer (Tor spp.) Fishes of the World: Status, Challenges and Opportunities for Conservation' (2019) 29 *Reviews in Fish Biology and Fisheries* 417.

[5]N Gupta, P Nautiyal, A Borgohain, K Sivakumar, VB Mathur and MA Chadwick, 'Catch-and-Release Angling as a Management Tool for Freshwater Fish Conservation in India' (2016) 50 *Oryx* 250; Pinder et al (n 4).

[6]P Dandekar, 'India's Community Fish Sanctuaries Protect Wild Fish and Rivers' (2011) 26 *World River Reviews* 1; P Harad, 'Fish and Fisheries in Marathi Folklore: A Cultural Study' in P Goyal, GS Abhayan and S Channarayapatna (eds), *Animals in Archaeology: Integrating Landscapes, Environment and Humans in South Asia (A Festschrift for Prof. P. P. Joglekar)* (University of Kerala 2023) 723–739.

[7]GD Dunbar, 'Tribes of the Brahmaputra Valley' (1915) 63 *Journal of the Royal Society of Arts* 289; A Borah, 'Linking Nature and Culture for Sustainable Tourism Development: A Study of Eco-Cultural Tourism Prospects in Northeast India' (2015) 3 *Asian Journal of Multidisciplinary Studies* 72; D Sarma, MS Akhtar, P Sharma and AK Singh, 'Resources, Breeding, Eco-Tourism, Conservation, Policies and Issues of Indian Mahseer: A Review' (2018) 1 *Coldwater Fisheries Society of India* 4; J Ruffner and E Barbery Smith, *Healing the Broken Spine: A Community-led Conservation Initiative in Garo Hills, Meghalaya, India* (ICOMOS 2019).

community-protected 'temple-based fish sanctuaries' to safeguard these revered fishes in Karnataka, Maharashtra and Uttarakhand,[8] along with several other government–local communities, partnered and managed fish sanctuaries in Meghalaya.[9] However, in northeastern states like Assam, Arunachal Pradesh, Nagaland and Sikkim, along with the northern regions of West Bengal, local community members have been fishing mahseers for generations[10] and these fishes often fetch high price in the market.[11] They are also fished in other states such as Himachal Pradesh, Jammu and Kashmir, Odisha and Kerala.[12]

Traditionally in India, mahseers have been angled for recreation,[13] and a 12th century Sanskrit text *Manasollasa* describes mahseers as valuable for both culinary and angling purposes.[14] From the British colonial era, anglers from different continents visited India to hook these mighty fishes.[15] In recent times, catch and release recreational angling-based ecotourism boosted local economies by generating income, providing livelihood opportunities and employment for local communities in Uttarakhand, Karnataka and Himachal Pradesh.[16] Sadly, natural populations of many of these mahseer species are facing threats of extermination across India due to multiple pressures such as dam construction, siltation, introduction of

[8]M Gadgil, 'Conserving India's Biodiversity: The Societal Context' (1991) 5 *Evolutionary Trends in Plants* 3; Dandekar (n 6); C Katwate, R Pawar, V Shinde, D Apte and U Katwate, 'How Long Will Social Beliefs Protect the Pride of River Savitri?' (2014) 2 *MIN: The Newsletter of the IUCN SSC/WI Freshwater Fish Specialist Group (South Asia)* 21

[9]VV Sugnnan, *Reservoir Fisheries of India. FAO Fisheries Technical Paper. No. 345* (FAO 1995); AP Rahman, 'Fish Sanctuaries and Community Support for Conservation of Meghalaya's Mahseer' <https://vikalpsangam.org/article/fish-sanctuaries-and-community-support-for-conservation-of-meghalayas-mahseer>.

[10]D Baruah and D Sarma, 'Mahseer in Recreational Fisheries and Ecotourism in India' (2018) 22 *NACA Newsletter* 1.

[11]Dunbar (n 7); Sikkim Government Gazette <https://twitter.com/sikkimgovt/status/1439217038954614787?t=Y7haHirdK2lJhpyiAe1qMw&s=19>.

[12]N Gupta, M Everard, P Nautiyal, I Kochhar, K Sivakumar, JA Johnson and A Borgohain, 'Potential Impacts of Non-Native Fish on the Threatened Mahseer (*Tor*) Species of the Indian Himalayan Biodiversity Hot Spot' (2020) 30 *Aquatic Conservation: Marine and Freshwater Ecosystems* 394.

[13]P Nautiyal, 'Review of the Art and Science of Indian Mahseer (Game Fish) From Nineteenth to Twentieth Century: Road to Extinction or Conservation?' (2014) 84 *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences* 215; N Gupta, R Raghavan, K Sivakumar, V Mathur, and AC Pinder, 'Assessing Recreational Fisheries in an Emerging Economy: Knowledge, Perceptions and Attitudes of Catch-and-Release Anglers in India' (2015) 165 *Fisheries Research* 79.

[14]SL Hora, 'Knowledge of Ancient Hindus Concerning Fish and Fisheries of India: Fish in Sutras and Smriti Literature' (1953) 110 *Journal of the Asiatic Society: Letters* 63; N Sadhale and YL Nene, 'On Fish in Manasollasa (c. 1131 AD)' (2005) 9 *Asian Agri-History* 177.

[15]Nautiyal (n 13); Gupta et al (n 13).

[16]M Everard and G Kataria, 'Recreational Angling Markets to Advance the Conservation of a Reach of the Western Ramganga River' (2011) 21 *Aquatic Conservation: Marine and Freshwater Ecosystems* 101; AC Pinder and R Raghavan, 'Conserving the Endangered Mahseers (*Tor* spp.) of India: The Positive Role of Recreational Fisheries' (2013) 104 *Current Science* 1472.

alien species, community and mass fishing, illegal and destructive fishing, poaching, overfishing, deforestation and unregulated angling.[17]

Various plans are being implemented by both central and various state governments in India to conserve mahseers. Designating many species as state fishes (e.g., *T. putitora* by Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh; *T. mahanadicus* by Odisha; *T. tor* by Madhya Pradesh and *N. hexagonolepis* by Sikkim and Nagaland),[18] banning recreational angling in all protected areas across the nation,[19] and the captive breeding of many mahseers and restocking approximately 5,00,000 fingerlings into different rivers and lakes annually[20] are few such measures taken. Furthermore, the many state governments such as Assam, Bihar, Himachal Pradesh, Karnataka and Uttarakhand have implemented specific Fisheries Acts and Rules to prohibit fishing activity during the breeding season to protect migrating mahseer breeders,[21] lease specific stretches of rivers to non-governmental organisations (NGOs) as for conservation purposes, and establish fish sanctuaries, protected areas, no fishing zones, ban of fishing and fish movement during closed seasons.[22]

Despite these efforts, there is abundant evidence that mahseer populations across India continue to dwindle.[23] The identification of all relevant individuals and groups affected by or capable of influencing any step of the management plan[24] and fostering conservation-positive changes in their

[17]R Raghavan, A Ali, N Dahanukar and A Rosser, 'Is the Deccan Mahseer, *Tor khudree* (Sykes, 1839) (Pisces: Cyprinidae) Fishery in the Western Ghats Hotspot Sustainable? A Participatory Approach to Stock Assessment' (2011) 110 *Fisheries Research* 29; JP Bhatt and MK Pandit, 'Endangered Golden Mahseer *Tor putitora* Hamilton: A Review of Natural History' (2016) 26 *Reviews in Fish Biology and Fisheries* 25.

[18]MS Akhtar and A Ciji, 'The Endangered Mighty Mahseer (*Tor putitora*) in the Himalayan Waters' in PK Pandey, N Pandey and MS Akhtar (eds), *Fisheries and Aquaculture of the Temperate Himalayas* (Springer 2023) 81–94; Sikkim Government Gazette (n 11).

[19]*Ajay Dubey* v. *NTCA*: SLP No. 21339/2011. See further Gupta et al (n 13).

[20]CV Kulkarni and SN Ogale, *Conservation of the Mighty Mahseer of India* (Tata Press Limited 1995); ICAR-DCFR, 'Annual Report 2015–16' <https://cicfr.res.in/wp-content/uploads/2025/04/Annual_Report_2015-16.pdf>.

[21]See the Assam Fishery Rules, 1953; the Himachal Pradesh Fisheries Act, 1976; and the Uttarakhand Fisheries Act, 2003 (Uttarakhand Act No. 2 of 2003) <https://faolex.fao.org/docs/pdf/ind195252.pdf>.

[22]See the Karnataka Inland Fisheries (Conservation, Development and Regulation) Act, 1996 (Karnataka Act 27 of 2003); and the Bihar Jalkar Management (Amendment) Act, 2018 (Bihar Act 13 of 2006).

[23]Pinder et al (n 4); D Sarma, D Mohan, R Posti, M Arya and PA Ganie, 'The Mighty Mahseers of the Genera *Tor, Neolissochilus* and *Naziritor*: A Review on Resource Distribution, Biology, Ecotourism and Conservation' (2022) 69 *Indian Journal of Fisheries* 146; Z Abass et al, 'The Mahseer: The Tiger of Water—An Angler's Delight in the Himalayas and the Undisputed King of Sport Fishing' (2024) 279 *Fisheries Research* 107.

[24]See the stakeholder responses in Section 3 below; see also DJ Decker, CC Krueger, RA Baer Jr, BA Knuth and ME Richmond, 'From Clients to Stakeholders: A Philosophical Shift for Fish And Wildlife Management' (1996) 1 *Human Dimensions of Wildlife* 70: DJ Decker, TB Lauber and WF Siemer, *Human–Wildlife Conflict Management: A Practitioner's Guide* (Human Dimensions Research Unit, Cornell University 2002).

attitude and behaviour[25] is therefore highly important to understanding ecological, breeding, genetics and taxonomic aspects of the focal species for conserving any wild population. Furthermore, excluding groups or individuals, especially those with whom the researchers and wildlife managers disagree,[26] and the differences existing in the values attributed by different stakeholders to the wild species can significantly undermine conservation efforts,[27] result in conservation policy failure, and may even lead to human–human conflict.[28]

Although attempts to integrate a human dimension into fish conservation are not novel,[29] this approach remains underutilized in both policy making and on-ground conservation actions to protect aquatic species in India. With the interest in mahseer conservation growing amongst policymakers, government officials, scientists, anglers and local communities in India,[30] it is vital to align perspectives, knowledge, attitudes, values, and individual and collective ways of feeling and acting, and to trace out the socio-cultural, political and environmental factors determining the human–mahseer relationship in different states of India to protect these apex predators in their natural habitats.[31]

One of the schemes popularly utilised for integrating human dimensions into wildlife conservation and management is the conservation planning framework (CPF).[32] Studies based on the CPF are conducted to find effective strategies for mitigating human–human conflicts and promoting

[25]J Cinner, 'How Behavioral Science Can Help Conservation' (2018) 362(6417) *Science* 889.

[26]S Marchini, 'Who's in Conflict with Whom? Human Dimensions of the Conflicts Involving Wildlife' in LM Verdade, MC Lyra-Jorge and CI Pina (eds), *Applied Ecology and Human Dimensions in Biological Conservation* (Springer 2014) 189–209.

[27]Marchini ibid.

[28]M Dorow, B Beardmore, W Haider and R Arlinghaus, 'Using a Novel Survey Technique to Predict Fisheries Stakeholders' Support for European Eel (*Anguilla anguilla L.*) Conservation Programs' (2009) 142 *Biological Conservation* 2973; LM Hunt, SG Sutton and R Arlinghaus, 'Illustrating the Critical Role of Human Dimensions Research for Understanding and Managing Recreational Fisheries Within a Social-Ecological System Framework' (2013) 20 *Fisheries Management and Ecology* 111; R Arlinghaus, K Lorenzen, BM Johnson, SJ Cooke and IG Cowx, 'Management of Freshwater Fisheries: Addressing Habitat, People and Fishes' in JF Craig (ed), *Freshwater Fisheries Ecology* (Wiley 2016) 557–579.

[29]Cinner (n 25).

[30]Pinder et al (n 4); A Roy and N Sreenivasan, 'A Sanctuary for Fish and a Future for the River is Shivanasam udram's Conservation Story' <https://www.downtoearth.org.in/wildlife-biodiversity/a-sanctuary-for-fish-and-a-future-for-the-river-is-shivanasamudrams-conservation-story>.

[31]R Dacks, S Yadav and A Mawyer, 'Emerging Human Dimensions Research in Coastal and Nearshore Oceania' (2025) 39 *Conservation Biology* e14455.

[32]S Marchini, KMPMB Ferraz, A Zimmermann, T Guimarães-Luiz, R Morato, PL Correa and DW Macdonald, 'Planning for Coexistence in a Complex Human-Dominated World' in B Frank, JA Glikman and S Marchini (eds), *Human–Wildlife Interactions: Turning Conflict into Coexistence* (Cambridge University Press 2019) 414–438.

human–wildlife coexistence.[33] The CPF examines three fundamental aspects of conservation: (a) individual attributes (knowledge, attitudes, values), (b) social phenomena (governance, policies) and (c) social processes (decision-making, development).[34]

The CPF involves three essential stages, each encompassing multiple themes: situation assessment, decision-making and implementation, and monitoring and evaluation (detailed in Supplementary Materials SM 1).[35] Since social values can guide what people perceive and the action chosen by them towards the focal organisms decisively,[36] recent research strongly advised the integration of this concept into CPF.[37] Although 'value' is a debatable topic due to its innate sensitivity to individual, context and culture, Chan et al classifies the social values of humans towards nature and wildlife into three categories, viz., 'intrinsic' (appreciation of wildlife and nature for its own sake; inherent values), 'instrumental' (value of wildlife based on human material needs and usefulness; valuing for tangible benefits like livelihood) and 'relational' (value of wildlife developed through cultivated relationships and meanings with humans that involves a sense of morality, responsibility, spiritual, identity, sense of belonging, personal and cultural connection with wildlife).[38]

Relational values built on the cultural beliefs and social norms prevalent in a community can, in turn, promote both intrinsic and instrumental values by influencing cultural and individual identity, moral responsibility to non-humans, social responsibility, environmental stewardship, and so on.[39] Hence the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Service (IPBES) Value Assessment (2022) recommends

[33]M Pimid, MR Mohd Nasir, KT Krishnan, GK Chambers, AG Ahmad and J Perijin, 'Understanding Social Dimensions in Wildlife Conservation: Multiple Stakeholder Views' (2022) 12 *Animals* 811.

[34]NJ Bennett et al, 'Conservation Social Science: Understanding and Integrating Human Dimensions to Improve Conservation' (2017) 205 *Biological Conservation* 93; Pimid et al (n 33).

[35]Marchini et al (n 32); S Zuluaga, JM Grande and S Marchini, 'A Better Understanding of Human Behavior, Not Only of "Perceptions", Will Support Evidence-Based Decision Making and Help to Save Scavenging Birds: A Comment to Ballejo et al' (2020) 250 *Biological Conservation* 108747.

[36]KM Chan et al, 'Why Protect Nature? Rethinking Values and the Environment' (2016) 113 *Proceedings of the National Academy of Sciences* 1462.

[37]Pimid et al (n 33).

[38]Chan et al (n 36).

[39]Gupta et al (n 5); JY Thinley and J Hartz-Karp, 'National Progress, Sustainability and Higher Goals: The Case of Bhutan's Gross National Happiness' (2019) 2 *Sustainable Earth* 11; A Balmford et al, 'Making More Effective Use of Human Behavioural Science in Conservation Interventions' (2021) 261 *Biological Conservation* 109256.

utilising relational values for formulating conservation plans involving multi-stakeholders.[40]

Along with the knowledge of the different dimensions of social values, insights into the psychological underpinnings of the responses towards a conservation issue by different stakeholders are also essential to promote sustainable pro-conservation behaviours and environmental stewardship in a society to facilitate positive behaviour change. In many contexts, the successful induction of the desired changes in the behaviours of the targeted stakeholders can even reduce the cost of expensive interventions and hence catalyse the momentum of conservation actions that have often been afflicted by the limited availability of resources.[41]

One of the most robust and widely used socio-psychological models of human behaviour in conservation scenarios is the theory of planned behaviour (TPB).[42] According to the TPB the strongest predictor of what a person or a group does in a given context is their intention.[43] However, three factors, popularly known as the 'motivational factors'—namely, attitudes,[44] societal norms and pressures, and perceived control over one's own behaviour[45]—have a profound influence on a person's intention and hence the choices they make in a decision-making context.[46] The first component, attitude, plays a central role in TPB, and significantly shapes how an individual perceives and evaluates a behaviour associated with a particular organism. This evaluative judgment is largely influenced by that individual's underlying beliefs and the context in which the behaviour

[40]P Balvanera, U Pascual, M Christie, B Baptiste and D González-Jiménez (eds), *Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES Secretariat 2022) <https://doi.org/10.5281/zenodo.6522522>; U Pascual et al, *Summary for Policymakers of the Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES Secretariat 2022), Bonn, Germany. <https://doi.org/10.5281/zenodo.6522392>; U Pascual et al, 'Diverse Values of Nature for Sustainability' (2023) 620 *Nature* 813.

[41]A Echols, A Front and J Cummins, 'Broadening Conservation Funding' (2019) 43 *Wildlife Society Bulletin* 372.

[42]I Ajzen, 'From Intentions to Actions: A Theory of Planned Behavior' in J Kuhl and J Beckmann (eds), *Action Control: From Cognition to Behavior* (Springer 1985) 11–39; I Ajzen, 'The Theory of Planned Behavior' (1991) 50 *Organizational Behavior and Human Decision Processes* 179.

[43]F Zhong et al, 'Quantifying The Influence Path of Water Conservation Awareness on Water-Saving Irrigation Behavior Based on the Theory of Planned Behavior and Structural Equation Modeling: A Case Study from Northwest China' (2019) 11 *Sustainability* 4967.

[44]S Ullah, A Abid, W Aslam, RS Noor, MM Waqas and T Gang, 'Predicting Behavioral Intention of Rural Inhabitants Toward Economic Incentive for Deforestation in Gilgit-Baltistan, Pakistan' (2021) 13 *Sustainability* 1.

[45]Ajzen, 'From Intentions to Actions' (n 42); Ajzen, 'The Theory of Planned Behavior' (n 42).

[46]M Sánchez, N López-Mosquera, F Lera-López and J Faulin, 'An Extended Planned Behavior Model to Explain the Willingness to Pay to Reduce Noise Pollution in Road Transportation' (2018) 177 *Journal of Cleaner Production* 144.

occurs.[47] Social norms or social pressures originate from the perceived expectations of their significant others (family, peers, or community leaders) and their belief about whether these important people would support or disapprove of their chosen course of action.[48] Meanwhile, perceived behavioural control (PBC) is related to the self-efficacy and the belief of the ease or difficulty of performing that particular behaviour (SM 2).[49] Therefore, positive attitudes, supportive social norms and strong perceived control could encourage positive changes in behaviours.[50] In addition to these three motivating factors, other non-motivating external factors like the availability of time, resources, facilitating conditions, autonomy in decision making, and so on, that can also directly influence the behaviour in addition to PBC, are known as actual behavioural control (ABC).[51]

The CPF offers a structured and stepwise approach for effective conservation planning, decision-making and conflict management,[52] while explaining how individual behavioural intentions are determined by attitudes, subjective norms and PBC is the aim of the TPB.[53] Another important aspect of conservation behaviour at the individual and community levels is the attribution of values to various components of nature, including non-human life forms, and its role in directing people's conservation actions is elaborated by the widely studied social values approach.[54] These help reveal a deeper normative foundation as to why people care about conservation in the first place, based on how they value wildlife. These values influence TPB variables, such as attitudes and norms, and through them, they also influence the CPF outcomes. For example, strong relational

[47]Ullah et al (n 44).

[48]Y Liang, KF Kee and LK Henderson, 'Towards an Integrated Model of Strategic Environmental Communication: Advancing Theories of Reactance and Planned Behavior in a Water Conservation Context' (2018) 46 *Journal of Applied Communication Research* 135.

[49]Sánchez et al (n 46); AVA Empidi and D Emang, 'Understanding Public Intentions to Participate in Protection Initiatives for Forested Watershed Areas Using the Theory of Planned Behavior: A Case Study of Cameron Highlands in Pahang, Malaysia' (2021) 13 *Sustainability* 4399.

[50]AY Farani, Y Mohammadi, F Ghahremani and P Ataei, (2021). 'How Can Iranian Farmers' Attitudes Toward Environmental Conservation be Influenced?' (2021) 31 *Global Ecology and Conservation* e01870; H Karimi and P Ataei, 'Farmers' Cultural Biases and Adaptation Behavior Towards Drought: A Case in Sistan Plain' (2022) 24 *Journal of Agricultural Science and Technology* 793; N Batool, MD Wani, SA Shah, and ZA Dada, 'Theory of Planned Behavior and Value-Belief Norm Theory as Antecedents of Pro-Environmental Behaviour: Evidence from the Local Community' (2024) 34 *Journal of Human Behavior in the Social Environment* 693.

[51]Ajzen, 'The Theory of Planned Behavior' (n 42); I Ajzen,'The Theory of Planned Behavior: Frequently Asked Questions' (2020) 2 *Human Behavior and Emerging Technologies* 314.

[52]Marchini et al (n 32); Pimid et al (n 33).

[53]Ajzen, 'From Intentions to Actions' (n 42); Ajzen, 'The Theory of Planned Behavior' (n 42).

[54]Chan et al (n 36); Balmford et al (n 39); Pascual et al, 'Diverse Values of Nature for Sustainability' (n 40).

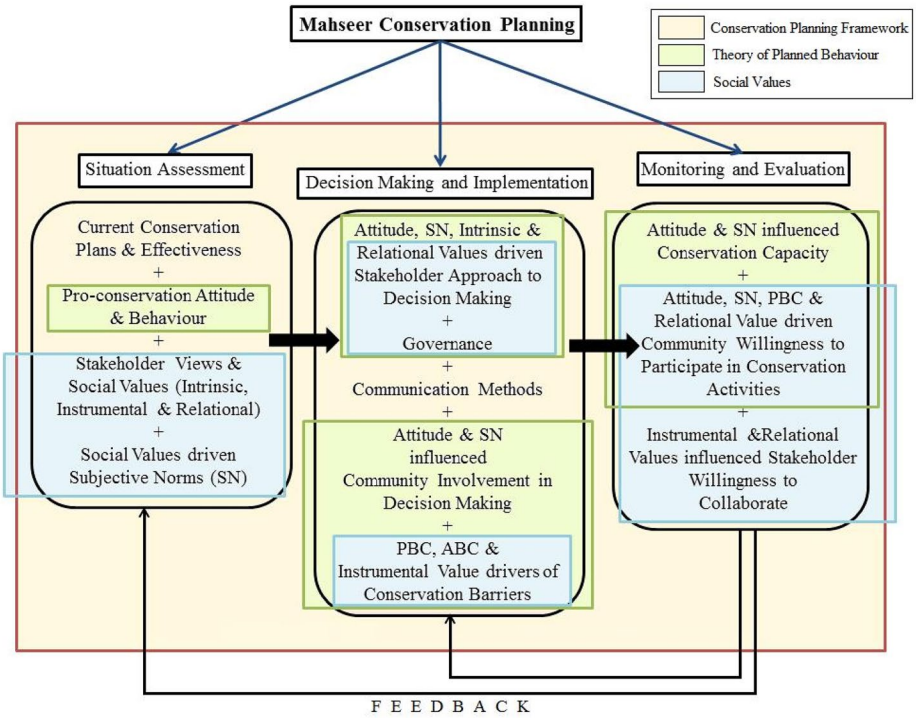

FIGURE. 1. Integration of the theory of planned behaviour (TPB) and social values into the conservation planning framework (CPF). SN: subjective norms; PBC: perceived behavioural control; ABC: actual behavioural control.

values may increase the willingness to engage in conservation, while a primarily instrumental outlook might lead to resistance if conservation is seen as economically damaging.[55]

Although these three models may appear to be independent, a closer examination reveals overlaps between many of the concepts on which they are built, hence they offer a strong potential for integration thereby enhancing the effectiveness of conservation planning (Figure 1). Given that conservation behaviour is complex in nature, an approach amalgamating the different frameworks utilised to explain it could enhance the efficacy of interventions and policies designed keeping such ideas in focus. For instance, the situation assessment phase of the CPF is dedicated to understanding the knowledge, perceptions, and existing plans of the stakeholders, which aligns closely with the two major components of TPB: attitudes and subjective norms. Hence, incorporating the attitude component of

[55]Balvanera et al (n 40); Pascual et al, *Summary for Policymakers* (n 40); H Jolly and A Stronza, 'Insights on Human–Wildlife Coexistence from Social Science and Indigenous and Traditional Knowledge' (2025) 39 *Conservation Biology* e14460; S Iqbal, R Desai, U Kumar, O Ilyas and Q Qureshi, 'Den Site Selection by Indian Gray Wolves in Tribal Landscapes of Mahuadanr Wolf Sanctuary Considering Ecological and Cultural Factors' (2025) 14 *Scientific Reports* 10060.

TPB into the situation assessment could help better understand the views and pro-conservation behaviours of stakeholders at the individual level, thereby enabling policy makers to set clear goals and more accurate identify priority areas for conservation.

It is well known that social values—and more specifically the intrinsic, instrumental and relational values—have profound effects on the opinions and actions of stakeholders, as well as the motivational factors determining them.[56] Intrinsic and relational values shape stakeholders' attitudes and perceptions of control over their actions (PBC) thus their decision-making,[57] while knowledge of instrumental values can help in managing conservation barriers. For instance, whether individuals perceive conservation efforts as resource-intensive, or whether their either have or lack tangible or intangible benefits, are factors that could determine their motivation to act. Including these concepts of values could help in tightly bridging the first and second (decision-making and implementation) phases of the CPF. Aligning individual interests, expectations, and normative practices with the rules and regulations promoted by institutions and the broader community, of which these individuals are a part, can help reduce the likelihood of conflict.[58]

Furthermore, the CPF tends to take each stakeholder group as a collective with common interests and often fails to capture individual-level variations present in the mindset and behaviours of the members while considering decision-making, governance, communication and ensuring the involvement of diverse community members (the second phase of the CPF). However, TPB offers a more granular understanding of these aspects. Additionally, the PBC and ABC components of TPB can elucidate the 'conservation barriers' discussed by the CPF by shedding light on how the perceived and actual control by individuals over actions can impact outcomes of the conservation plans.

Monitoring and evaluation, the third phase of the CPF, can also benefit from the incorporation of TPB and social values. Development of a communication and governance plan considering the attitudes, norms and the determinants of the behavioural control of both individuals and groups

[56]S Brackhane, G Webb, FME Xavier, J Trindade, M Gusmao and P Pechacek, 'Crocodile Management in Timor-Leste: Drawing Upon Traditional Ecological Knowledge and Cultural Beliefs' (2019) 24 *Human Dimensions of Wildlife* 314; Jolly and Stronza (n 55).

[57]Dhee, V Athreya, JD Linnell, S Shivakumar, and SP Dhiman, 'The Leopard that Learnt from the Cat and Other Narratives of Carnivore–Human Coexistence in Northern India' (2019) 1 *People and Nature* 376; H Jolly, T Satterfield, M Kandlikar and TR Suma, 'Indigenous Insights on Human–Wildlife Coexistence in Southern India' (2022) 36 *Conservation Biology* e13981.

[58]MS Reed, LC Stringer, I Fazey, AC Evely and JH Kruijsen, 'Five Principles for the Practice of Knowledge Exchange in Environmental Management' (2014) 146 *Journal of Environmental Management* 337.

of stakeholders can be useful in translating their conservation capacity into action and ascertaining their willingness to work for it. The impact of such an approach will be synergised when relational and instrumental values, with the potential to explain how stakeholders' sense of morality, responsibility, belongingness, identity, and personal and cultural relationships with wildlife and nature transform into a willingness to collaborate and engage in conservation-related activities, are also kept simultaneously in focus.

Hence an integrated model where the CPF is used as the structural backbone to outline the 'what' and 'how' of the conservation by groups, TPB as the individualistic behavioural mechanism explaining 'why' some individuals act while others fail to do so, and social values as the drivers of socio-cultural underpinnings, the 'deeper why' behind behaviours and decisions at the levels of individuals and collective, could provide a more comprehensive, stakeholder-oriented and sustainable foundation for conservation planning and decision-making. Furthermore, including a feedback loop from the third phase of TPB and value-integrated CPF to the first and second will be beneficial in strengthening this framework by the timely incorporation of the new and constantly evolving dimensions of the attitudes, norms, insights and other determinants of actions.[59]

Even though numerous stand-alone CPF and TPB based studies have been conducted[60] to explain, predict and manage a range of environmental and conservation issues,[61] and in the recent past many researchers have

[59]Marchini et al (n 32); Zuluaga et al (n 35); Pimid et al (n 33).

[60]Marchini et al (n 32); Pimid et al (n 33).

[61]S Renzi and JE Klobas, *Using the Theory of Planned Behavior with Qualitative Research* (Dondena Working Papers 2008); C Oztekin, G Teksöz, S Pamuk, E Sahin and DS Kilic, 'Gender Perspective on the Factors Predicting Recycling Behavior: Implications from the Theory of Planned Behavior' (2017) 62 *Waste Management* 290; MK Hill, MC Monroe, TT Ankersen, RR Carthy and TA Kay, 'Conservation Easements and Coastal Armoring: Protecting Sea Turtle Nesting Habitat Through Property Ownership' (2019) 182 *Ocean and Coastal Management* 104944; X Liu, QC Wang, IY Jian, HL Chi, D Yang and EHW Chan, 'Are You An Energy Saver At Home? The Personality Insights of Household Energy Conservation Behaviors Based on Theory of Planned Behavior' (2021) 174 *Resources, Conservation and Recycling* 105823; NL Nageotte and GA Buck, 'Barriers and Motivations to Conservation Behaviors in Zoo Visitors' (2023) 29 *Environmental Education Research* 179; P Przymuszała, J Szmelter, Ł Zielińska-Tomczak, M Cerbin-Koczorowska and R Marciniak, 'Future Physicians' Behavioral Intentions Towards Collaborative Practice—A Qualitative Study on Polish Final-Year Medical Students Guided by the Theory of Planned Behavior' (2023) 23 *BMC Medical Education* 151; P Przymuszała, M Turalska, Ł Zielińska-Tomczak, A Chmielewski, M Cerbin-Koczorowska and R Marciniak, 'Theory of Planned Behavior as a Theoretical Framework for Exploring Nursing Students' Intentions for Interprofessional Collaboration: A Qualitative Study' (2024) 14 *SAGE Open* 21582440241284472; M Savari and B Khaleghi, 'Application of the Extended Theory of Planned Behavior in Predicting the Behavioral Intentions of Iranian Local Communities Toward Forest Conservation' (2023) 14 *Frontiers in Psychology* 1121396.

begun incorporating social values into CPF[62] and environmental planning,[63] to our knowledge, no attempt to integrate these three important components for wildlife conservation has been undertaken to date.

Considering the cultural, environmental and stakeholder diversity, this novel approach integrating values, TPB and CPF can improve the management and conservation of important yet under-appreciated freshwater fish species, such as the mahseers and their habitats in India, where conservation discourses and programmes are traditionally focused on ecological and biological dimensions and often overlook the socio-psychological aspects of human behaviour.[64] Building on the integrated framework, the current study aims to address the following key questions:

1. Can the conservation planning framework (CPF), theory of planned behaviour (TPB), and social values be integrated into a single framework to examine multi-stakeholder attitudes, perceptions, values, and behaviours oriented towards the conservation of mahseer?
2. How does such an integrated framework help in understanding the points of agreement and variance in the mahseer conservation intentions and behaviours of the stakeholders of culturally distinct social-ecosystems?

2. Methodology

2.1. Study Areas

The present study focused on different stakeholders from three Indian states, viz. Karnataka, Uttarakhand, and Assam, which are well known for the presence of mahseers. However, we had to restrict our analysis to five species: *Tor khudree* (Deccan mahseer), *T. putitora* (golden mahseer), *T. remadevii* (humpback/orange-finned mahseer), *T. mosal* (mosal mahseer) and *Neolissochilus hexagonolepis* (chocolate mahseer), due to the existing ambiguity over taxonomy, distribution and insufficient data availability

[62]Pimid et al (n 33).

[63]A Vatn et al, 'Incorporating Diverse Values of Nature in Decision-Making—Theory and Practice' (2024) 379 *Philosophical Transactions of the Royal Society B* 20220315.

[64]Pinder et al (n 4); P Das and VV Binoy, 'Insights on the Distribution, Catch and Release and Public Sentiment Towards Recreational Angling of Mahseers—A Study of Youtube Videos from India' (2024) 34 *Aquatic Conservation: Marine and Freshwater Ecosystems* e4176; P Das and VV Binoy, '"Crafting Fishy News": Framing and Attitudinal Positioning in English Newspaper Articles on Mahseer from Their Endemic Range' (2025) 12 *bioRxiv* 655491; P Das and VV Binoy, 'Mapping Minds to Manage the "Tiger of Rivers": A Fuzzy Cognitive Mapping Approach to Understanding Multi-Stakeholder Perspectives on Mahseer Conservation' (2025) 12 *bioRxiv* 692881.

(data deficient) for *T. tor* (deep-bodied mahseer)[65] and *T. dukai*[66] which are also distributed in these regions. Key stakeholders were selected for the interviews and focus group discussions (FGDs) employing purposive sampling followed by snowball sampling methods. Multiple districts across these three states were selected to conduct the interviews, and FGDs of the stakeholders are provided in detail in the following sections:

(a) Karnataka

The study in Karnataka was conducted in four districts located within the Cauvery River basin: Kodagu (Coorg), Hassan, Mandya and Ramanagara (Figure 2). These districts are recognised biodiversity hotspots and habitat for both *T. khudree* and *T. remadevii*.[67] The former is found in the rivers of central and southern India,[68] and the latter is endemic to the Cauvery River basin in Karnataka, Kerala and Tamil Nadu.[69] Kodagu hosts the only state-run mahseer hatchery (Harangi hatchery; producing *T. khudree* fingerlings), and is a primary ranching site for *T. khudree* in the Cauvery. Interestingly, the first release of the mahseer fingerlings in this state by Tata Power's Lonavala hatchery in the early 1990s were in the Kodagu stretch of the Cauvery.[70] Conservation actors such as the Chendanda Clan of the Kodava community and two major recreational angling associations of the Karnataka state, WASI and Coorg Wildlife Society (CWS), have been active in this region since the 1970s. Mahseers hold a high religious and cultural reverence in this area and are called '*devaru meenu*' (God's fish) in the study areas, except in Kodagu and Mandya districts (where the vernacular name is '*bili*': white or '*gande meenu*': back fish). Hence, the state Fisheries Department-declared temple-based fish sanctuary

[65]A Rayamajhi, BR Jha, CM Sharma, A Pinder, A Harrison, U Katwate and N Dahanukar, '*Tor tor*' *The IUCN Red List of Threatened Species 2018*: *e.T166534A126321898* <https://doi.org/10.2305/IUCN.UK.2018-2.RLTS.T166534A126321898.en>.

[66]R Devi and N Boguskaya, '*Neolissochilus dukai*' *The IUCN Red List of Threatened Species 2009: e.T166614A6247845* <https://doi.org/10.2305/IUCN.UK.2009-2.RLTS.T166614A6247845.en>.

[67]Pinder et al (n 4).

[68]SN Ogale, *Mahseer Breeding and Conservation and Possibilities of Commercial Culture. The Indian Experience* (FAO 2002) 193–212; Pinder et al (n 4).

[69]BM Kurup and KV Radhakrishnan, '*Tor remadevii*, A New Species of Mahseer from Kerala (South India), and Distribution and Abundance of *Tor* Spp. in the River Systems of Kerala' in SS Siraj, A Christianus, NC Kiat and SS De Silva (eds), *Mahseer, the Biology, Culture and Conservation: Proceedings of the International Symposium on the Mahseer* (Malaysian Fisheries Society Occasional Publication No 14 2007); BM Kurup and KV Radhakrishnan, '*Tor remadevii*, A New Species of *Tor* (gray) from Chinnar Wildlife Sanctuary, Pambar River, Kerala, Southern India' (2010) 107 *Journal of the Bombay Natural History Society* 227.

[70]Kulkarni and Ogale (n 20).

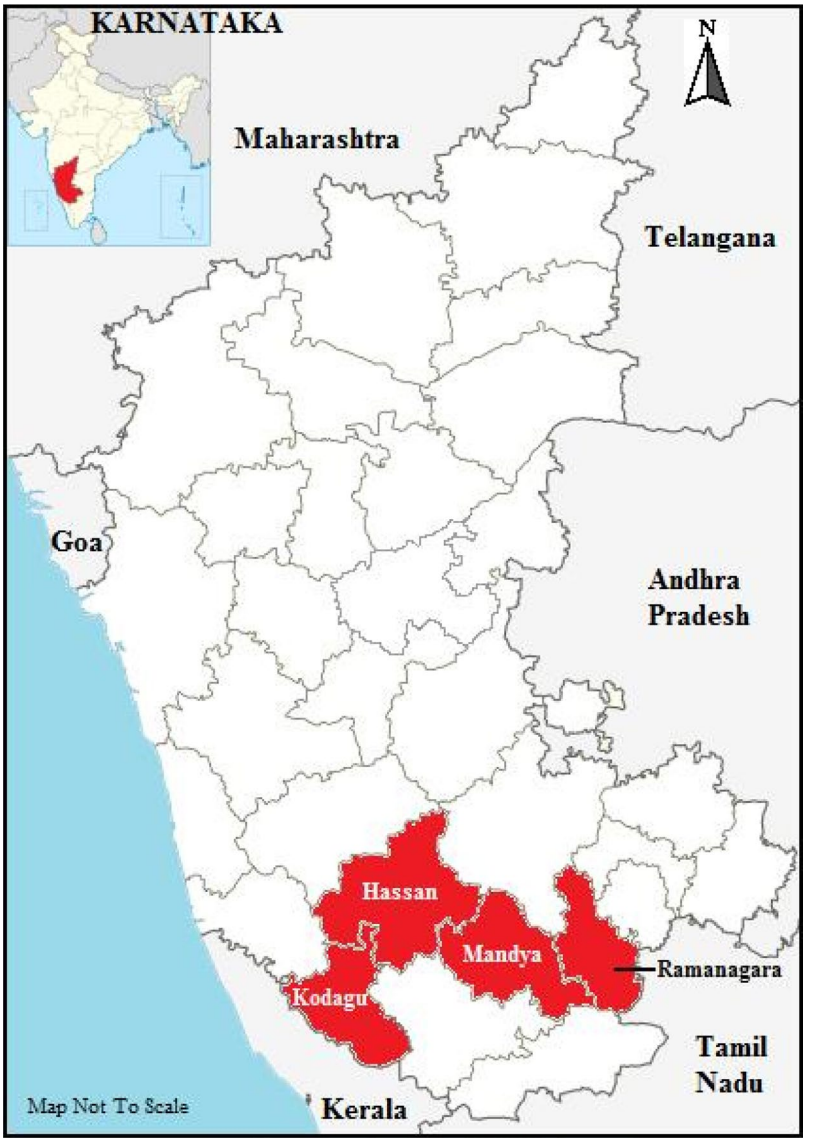

FIGURE 2. The districts in the Indian state of Karnataka where the study was carried out. Map not to scale.

(*matsyadhamas*) for mahseers in Ramanathapura in Hassan district[71] and multiple other formal, non-templebased fish sanctuaries in places like Kodagu (Harangi Dam to Kudige Bridge, Valnoor Cauvery stretch) and

[71]Y Gokhale and MS Chandran, 'Community Conservation Systems in Parts of Karnataka' in N Pathak (ed), *Community Conserved Areas in India: A Directory* (Kalpavriksh 2009) 283–298.

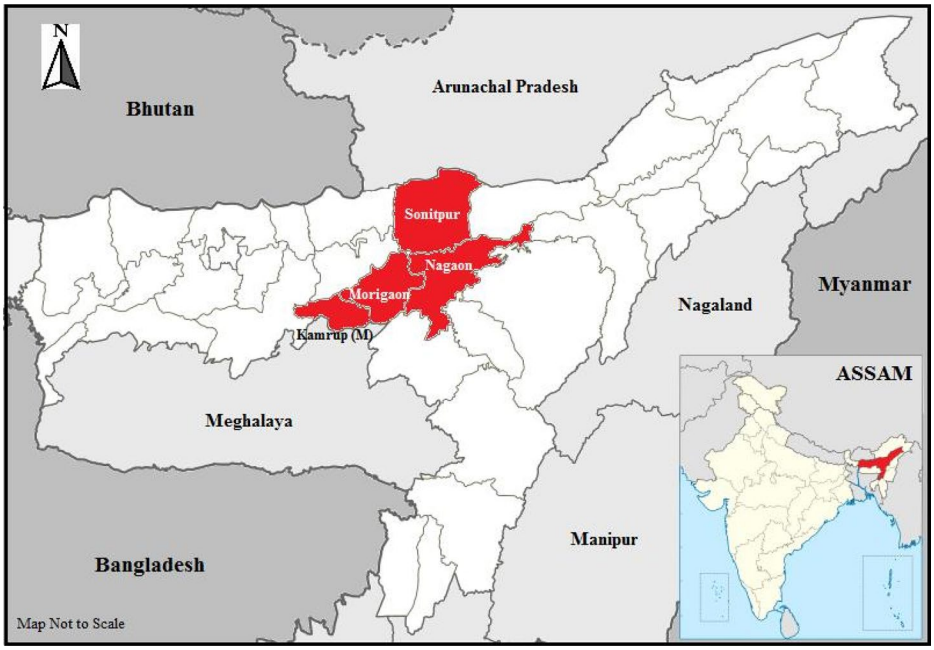

FIGURE 3. The districts in the Indian state of Assam where the study was carried out. Map not to scale.

Mandya (Shivanasamudra Fish Sanctuary) account for a total of 22 fish sanctuaries in the state.[72]

In Mandya and Ramanagara districts, the Cauvery River flows through a Protected Forest Area (PA) that has been declared to be the Cauvery Wildlife Sanctuary (CWLS), known for harbouring pristine and untouched wild populations of the two mahseer species.[73] In total, 23 interviews of the selected individual stakeholders and one FGD ($n = 19$) were conducted in the English, Hindi and Kannawda languages (Table 1). The anglers from the Wildlife Association of South India (WASI) operating mainly in Mandya and Ramanagara districts participated in the FGD conducted in Bangalore Urban district.

(b) Assam

The study in Assam was undertaken in four districts: Kamrup (Metropolitan), Morigaon, Nagaon and Sonitpur (Figure 3), known for the presence of both *T. putitora* (golden or Himalayan mahseer; locally known

[72]Department of Fisheries, *Karnataka Handbook of Fisheries Statistics* (Government of Karnataka 2020) <https://fisheries.karnataka.gov.in/storage/pdf-files/Karnataka%20-%20Handbook%20of%20Fisheries%20Statistics.pdf>; Roy and Sreenivasan (n 30).

[73]Roy and Sreenivasan (n 30).

as '*sonali pithia*') and *Neolissochilus hexagonolepis* (chocolate mahseer; '*boka pithia*'). Assam is well known for the Brahmaputra River system, and the tributaries of this river flowing through the Nameri National Park (NP) in Tezpur, Sonitpur district, support abundant wild mahseer populations.[74]

Assam is also the only state in India with two ICAR-DCFR funded mahseer hatcheries: one within the Eco-Camp of NP and the second in Nagaon district.[75] The NP hatchery is operated in collaboration with the Indian Council of Agricultural Research—Directorate of Coldwater Fisheries Research (ICAR-DCFR) and the Assam Bhorelli Angling and Conservation Association (ABACA). In Nagaon, *T. putitora* is bred with the support from ICAR-DCFR and this facility hosts a unique aqua-tourism centre on the bank of the Mahrul *beel* (wetlands/lakes). This centre is also known for hosting annual national angling competitions and fish festivals attracting both anglers and the general public.[76] These initiatives have also contributed immensely to the local community by generating employment opportunities.[77] Moreover, the ICAR-DCFR has undertaken initiatives to ranch mahseers in various lakes across Guwahati, Kamrup (M) and Tezpur, Sonitpur and launched 'mahseer watching' programmes along the lines of bird watching[78] to increase public awareness of these fishes.

Assam is also famous for traditional community fishing festivals. During the *Magh Bihu 'Uruka,'* the harvest festival, multiple tribal communities of this state, such as Tiwa, Karbi, and Bodo, along with the non-tribal Assamese people, participate in such events to celebrate their identity, heritage and culture.[79] For instance, Baghjap village in Mayong block (Morigaon district) conducts a three-day *Junbeel Mela*, annually. Community fishing, with participants from the Tiwa, Karbi, Bodo, Khasi and Jaintia

[74]A Borgohain, 'Hill Fishery Aquaculture and Conservation of Golden Mahseer Through Angling Tourism' in RN Bhuyun, D Ghosh, SM Kharbuli and R Nath (eds), *Proceedings of The National Seminar: Aquaculture in North East Region: Realities, Opportunities and Challenges* (Department of Fishery Science, St Anthony's College, Shillong 2015) 153–160.

[75]Borgohain ibid; KC Das and NK Gogoi, 'Jasingfa Aqua Tourism Centre: A Fledgling but Promising Fishery Based Eco Tourism Venture in Aquaculture' in Bhuyun, Ghosh, Kharbuli and Nath (n 74) 161–170.

[76]KC Das, N Gogoi, P Das and D Sarma, 'Fish-Based Aqua-Tourism Centre for Development of Economical, Environmental and Cultural Security—A Case Study at Jasingfaa Aqua-Tourism Centre, Nagaon, Assam, India' (2023) 41 *Asian Journal of Agricultural Extension, Economics and Sociology* 450.

[77]Das et al ibid.

[78]D Baruah, 'Scope of Recreational Fisheries in North-East India' (2018) 38 *Aquaculture Asia* 93; Baruah and Sarma (n 10).

[79]D Baruah, 'Traditional Community Fishing Practices of Rural Kamrup of Assam' (2017) 21 *Aquaculture Asia* 7.

tribes,[80] is one of the main attractions of this cultural festival initiated by the Tiwa king with the help of Ahom kings of Assam and Jaintia kings of Meghalaya in the 14th or 15th century.[81] Similarly, in Kamrup (M), Maloibari village in Dimoria block hosts a historic fishing festival started in the early 19th century by the kings of Tentelia (Telelia) and Dimoria.[82] Here, people irrespective of their social and religious backgrounds enjoy fishing in three *beel*, namely Parokhali, Bomani and Jalikhora, connected to the Digaru (tributary) and Kolong rivers (distributaries of Brahmaputra River). These festivals attract tourists and media from all over the country. However, the commercialisation and uncontrolled use of non-traditional equipment for fishing have negatively impacted the mahseers and other ichthyo- and avi-fauna of these aquatic ecosystems.[83] In Assam 91 interviews and two FGDs (number of participants = 11 and 12) were conducted in Assamese, English and Hindi languages (Table 1).

(c) Uttarakhand

Historical records indicate that in Uttarakhand *T. putitora* was introduced into Bhimtal and Nainital lakes in Nainital district in 1858 by British official Sir Henry Ramsay for the purpose of recreational angling.[84] In 2001, Uttarakhand recognised this species as its state fish. Nainital district hosts the only central-government-run *T. putitora* hatchery in India, operated jointly by the ICAR-DCFR and Nainital District Fisheries Department. Ramganga and Kosi rivers flowing through Corbett National Park and Kalagarh Tiger Reserve present in this district also harbour populations of mahseer.[85] Furthermore, the Pancheshwar region of Champawat district, situated at the confluence of the Saryu and Mahakali Rivers near the

[80]G Doloi, 'The Role of Rituals and Festivals in Preserving Tiwa Heritage within the Indian Knowledge Framework' (2024) 7 *Gap Gyan: A Global Journal of Social Sciences* 14.

[81]S Roy, 'Community Based Events and Tourism Promotion: A Study with Special Reference to Jonbeel Mela in Assam' (2017) 4 *International Journal of Management Studies* 66.

[82]U Das, and J Das, 'Community Fishing During Magh Bihu: An Age-Old Practice in the Dimoria Region of Kamrup (Metro) District, Assam' (2020) 38 *Environment and Ecology* 476.

[83]DR Deka and P Sharma, 'An Analysis of Wetland Degradation in the Dimoria Region of Assam, India' (2013) 7 *Journal of Life Sciences* 781; P Kalita, S Pathak and P Deka, 'A Preliminary Study on Ichthyofaunal Resource of Motapung-Maguri Beel of Tinsukia district of Assam, India' (2016) 3 *International Journal of Fauna and Biological Studies* 97; T Medhi and S Sharma, 'Avifaunal Diversity and Abundance of Jalikhara and Etila Beel (Wetland) of Kamrup (Metro) District, Assam, India' (2017) 6 *International Journal of Scientific Research* 739; P Dutta, N Agarwal and M Neog, 'Different Tribes of Assam and their Indigenous Knowledge in Promoting Sustainable Development in SAARC Countries' in LM Dharmasiri et al (eds), *Sustainable Development Goals in SAARC Countries: Key Issues, Opportunities and Challenges* 85–96.

[84]W Walker, *Angling in Kumaun Lakes* (Thacker, Spink and Co 1888).

[85]MS Johal, KK Tandon and GS Sandhu, 'Morphometry of *Tor putitora*' in P Nautiyal (ed), *Mahseer the Game Fish* (Jagdamba Publication 1994) B68–B75; AJT Johnsingh, AS Negi and D Mohan, 'Golden Mahseer Conservation in Uttaranchal' (2006) 43 *Cheetal* 9.

TABLE 1 List of stakeholders from three Indian states interviewed and participating in the focus group discussions (FGDs) conducted for the study.

No.	States	Species Focused	Stakeholders	Number of Participants
1.	Karnataka	*T. khudree* *T. remadevii*	Fisheries Department	3
			Forest Department	5
			Recreational anglers associations	6 19 (FGD)
			Research and educational colleges/institutes/ universities	3
			Temple employed vendors at bank/locals (Ramanathapura Temple Fish-based Fish Sanctuary)	6
2.	Assam	*T. putitora* *N. hexagonolepis*	Fisheries Department	5
			Forest Department	4 11 (FGD)
			Research and educational colleges/institutes/ universities	5
			Recreational anglers associations	12 (FGD)
			Pond and lake/*pukhuri* managers	6
			Local NGOs (Aqua-tourism Centre-cum-Hatchery)	2
			Local community (residents of Nameri National Park Fringe Village/Buffer Area)	16
			Traditional community fishing participants (Members of Tribal Communities—Tiwa, Karbi, Bodo, and Rabha tribes, and Non-tribal Assamese communities)	40
			Community Fishing Festival/*Mela* Organising Committee (Also includes members of Karbi and Gobha-Tiwa *Raja's*/King's Court)	11
			Politically elected members of Tiwa (Lalung) Autonomous Council	2
3.	Uttarakhand	*T. putitora*	Fisheries Department	8
			Forest Department	8
			Research and educational colleges/institutes/ universities	4
			Recreational angling company (Anglers-cum-Guides)	7
			Local NGOs (eco-tourism, research, biodiversity conservation and societal research-based organisations)	5
			Local fishers and participants of community fishing events	12

India–Nepal border, is a globally acclaimed destination for *T. putitora* recreational angling, with several prominent private angling companies operating here. The key spawning grounds for *T. putitora* have been identified across multiple rivers: Song and Tons rivers (tributaries of the rivers Yamuna and Ganga) in Dehradun, Aglar in Tehri Garhwal, Nayar and Khoh in Pauri Garhwal,[86] and the Mandal River in Nainital.[87]

[86]JP Bhatt, P Nautiyal and HR Singh, (2004) 'Status (1993–1994) of the Endangered Fish Himalayan Mahseer *Tor Putitora* (Hamilton) (Cyprinidae) in the Mountain Reaches of the River Ganga' (2004) 17 *Asian Fisheries Science* 341.

[87]VM Atkore, K Sivakumar, AJT Johnsingh, 'Patterns of Diversity and Conservation Status of Freshwater Fishes in the Tributaries of River Ramganga in the Shiwaliks of the Western Himalaya' (2011) 100 *Current Science* 731.

Uttarakhand is also famous for *Maund* (or *Maun*) *Matsya Mela*, a century-old annual community fishing festival conducted in the Aglar River (tributary of Yamuna River), which unfortunately coincides with the onset of monsoon and fish breeding season (the months of June and July).[88] Started by the king of Tehri in the mid-1860s, the main component of this festival is community fishing, primarily undertaken by the members of the Jaunpuri community from different villages from the Jaunpur areas of Tehri Garhwal and Dehradun districts,[89] attracting tourists and media from all over the country. Sadly, the use of a toxic powder, made from the bark, seeds and leaves of the Timur plant (*Zanthoxylum armatum*), to paralyse fishes in the river during the festival,[90] has been widely documented to have adversely affected mahseers and other fish populations.[91] Stakeholders ($n = 44$) from the study area comprising Dehradun, Tehri Garhwal, Nainital and Champawat districts (Figure 4) were interviewed in Hindi language. These districts are also known for several non-formal temple pools and fish sanctuaries, such as along the Garjiya Devi temple, the Kosi River stretch at Khairna, and *Nal-Damyanti Tal* in Bhimtal in Nainital district, which support healthy wild populations of mahseers.[92]

2.2. Data Collection

In-depth, semi-structured, discursive, one-on-one interviews of the stakeholders were conducted following a list of questions reflecting multiple aspects of CPF and TPB (SM 3), which lasted for 15–45 minutes. In addition to these individual interviews, a total of three focus group discussions (FGDs), one in Karnataka ($n = 19$) and two in Assam ($n = 11$, 12), were conducted with the participants who preferred group discussions over interviews. We ensured that all interviews and FGDs adhered to the

[88]K Sharma, N Gupta, JA Johnson and K Sivakumar, '"Fish festivals" in the Garhwal Himalaya: Conservation Options Amidst Age-Old Practices' (2016) 110 *Current Science* 1155.

[89]DK Sundriyal and VP Kumar, 'Impact Assessment of the Traditional Fishing Festival (Maun Mela) of Jaunpuri Community, Uttarakhand (India): A Conservation Approach' (2019) 33 *Asian Journal of Experimental Sciences* 35.

[90]PJ Singh et al, 'Traditional Community Fishing Festival (Maund Mela) of Garhwal Himalaya, Uttarakhand Using *Zanthoxylum armatum* (Timur)' (2016) 8 *World Journal of Fish and Marine Sciences* 123.

[91]Singh et al ibid; Sharma et al (n 88); Sundriyal and Kumar (n 89); DP Uniyal and M Uniyal, 'Fish Fauna of Uttarakhand, India: Present Status, Diversity and Conservation' (2021) 16 *Journal of Mountain Research* 301.

[92]P Dandekar, 'Community Fish Sanctuaries: Protecting the Fish and their Rivers' <https://sandrp.in/2013/11/21/community-fish-sanctuaries-protecting-the-fishe-and-their-rivers/#:~:text=Uttarakhand%20and%20Himachal%20Pradesh%20too,Machendru%20Devta%2C%20the%20Fish%20God>; D Baruah et al, 'Recreational Fisheries in Uttarakhand' (2022) 26 *Aquaculture Asia Magazine* 13; Kattyayani, 'Nal-Damyanti and The Visitor' <https://medium.com/kattyayanis-travelling-circus/nala-damayanti-and-the-visitor-20a85bb82a5>.

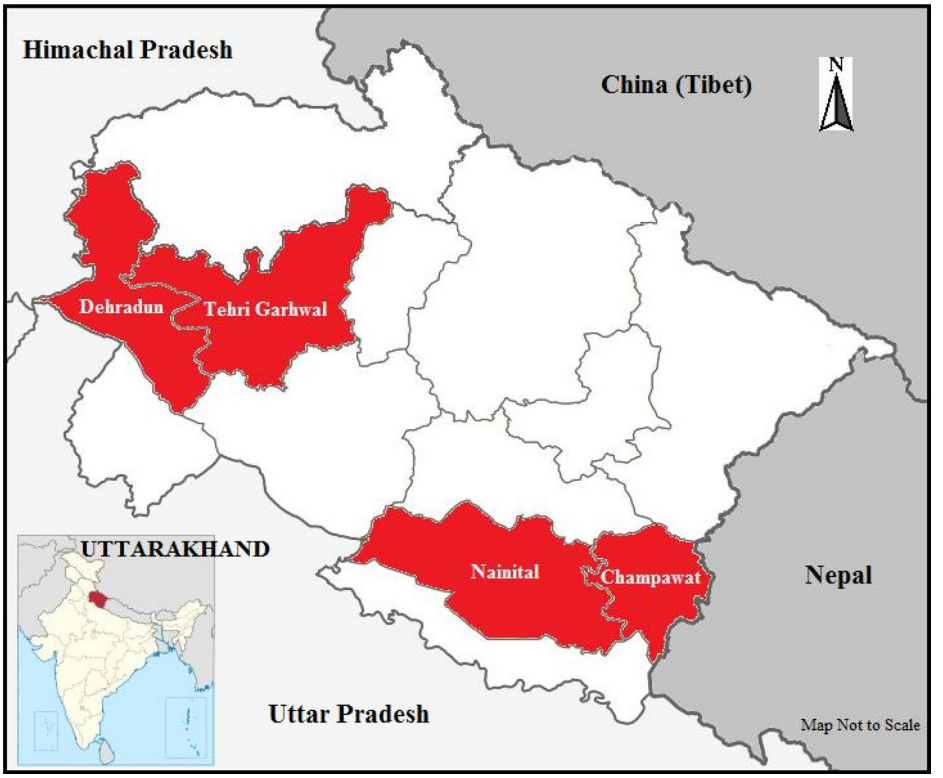

FIGURE 4. The districts in the Indian state of Uttarakhand where the study was carried out. Map not to scale.

required institutional ethical guidelines for conducting non-invasive human research. Interviews and FGDs were audio recorded, written notes taken and photographs captured after acquiring oral or written informed consent from the participants. The participants were assured of the anonymity of their names, personal details and designations to protect their identity and privacy.

2.3. Data Analysis

The English interviews were transcribed verbatim using Otter.ai and Rev.ai, while the others were transcribed manually into English. The transcripts were then manually cross-checked for inconsistencies by referring to the audio recordings. Additionally, the field notes were reviewed for additional contextual support.[93] These transcripts were subjected to the thematic

[93]E Nkansah-Dwamena, 'Lessons Learned From Community Engagement and Participation in Fostering Coexistence and Minimizing Human–Wildlife Conflict in Ghana' (2023) 14 *Trees, Forests and People* 100430.

qualitative data analysis (QDA) following a hybrid deductive–inductive coding approach to ensure greater qualitative depth and rigor.[94]

The thematic QDA followed six steps, adapted from Braun and Clarke,[95] involving transcribing, data familiarisation, initial code generation (deductive codes based on CPF and TPB and additional inductive codes), organising codes into meaningful themes, reviewing and refining themes, and defining themes. As specified by Braun and Clarke,[96] thematic QDA is often reflexive in nature (reflexive thematic analysis, RTA).[97] The RTA focuses on the researcher's knowledge, reflexivity, subjectivity, and contextual specificity, as well as on transparency, and the thoughtful and interpretative depth of the data. Differing from the conventional coding analysis, RTA is rooted in a constructivist interpretive approach, and considers 'replicability' and inter-coder reliability unsuitable and inappropriate.[98] Hence the entire data set was coded by a single coder (PD) well versed with the methodologies of RTA.

3. Results

3.1. Karnataka

The situation assessment (CPF) revealed river conservation leases to angler and NGOs (frequency of codes from interviews and FGDs, Fr = 36; Figure 5), issuing formal angling licenses (36), declaration of fish sanctuaries (42), conservation breeding of *T. khudree* (36), angling training (25), and anti-poaching camps (5) as the active intervention plans existing for the protection of mahseer populations in Karnataka. The stakeholder

[94]J Fereday and E Muir-Cochrane, 'Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. (2006) 5 *International Journal of Qualitative Methods* 80; V Braun and V Clarke, *Successful Qualitative Research: A Practical Guide For Beginners* (Sage 2013); V Braun and V Clarke, 'Reflecting on Reflexive Thematic Analysis' (2019) 11 *Qualitative Research in Sport, Exercise and Health* 589; V Braun and V Clarke, '"One Size Fits All": What Counts as Quality Practice in (Reflexive) Thematic Analysis?' (2021) 18 *Qualitative Research in Psychology* 328; D Byrne, 'A Worked Example of Braun and Clarke's Approach to Reflexive Thematic Analysis' (2022) 56 *Quality and Quantity* 1391; K Proudfoot, 'Inductive/Deductive Hybrid Thematic Analysis In Mixed Methods Research' (2023) 17 *Journal of Mixed Methods Research* 308.

[95]V Braun and V Clarke, 'Using Thematic Analysis in Psychology' (2006) 3 *Qualitative Research in Psychology* 77.

[96]V Braun and V Clarke, '"One Size Fits All"'(n 94).

[97]G Terry, N Hayfield, V Clarke and V Braun, 'Thematic Analysis' in C Willig and W Stainton Rogers (eds), *The SAGE Handbook of Qualitative Research in Psychology* (2nd ed, SAGE 2017) 17–37, 25; Braun and Clarke, 'Reflecting on Reflexive Thematic Analysis' (n 94); V Braun, V Clarke, N Hayfield, L Davey and E Jenkinson, 'Doing Reflexive Thematic Analysis' in S Bager-Charleson and A McBeath (eds), *Supporting Research in Counselling and Psychotherapy: Qualitative, Quantitative and Mixed Methods Research* (Springer 2022) 19–39.

[98]Braun and Clarke, 'Reflecting on Reflexive Thematic Analysis' (n 94); V Braun and V Clarke, '"One Size Fits All"'(n 94).

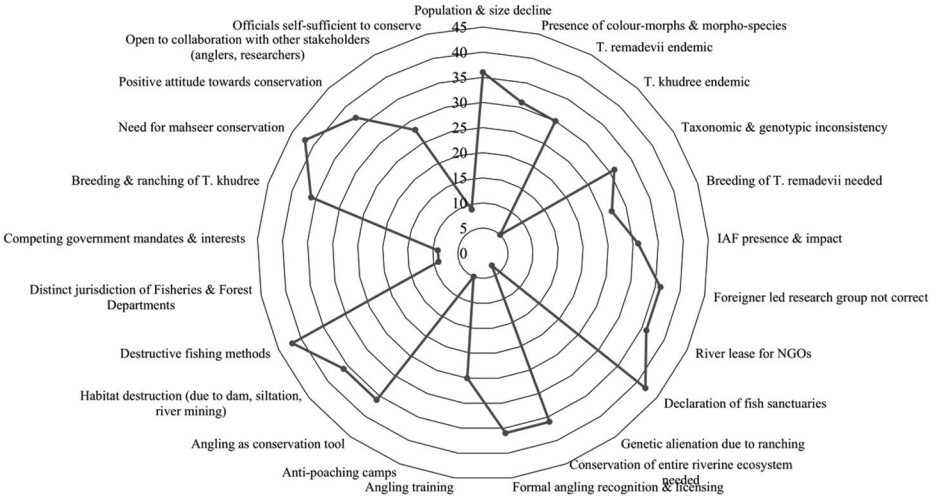

FIGURE 5. Radar chart depicting the frequency of codes used for generating the theme 'consensus between stakeholders' from the reflexive thematic analysis conducted on the interviews and FGDs from Karnataka.

attitudes (TPB) were generally positive (36) in nature, and many were of the opinion that these activities are useful in increasing the numbers of the wild mahseers and reducing illegal and destructive fishing activities.

'Consensus between stakeholders' was an important theme generated from the Karnataka data. This theme appeared in multiple contexts, ranging from the taxonomic ambiguity and research leadership to the jurisdiction of the conservation activities. Many stakeholder groups were aware of and subscribed to the ongoing debates on the taxonomy of mahseers, and due to the presence of colour morphs and morpho-species they believed that the rivers of Karnataka might be harbouring many more species of mahseer (Fr = 31; Figure 5) than are currently known. This disagreement also resonated in the case of endemic status attributed to *T. remadevii* (30) and *T. khudree* (5).

Quote 1: *'I think that T. remadevii and T. khudree are both endemic to the Cauvery River in Karnataka.'* Quote 2: *'Only T. remadevii is endemic to the Cauvery River in Karnataka, T. khudree is endemic to the rivers in Maharashtra and were introduced here.'*

The perception reflected in quote 1 was more prominent amongst the staff from the fisheries department (5), while quote 2 was more prevalent between the anglers (25) and the forest department staff (5). However, respondents (36) from multiple stakeholder groups shared their dissatisfaction over 'foreign scientist'-led mahseer research, especially in the area of taxonomy. In their opinions, short-term research programmes run by researchers from abroad fail to elucidate a holistic picture of the local mahseer populations and hence a dedicated long-term plan lead by Indian-scientists is a pressing need.

Quote 3: '*We have our own jurisdiction; the forest department has their own. Aquatic organisms come under our purview while the terrestrial and arboreal animals are under them.*'

This statement highlights the lack of consensus among government departments involved in conserving natural mahseer populations. Although mahseer habitats lie within the rivers that traverse protected forest areas, these fish lack legal protection as they are not listed under any schedule of the Wildlife Protection Act (WPA) 1972. While the fisheries department breeds juvenile mahseers, the release sites may fall within protected forest areas, creating jurisdictional overlaps and disputes (9). Even though the stakeholder attitudes were generally positive, their willingness to be involved in conservation activities varied. The anglers and researchers demonstrated their openness to collaborate with other stakeholders (28), while the staff members of the governmental departments were hesitant to collaborate, displaying a strong sense of self-efficacy (9). These jurisdictional tensions and conflicts arise from mismatched mandates (9), conflicting interests and underlying causes of political and power dynamics, which can often slow, hinder or derail coordinated wildlife conservation efforts.[99]

'Communication and collaboration' was another theme developed that closely aligned with decision-making and implementation, the second component of CPF, as well as the subjective norms and perceived control over behaviour (TPB). The sub-themes that came out under this category, that is, communication gaps (42; Figure 6), lack of collaborative mechanisms (34), and interdepartmental divergences and frictions (9), revealed shortcomings that were more than readily fixable technical shortcomings in the existing mechanisms for promoting mahseer conservation.

An absence of credible communication channels (6) could further intensify the misalignment between stakeholders and delay the translation of positive attitudes present into the expected actions. Although social media were recognised as a tool for raising awareness (25), many also identified this medium as a promoter of unsustainable behaviours (25). Therefore, establishing a platform where representatives from the society and stakeholders can be involved in bidirectional communication[100] can help to a certain extent in possibly resolving the clash of interests by reconciling

[99]S Lele, P Wilshusen, D Brockington, R Seidler and K Bawa, 'Beyond Exclusion: Alternative Approaches to Biodiversity Conservation in the Developing Tropics' (2010) 2 *Current Opinion in Environmental Sustainability* 94; S Jacobs et al, 'Use Your Power for Good: Plural Valuation of Nature—The Oaxaca Statement' (2020) 3 *Global Sustainability* e8; M Riechers, J Pearson, N Diaz-Cruz, S Ortiz-Przychodzka and E Topp, 'Interplays Between Relational and Instrumental Values: Insights from Research Experiences on Human–Nature Relations' (2025) 20 *Sustainability Science* 287.

[100]D Bickford, MRC Posa, L Qie, A Campos-Arceiz and EP Kudavidanage, 'Science Communication for Biodiversity Conservation' (2012) 151 *Biological Conservation* 74.

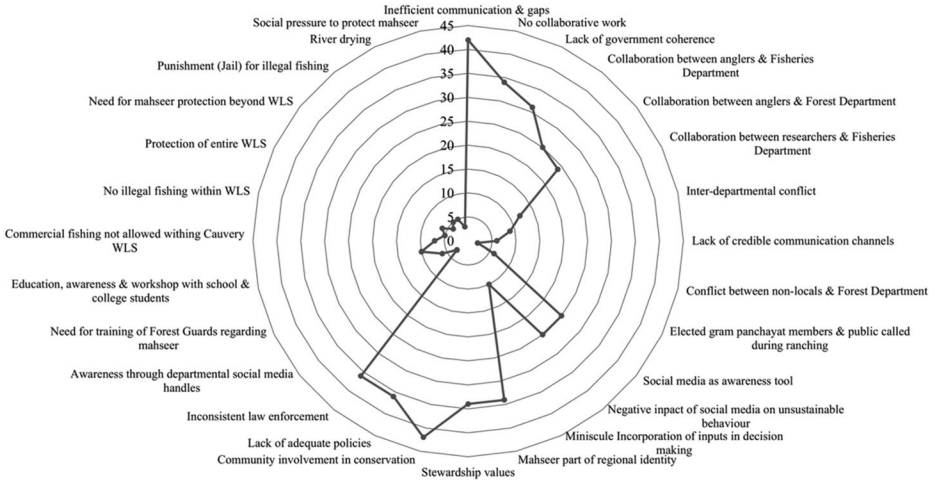

FIGURE 6. Radar chart depicting the frequency of codes used for generating the theme 'communication and collaboration' from the reflexive thematic analysis conducted on the interviews and FGDs from Karnataka.

differences. Such a platform, with the active stakeholder interaction promoted by it, has the potential to bring about reconciliation by inculcating a sense of duty and moral responsibility towards the mahseers and their habitat, and pto romote wildlife value orientations (WVOs) of mutualism and respect towards biodiversity,[101] leading to greater pro-conservation activities. Furthermore, along with adding evidence-based scientific inputs to the plans and protecting the interests of each stakeholder, such a system will ensure shared accountability for conservation problems and failures as well.[102]

Interestingly, examples of multi-stakeholder collaborations for mahseer conservation with the potential to be replicates in other parts of the country were also recorded from selected regions of Karnataka. The joint initiatives between the recreational anglers and fisheries department in Kodagu (25), partnerships between anglers and forest department in Mandya and Chamarajanagara (24) and the ongoing collaborations between researchers and the fisheries department (12) are noteworthy.

The collaboration between different stakeholders at a micro level can be initiated by involving villagers and members of the local governing bodies such as *gram panchayat* (6) during fingerling ranching, post-release monitoring, angling activities and engaging former poachers as river guards

[101]DC Fulton, MJ Manfredo and J Lipscomb, 'Wildlife Value Orientations: A Conceptual and Measurement Approach' (1996) 1 *Human Dimensions of Wildlife* 24; J Gomez, N van Vliet and N Canales, 'The Values of Wildlife Revisited' (2022) 27 *Ecology and Society* 23.

[102]Pimid et al (n 33).

or *ghillies*, and so on. These actors demonstrated strong intrinsic and relational values, often driven by regionally based pride, regional identity and a cultural connection to the mahseer and the river (34), alongside their pronounced stewardship values (34). Such a relational view of the species offers a powerful foundation for conservation, fostering respectful behaviour towards wildlife.[103]

Quote 4: '*The local community members who have been fishing for generations have immense local knowledge about how to sustainable coexist with wild animals. They respect and value the animals, the water, the river. Everyone should learn from them. The decision makers should incorporate their views and knowledge; involve them in decision making discussions for effective management.*'

Insights from TPB affirm that when attitudes and social norms are aligned, and behavioural control is adequately supported, participation and conservation behaviour can be sustained.[104] Hence, people are more likely to participate in conservation and management activities if their knowledge and inputs are sought, incorporated and built upon, highlighting their importance to conservationists and officials.[105] However, such participation remains extremely under-recognised in the context of mahseer conservation. Incorporating local community members and their knowledge in decision-making (42), facilitating community involvement while acknowledging cultural contexts (e.g., religious-significance based site selection for temple-based *matsyadhamas*), and offering both monetary and symbolic recognition (through certificates, news media acknowledgments, etc.) can enhance long-term engagement and partnership between different actors involved in mahseer conservation and the people inhabiting such areas.

The theme 'values and moral responsibility,' along with its sub-themes, stewardship (34; relational; Figure 7), socio-cultural association and meaning (31; relational) and mahseer as part of nature (42; intrinsic), is associated with all three components of TPB, social values, and the second and third phases of CPF. The recreational anglers, especially the multi-generational ones, exhibited strong relational values, viewing mahseer as a natural heritage (25) and as part of their identity (25), with their lives being intertwined with them (25; all relational).

[103]Brackhane et al (n 56); Jolly and Stronza (n 55).

[104]Ullah et al (n 44); Karimi and Ataei (n 50).

[105]J Pretty and D Smith, 'Social Capital in Biodiversity Conservation and Management' (2004) 18 *Conservation Biology* 631; JC Young, A Jordan, KR Searle, A Butler, DS Chapman, P Simmons and AD Watt, 'Does Stakeholder Involvement Really Benefit Biodiversity Conservation?' (2013) 158 *Biological Conservation* 359; JM Setchell, E Fairet, K Shutt, S Waters and S Bell, 'Biosocial Conservation: Integrating Biological and Ethnographic Methods to Study Human–Primate Interactions' (2017) 38 *International Journal of Primatology* 401.

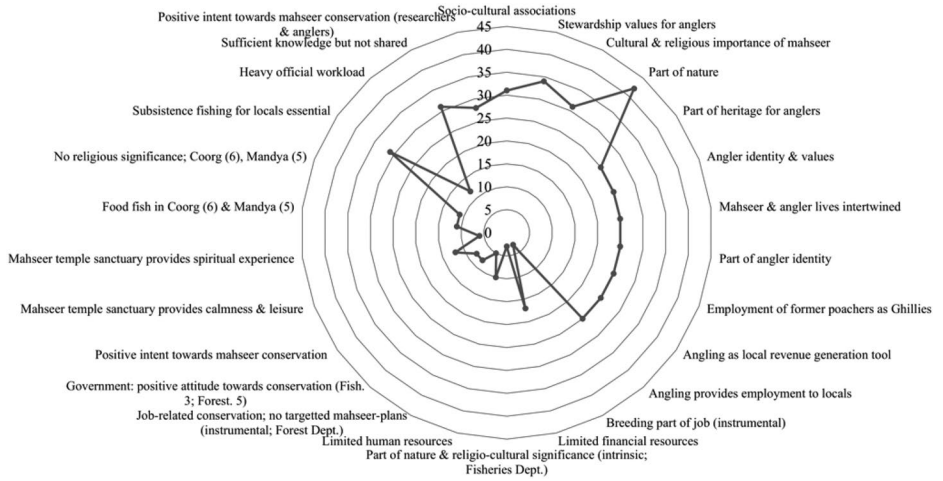

FIGURE 7. Radar chart depicting the frequency of codes used for generating the theme 'values and moral responsibility' from the reflexive thematic analysis conducted on the interviews and FGDs from Karnataka.

Quote 5: '*We feel that it is our duty to protect the mahseers, maintain a healthy aquatic ecosystem, monitor any illegal activities, make people aware about the benefits of sustainable angling and make sure that the species survive for our next generation to angle, just like we learnt from our previous generation. Such activities give us a sense of peace, happiness and calm.*'

Amongst the anglers, the shared identity (25) of being the caretaker and protector of the river and mahseers, which in turn applies a degree of peer pressure from the members of this community, may potentially be fostering a culture of voluntary stewardship and motivating them to participate in patrols, doing catch-and-release fishing, reporting illegal activities, employing former poachers and locals as river watchers or *ghillies* (25) and involving local community members in such activities, thereby contributing to the local revenue generation (25). However, the staff from the fisheries department expressed both intrinsic and instrumental values towards mahseer. They considered the fishes to be an integral part of nature and acknowledged their religio-cultural significance (3; intrinsic), while simultaneously reflecting instrumental values linked to their professional responsibility through active participation in conservation breeding initiatives (3). The forest department staff similarly demonstrated job-related instrumental values associated with broader wildlife protection (5), although they did not possess any targeted mahseer-specific conservation approach. Such values may have resulted in their intent towards conservation being slightly less positive (3; fisheries, 5; forest).

Quote 6: '*We are very understaffed, we also have a lot of official work, paperwork to complete and other government duties beyond mahseer*

conservation, so we cannot completely invest our time in this. It would be good both for us and the mahseers, if there were a dedicated mahseer conservation unit with more staff and funds.'

This statement from a member of fisheries department staff provides insights on how both the ABC and PBC can limit conservation efforts. Although the government staff (both fisheries and forest department) demonstrated a positive attitude towards conservation (8), shortages of human (10) and financial resources (17) may reduce both their perceived and actual ability to act. Additional barriers such as heavy official workload (12) and unshared available knowledge (31) can further serve as a barrier to conservation efforts. Such misalignment between intent and capacity highlights the need for incorporating TPB into CPF implementation and monitoring to understand if the prevalent enabling conditions are addressed alongside attitudes and social norms. A positive attitude, with supporting social pressures, along with enough perceived and actual behavioural control, has been shown to lead to a positive intention of performing behaviour.[106]

Mahseers are associated with a high level of socio-cultural values and divinity (relational values), particularly at the Ramanathapura temple-based fish sanctuary area in Hassan district. Local people irrespective of gender, age and occupation come to pray in the temple first; then they move to the river bank and pray to the water and the large aggregation of mahseers present there. They offer them *prasada* (offerings consisting of flattened and puffed rice, peanuts, and flowers) as an act of devotion and spend time by sitting by the river banks, reflecting the relational values that the local devotees attribute to these fishes.

Quote 7: '*These fishes are God for us. We pray to them and make wishes. No one is allowed to catch and eat them here,*' one of the devotees we met said. The people visiting this sanctuary claim to achieve calmness (12) and spiritual experience (6; relational) by watching, praying and feeding the fish, stressing the non-tangible cultural ecosystem services (CES) provided by them.

The mahseers also contribute to the local economy. Quote 8: '*Our livelihood depends on the devotees, who buy puffed rice, flowers, and other offerings from us to worship the mahseers.*' However, this divinity enjoyed by the mahseer is not uniform in the entirety of Karnataka. In Kodagu and Mandya districts, these fishes are perceived primarily as game and food fish (instrumental) with no religious significance attributed to them by the local community (6, 5, respectively; Figure 7). Such a discrepancy

[106]Ullah et al (n 44); Karimi and Ataei (n 50).

stresses the need for considering local cultural traditions while designing programmes for mahseer conservation.

3.2. Assam

This state also actively implemented multiple programs to conserve their mahseer populations—captive breeding in hatcheries (52; Figure 8), community-involved awareness programmes (41), 'mahseer watching' initiatives (10), imprisonment for poaching within protected areas (30). However, CPF (situation assessment phase) disclosed defunct hatcheries (45) and ineffectiveness of 'mahseer watching' (6). 'Consensus between stakeholders' reappeared as a major theme in Assam as well. Noticeably, all the stakeholders we met had a positive attitude towards mahseer conservation (114; TPB; Figure 8) in this state during our study. The concurrence of the decline of mahseer in Assam (66), and siltation and river-bed mining (68), destructive fishing methods (59), and commercialisation of traditional community fishing practices (67) as the major threats for these fishes, and the urgent need to implement conservation measures (66) were also noticed. Many also shared concerns over the decline in the native fish species (53) and increase in invasive alien fishes (IAFs) (53) caught during the community fishing events in the recent past. Furthermore, most of the researchers and anglers (17) we contacted were of the opinion that IAFs, such as common carp, grass carp, and silver carp, are quickly growing as competitors with the natural populations of mahseers in this state.

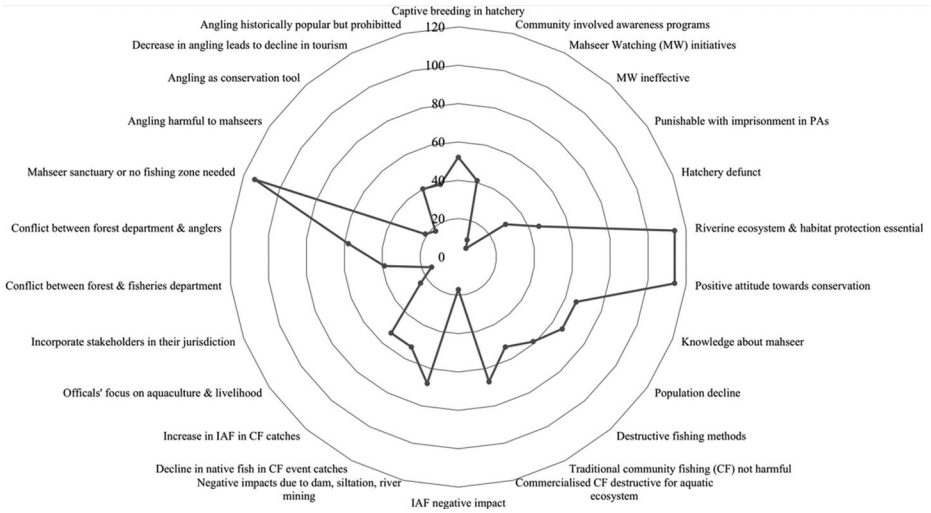

FIGURE 8. Radar chart depicting the frequency of codes used for generating the theme 'consensus between stakeholders' from the reflexive thematic analysis conducted on the interviews and FGDs from Assam.

However, competing stakeholder interests in economic development versus conservation and the jurisdictional issues existing between different governmental organisations involved in conservation of mahseer may also hinder the smooth implementation of such programmes. For instance, the majority of respondents from the fisheries department were primarily interested in livelihood generation and aquaculture-related activities (24), while anglers, researchers and local community members were vocal about conservation needs. The words of an aqua-tourism centre manager vouch for promoting stakeholders consensus as soon as possible:

Quote 1: '*We have told the officials multiple times that the beel can be used rationally, some for aquaculture related breeding of IMCs and other economically important fishes, while the others can be used for mahseer and other endemic fish conservation breeding.*'

Similarly, forest department staff expressed their displeasure about their exclusion from mahseer breeding and restocking activities undertaken by ICAR-DCFR and anglers within areas under their jurisdiction (15). In contrast, anglers believed that the activity of production of mahseer juveniles and releasing them into natural waterbodies does not come under the responsibilities of the forest department, and hence it is not mandatory to involve their staff in such activities. Tensions between the forest department and fisheries (39) and anglers (58) were also not rare.

Quote 2: '*Eco-camp once supported mahseer breeding with anglers and scientists working together. The forest department was, however, not involved in such programmes despite the eco-camp being located within the buffer zone of the National Park and right next to the DFO office. This exclusion may have angered the forest staff. As much as we support the forest department's decision to ban angling in protected areas, the closure of the camp led to decline in foreign tourists and anglers, which affected our income and many villagers who were employed there, lost their jobs.*'

This statement made by a local indigenous community member reflects the second theme generated, 'communication and collaboration.' In Assam, the decision-making and governance system guiding mahseer conservation was largely top-down, with lesser opportunity for the meaningful incorporation of local, indigenous values, and scientific insights. Political influence, bureaucratic and legal impediments, and fragmented inter-departmental responsibilities were found to play critical roles in reducing the sustainability of the efforts for maintaining collaboration amongst the stakeholders.

Communication gaps (67; Figure 9) and very little interaction (51) existing between the forest and fisheries departments often resulted in the de-synchronisation of the mahseer conservation activities (53) conducted by these two pillar institutions. The disconnect, bureaucratic pressures and legal challenges, the barriers of collaboration and cooperative

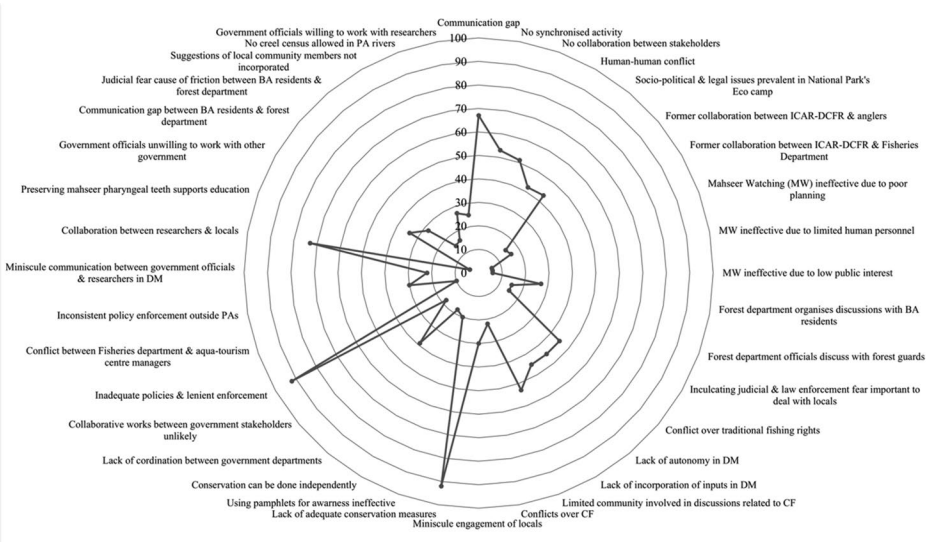

FIGURE 9. Radar chart depicting the frequency of codes used for generating the theme 'communication and collaboration' from the reflexive thematic analysis conducted on the interviews and FGDs from Assam.

decision-making (43), left the hatchery and eco-camp in the Nameri National Park jointly run by ICAR-DCFR, anglers (15) and state fisheries department (16) defunct, depriving the local community members of both revenue and livelihood opportunities from eco-tourism. According to major stakeholders (organisations involved in the management of the lakes), the mahseer watching initiative by the ICAR-DCFR in the *pukhuri*/lakes across cities such as Guwahati also failed because of poor planning (6), and limited human resources (6) resulted from the lack of consultation with the people working on the ground.

Quote 3: '*Mahseer watching was not well thought out. Since fish were invisible, the public were not interested to visit. The officials did not think of that nor did they ask us. We have only a couple of staff managing the entire pukhuri and the park, no one thought of who would take care of the fish, feed them*,' said *one of the* local *pukhuri* management staff members.

Another group of people who suffered from the unavailability of a trustworthy mechanism to answer their queries and guide their fishing activities was the buffer zone communities. Although forest officials acknowledged periodic discussions with these stakeholders (27), the lay-persons unaware of the legal dimension of the fishing in the buffer zone were greatly concerned about punishment (imprisonment) for subsistence fishing in their localities (15). Furthermore, interactions between forest officials and buffer zone communities seldom transformed into substantive decisions or had the potential to influence the policies (45). Similarly, diminished interactions and joint activities between government agencies

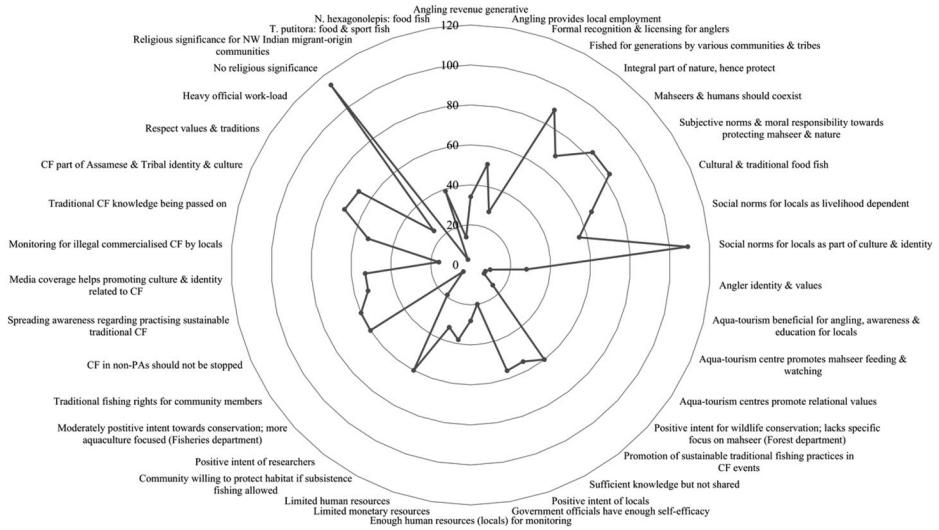

FIGURE 10. Radar chart depicting the frequency of codes used for generating the theme 'values and moral responsibility' from the reflexive thematic analysis conducted on the interviews and FGDs from Assam.

and local community members (53) weakened public trust and introduced frictions (22) in the community fishing events. Hence, acknowledging lived experiences and knowledge of the locals by the authorities, and involving them in the conservation activities along with installing an effective system for bidirectional communication, can reduce the resistance from the communities inhabiting landscapes important for managing mahseer populations.

The stakeholders expressed a mix of intrinsic, relational and instrumental values towards mahseers (theme 3: 'values and moral responsibility'). These fishes were considered as an integral part of the nature (69; intrinsic; Figure 10), a food source that has been historically fished for generations (88; instrumental), especially *N. hexagonolepis* (66), and many individuals we contacted felt a moral responsibility to protect them (83; relational). The long-standing socio-cultural connections with mahseer (relational values) echoing the strong pro-conservation social and subjective norms (TPB) prevalent within the community (109) were clearly notable in the words of an indigenous community member:

Quote 4: '*Mahseers and all other animals are a part of nature; they have their own right to live. Our lives are intertwined; we have traditionally fished them for generations as they are a food fish for us. It is our duty to safeguard these fishes.*'

The angling community was also vocal about its activities for promoting the practice of C&R angling, fostering voluntary stewardship and monitoring illegal activities, and the role of caretakers of the rivers and mahseers

(28). Many anglers suggested engaging local community members in angling-related eco-tourism activities to generate revenue (34) and employment (51) at the local level. Aqua-tourism managers also advocated promotion of ethical catch-and-release (C&R) angling, raising public awareness and education (10), and in their opinion offering opportunities for visitors to interact with, feed, and spend time with mahseers, and introducing the ecosystem services received from them (8) might catalyse the inculcation of relational values (8) towards these fishes among the general public.

Government officials from different departments acknowledged the importance of biodiversity conservation, but a domination of instrumental values over the relational aspects was noticed in their responses. Furthermore, in many contexts the species-specific conservation intent for mahseer (e.g., forest staff—15) was also not conspicuous. Although a high level of behavioural control is attributed to these stakeholders by others, the dearth of monetary (38) and human resources (33), human–human conflicts (42), heavy official work-load (25), reluctance for inter-departmental collaboration (34), poor knowledge -haring mechanisms (55), and restricted autonomy in decision-making (45; ABC) impacted the translation of their belief in self-efficacy (20) into action in the form of better governance, monitoring and evaluation (CPF).

However, local community members with traditional fishing knowledge displayed strong relational values and willingness to protect mahseer and their habitats (60). Motivated by the stewardship norms rooted in their cultural identity (109) and livelihood dependency (56) on the immediate environment, they claimed to have sufficiency in the human resource (PBC; 28) required for monitoring mahseer habitats if traditional fishing rights are recognised (60).

Quote 5: '*The government should allow subsistence fishing for the community members; they have traditionally done it for years without harming any species. If you allow them to do this, they will themselves monitor the river stretches preventing illegal activities and poaching*.' These words of an angling association member working closely with the local indigenous community point towards the need for utilising their familiarity with the focal environment and their experience for effectively managing the mahseer population. However, the enforcement of rigid policies, a lack of recognition for the traditional fishing rights of the buffer zones communities, and a ban on subsistence fishing served to limit their livelihoods and provoked resistance and friction with the authorities (45). Anglers, another stakeholder group with strong relational values, moral responsibility, and pro-conservation intent, and involved in monitoring mahseer habitats and promoting eco-tourism historically in this state, also complained about restrictions and absence of a mechanism issuing formal licensing (28).

Involving representatives of the local population in the organization and conduction of community fishing events (53) could enhance the quality of governance and monitoring, and can also generate opportunities for eliminating an important misconception held by many—the traditional fishing gear is not ecologically harmful (53). If safeguarded from commercialisation, community fishing festivals such as *Junbeel Mela* could serve as a powerful platform for promoting moral responsibility, cultural identity, social values and conservation-positive subjective norms of coexistence (83), alongside wildlife value orientations (WVOs) of mutualism and coexistence.[107] The following statement of a community member reflects this statement.

Quote 6: '*Community fishing is deeply etched in me as my culture, my identity, my heritage. We are very proud that we are able to promote cultural community fishing by inviting delegations from different states of India each year. Sadly, I have seen people illegally catching fishes with non-traditional gear, that is wrong and we do not support it. We have always practised non-destructive fishing for generations. It is also sad to see people making bandhs/bunds in the river channels feeding to our beel as they also affect the fish populations.*'

However, local indigenous community members felt that commercialisation and destructive fishing practices (67), driven by profit motives and inadequate regulation, have eroded their relational values, despite the inter-generational transmission (53) of the knowledge, and their exclusion from the vital roles of community fishing (53) restricted them from working to eliminate the human–human conflicts (22; Figure 10) associated with such events. These results demonstrate how a top-down approach in governance, without acknowledging the values, feelings and knowledge of the local communities and stakeholders, can reinforce behaviours counterproductive to conservation objectives.[108]

3.3. Uttarakhand

Similar to Karnataka and Assam, several mahseer conservation initiatives, such as enhancing public awareness through street plays, dance, skits, radio programmes, local newspapers (8; Figure 11), community-involved communication programs (16), and imprisonment for illegal fishing within protected areas (8), were observed also in Uttarakhand (situation assessment—CPF). However, this state gave a greater emphasis on mahseer

[107]Fulton et al (n 101); Gomez et al (n 101).

[108]Dhee et al (n 57); Jolly and Stronza (n 55); Riechers et al (n 99).

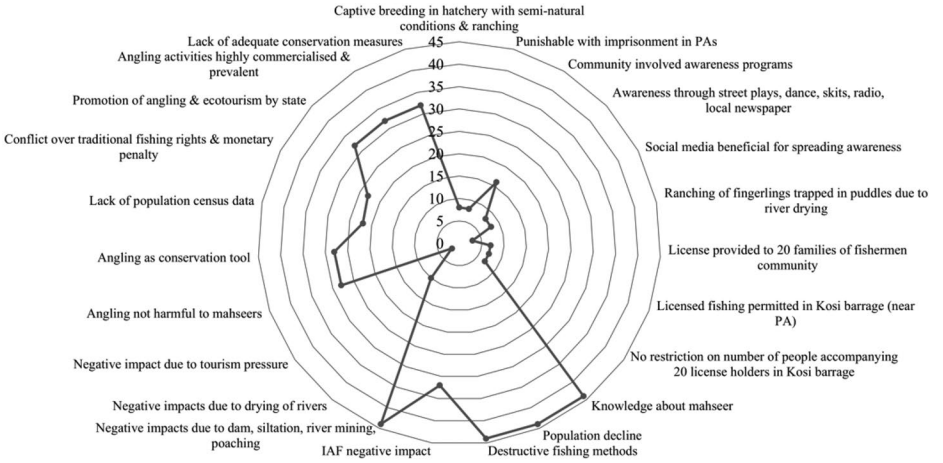

FIGURE 11. Radar chart depicting the frequency of codes used for generating the theme 'consensus between stakeholders' from the reflexive thematic analysis conducted on the interviews from Uttarakhand.

ranching, a hatchery dedicated for these fishes run by the state Fisheries Department in association with ICAR-DCFR at Bhimtal, Nainital, undertaking captive breeding in semi-natural conditions to increase the survival of juveniles post release (8) and the relocation of fingerlings trapped in river stretches that dry up during the summer to safer upstream sites (3) by the fisheries department.

Quote 1: '*We are very much invested in the survival of the fingerlings. During the summer months, the middle and lower stretches of many rivers dry up and the small fishes from our earlier release get trapped in the puddles of water. We pick them up from these puddles and release them upstream where there is sufficient water,*' said a fisheries department staff member, reflecting the value given to the fingerlings by the authorities in this state.

However, the situation assessment (CPF) revealed many inefficiencies in the conservation programmes caused by the fragmented regulation and monitoring systems, poorly coordinated activities by stakeholders, inadequate inclusion of diverse groups with an interest in the management of the ecosystem, loopholes existing in the mahseer fishing licensing system, and lethargic state-wide mahseer-specific conservation interventions. For instance, although a fixed number of individual fishing licences are officially issued annually for the Kosi Barrage in Ramnagar, Nainital (7) for the period from November to June, there is no restriction on the number of individuals (7) who may accompany the licensee to the field. This ambiguity is often abused by parties with a vested interest, resulting in excessive fishing pressure, as revealed by a forest official.

Quote 2: '*Recognising the livelihood needs and for the welfare of the fishing community, we have allowed fishing in the Kosi barrage area, which lies along the border of the Jim Corbett National Park buffer zone. We issue 20 licences to fishermen community members for a fee to fish, sell their catch and eat. But the problem is, there is no restriction on how many people can accompany a license holder, so the pressure on the fishes has increased. There is no proper mechanism to monitor what is happening there as well.*'

Almost all stakeholder groups we met agreed ('consensus between stakeholders'—Theme 1) that mahseer populations are critically declining in the wild (44; Figure 11), and they demanded urgent interventions for the conservation (44). While also illuminating the reasons behind such a reduction in the population size, sub-themes generated—namely, dam construction, siltation, riverbed mining, poaching (44), absence of population census efforts (22) and ecological disturbances caused by invasive alien fishes (IAFs)—they also reiterated the need for immediate collective actions. Although the presence of IAF common carp (32) was perceived as a threat for local fishes, none of the stakeholders acknowledged the impact of tilapia, another invasive fish spreading in the waterbodies of Uttarakhand.[109] Both officials from the forest department and NGOs agreed on drying up of the rivers (10) due to the indiscriminate extraction of water by hotels (pressure from tourism) and houses impacting mahseer populations. Interestingly, many focal groups viewed recreational angling, a key eco-tourism component, not as a threat to the mahseers but as a potential mechanism for ensuring their protection (28), pointing towards the possibility of merging conservation goals with the livelihood of the local people to gain public acceptance for the conservation interventions.

Another context in which lack of consensus between the two important stakeholders, the fisheries department and local people, led to conflict was the fine for illegal fishing (23). According to a staff of the fisheries department:

Quote 3: '*The fine for illegal fishing initially was Rs. 2,000 with jail time, but locals found it too high, which led to anger and conflicts. So, we decreased it to Rs. 500 with no jail. However, the instances of illegal fishing have increased over the years, so I think we will enforce stricter measures again. While we support traditional subsistence fishing through daily fishing licenses for locals, we strictly discourage large-scale illegal fishing that harms*

[109]A Trivedi, R Pathak and S Agniwanshi, 'Status of Exotic Fishes from the Yamuna River (Ganga Basin), Uttar Pradesh, India: A Review' (2021) 42 *Uttar Pradesh Journal of Zoology* 1123.

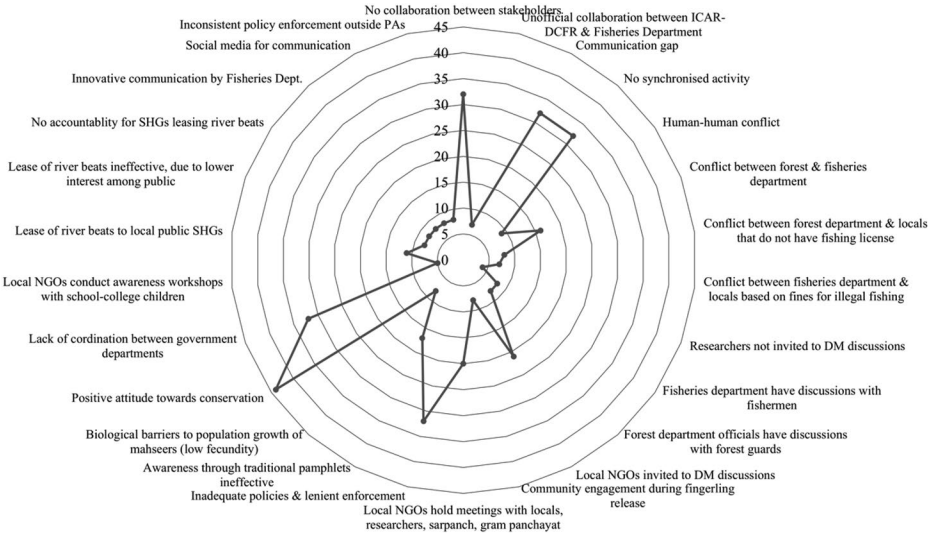

FIGURE 12. Radar chart depicting the frequency of codes used for generating the theme 'communication and collaboration' from the reflexive thematic analysis conducted on the interviews from Uttarakhand.

the ecosystem. As a result of such mass scale killing, we are not getting enough brood stock for hatchery breeding.'

These words should be taken seriously by the authorities and a consensus on the punishments for illegal fishing should be reached as soon as possible after conducting proper stakeholder consultation to avoid further escalations. The establishment of a platform under the direction of the institutions of local governance for promoting interaction between the stakeholders will also help in reducing the friction between government departments (forest and fisheries department, 16), forest department and non-license-holding locals (8), fisheries department and locals (7), and locals leaders and NGOs (7) reported from the study area.

The attitude towards mahseer conservation was positive (44; Figure 12) in this state also, but limited knowledge sharing (32) and collaboration (32), a lack of coordinated efforts between government departments (32), and disjointed and limited communication (32) (Theme 2—'communication and collaboration') meant that this failed to translate into meaningful actions on the ground. For instance, though an informal collaboration between ICAR-DCFR and the fisheries department existed (7), there were no active efforts to formalise it, which could have catalysed joint activities. Furthermore, the failure to incorporate vital feedback from key actors into decision-making or planning processes (10) and a lack of consideration of the inputs from researchers (4) and the advice of NGOs (10) point towards the prevalence of a top-down approach in mahseer conservation planning and interventions in the study area.

The efforts in the past few years to involve local communities or local self-help groups (SHGs) by leasing selected river stretches of 5 to 8 km, under a fee-based beat system (11), have not yielded the expected positive outcomes. Limited communication between the government departments and local beneficiaries, the absence of a clear statement of the purpose and expectations of the leasing, and a failure to implement a mechanism to monitor the activities of leases (8) diminished public interest (8) in this initiative. This situation rendered local participation largely income-driven rather than conservation-oriented, stressing the need for maintaining regular discussions between authorities and non-government organisations, as denoted by a member of a local nonprofit organisation working for the mahseer conservation.

Quote 4: '*After proper communication only the fisheries department should lease the river beats to NGOs who are accountable and interested in conservation and protecting the rivers along with sustainable fishing. There was no long-term collaborative effort from either the officials or the locals, hence people started losing interest. Many local groups who were leased the river stretch did not undertake any monitoring or safeguarding of the rivers which indeed led to more unsustainable fishing.*'

The forest department staff often consulted forest guards (8) while the fisheries department engaged with fishermen (8), but outcomes of these interactions were seldom considered for co-management and collaborative planning. However, the fisheries department staff conducted many innovative public awareness and communication programmes such as skits, *nukkad natak* (street plays), and so on. They used local radio channels and newspapers (8) and social media (8) as the medium for information dissemination.

Quote 5: '*We have been trying to spread awareness about mahseer decline and conservation in innovative ways. The traditional pamphlets and newsletters do not work; no one reads them. We are organising nukkad natak, planning to display slogans and hoardings, play songs on radio and use social media. Making things go viral is the best way to spread awareness. We plan to take this further by making humorous graffiti and street comedy stand-ups in local languages. These have more impact on the locals,*' said a staff member from the fisheries department. Local NGOs were also active in conservation education and community outreach. They conducted workshops and community meetings keeping school children and college students (5), village *sarpanch*, *gram panchayat* members, and locals (20) in focus.

The theme 'values and moral responsibility' also emerged in the state of Uttarakhand. Local communities and NGOs viewed the mahseer as an integral part of nature (17; intrinsic; Figure 13), a symbol of culture

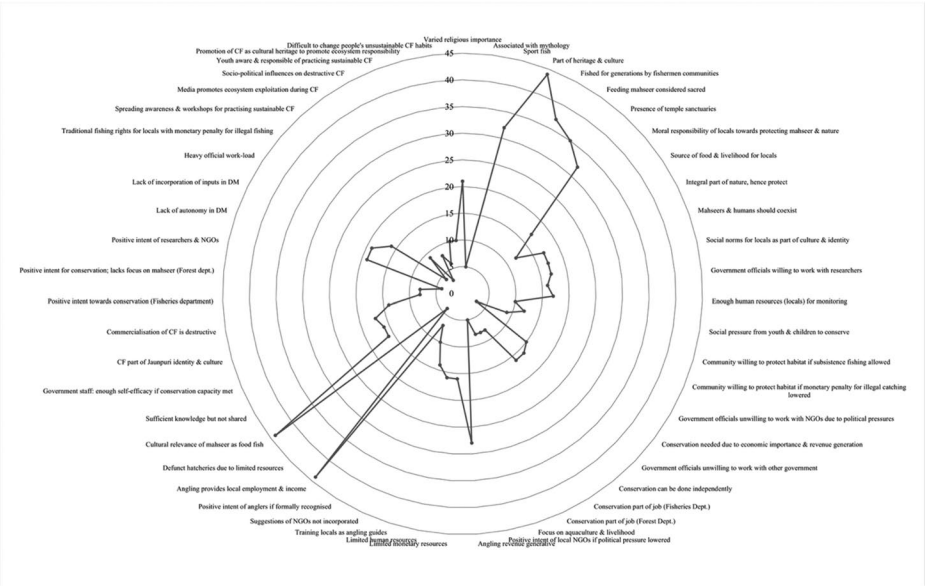

FIGURE 13. Radar chart depicting the frequency of codes used for generating the theme 'values and moral responsibility' from the reflexive thematic analysis conducted on the interviews from Uttarakhand.

and identity (17; relational), and a source of food and livelihood (17; instrumental). Their belief that the protection of this fish is their moral responsibility (17; relational) was echoed as strong pro-conservation social and subjective norms (TPB) prevalent in the study area (17). Here, youths displayed a particularly strong moral responsibility and supported conservation-positive norms (10). However, members of the local community expected permission for subsistence fishing (12) and a discount in the financial penalties for illegal fishing in return for the mahseer protection (9), since fishing was a major source of livelihood for many (12). Perceived behavioural control (PBC) for monitoring of mahseer habitat (human resource; 17) was high for both local communities and the NGOs, but the latter complained about the political pressures (5) they face.

Anglers, another important stakeholder group, expressed instrumental and relational values and positive conservation intent but felt that authorities do not recognize and value their activities (7).

Quote 6: '*Angling is hugely beneficial for the entire village. We share a major proportion of revenue earned from the visiting anglers with locals, train youths as angling guides, and buy all our vegetables from the local produce. It is sad that we do not have any recognition as anglers or guides. In Bhutan, anglers receive formal licenses or identity cards; we also want the same respect and legitimacy. We also request the Fisheries Department to set up a local office near angling hotspots, to partner with us and help*

us monitor and prevent illegal fishing,' said a member of the angling association.

Along with anglers, multiple other stakeholders were also of the opinion that regulated and formalised angling can generate revenue (28), create local employment opportunities (44), engage and train youths as angling guides (14), and support conservation through license fees and creel census data. As a result, the anglers expected the governance and decision-making mechanism (CPF) would implement a formal licensing system in the near future and promote a partnership between the fisheries department and the anglers to monitor the fishing and angling activities. They also expected that such a collaboration, along with reducing the conflicts and governance gaps, could promote eco-tourism, thus benefiting local communities and generating supplementary conservation funds[110] to resolve bottlenecks induced by the limited government grants[111] available for mahseer conservation.

In Uttarakhand, particularly in regions such as Bhimtal in the Nainital district, the mahseer holds significant religious (21) and mythological (5) importance (relational value), forming an integral part of the local folklore. In Uttarakhand, particularly in regions such as Bhimtal in the Nainital district, the mahseer holds significant religious (21) and mythological (5) importance (relational value), and this fish is an integral part of the local folklore. According to one legend, the Nal-Damyanti Tal, a prominent lake located in Bhimtal with a mahseer population, is believed to have emerged at the very site at which the palace of mythical King Nala and his consort Damayanti once stood. Lord Indra, the king of gods in Hindu mythology, collapsed the palace into a lake while cursing the royal couple. Later when Indra reversed the curse the lake came to be filled with golden mahseer, infused with *amrit,* the elixir of life. Myths hold that when the starving King Nala once tried to roast a mahseer, it leapt back into the lake, though with a mark of the fire on its body, proclaiming the boon of '*amrit*' and immortality. Revered as eternal beings and guardians of the lake's sacred essence, the mahseer of Nal-Damyanti Tal are venerated. Fishing in this lake is strictly prohibited, and for locals, harming mahseer means hurting the gods themselves.[112] Mahseers are also revered in several other non-formal temple fish sanctuaries in this state (32), such as in Baijnath temple and Garjiya Devi temple, located on the shores of the Gomti River and

[110]TM Phil, 'Ecotourism: A Sustainable Development Connect to Nature and a Strategy for Balancing Economic Growth, Socio-Cultural Development and Conservation' (2022) 1 *Asia Pacific Journal of Advanced Education and Technology* 64–72.

[111]Echols et al (n 41).

[112]Kattyayani (n 92); Vishwakarma, personal communication (on file with the authors).

Kosi River, respectively, where feeding the fish is considered to be sacred (35). These temple sanctuaries offer protection to mahseers, though their religious significance varies across communities.

Far more than catching fish, community fishing events include the *Maund (Maun) Matsya Mela,* held in the Jaunpur region of Tehri Garhwal, which maintains a deep connection with local culture, Jaunpuri identity, and heritage (17). Participating in this century-old annual festival, initiated by Raja Sudarshan Shah of Tehri in the mid-19th century, is regarded as an ancestral right by the Jaunpuri community.[113] Preparations for the '*mela*' begin one to two months in advance, and nearly ten to fifteen thousand villagers from Jaunpur (Tehri Garhwal) and Jaunpur-Bhabar (Dehradun) areas attend this fishing festival, underscoring its religious, cultural and historical significance[114] and its role in strengthening social bonds and cultural integrity among the participants.[115] However, a range of contemporary issues such as limited institutional recognition and reinforcement, shifting local priorities, and increasing migration have shaped this event in recent years.[116] As a result, what was once a community-bonding ritual and celebration has gradually become commercialised and destructive in the recent past (14), triggering human–human conflicts and eroding relational values, as reflected in the words of a local NGO member:

Quote 7: '*The traditional Maund Mela has now become completely commercialised, the essence of the community belongingness, culture and tradition is not there anymore. Nowadays, people use chemicals, poisons and nets in the river, play loud music, have a party and throw garbage in the river. Sadly, due to very high political influences and pressures, no one says anything. Many NGOs are raising awareness but it will take time. Positively, some of the youth have shown enthusiasm and they refrain from such activities.*'

Stakeholders also complained that socio-political factors, including political influence and power dynamics, led to politicians supporting such destructive fishing (8) during the *Mela*, and the media reinforcing this negative trend by projecting destructive events rather than highlighting ecosystem degradation and its implications (3). On a positive note, the NGOs and researchers (also supported positive conservation behaviour; 4) have been working to restore relational values among locals by

[113]Sharma et al (n 88).

[114]Sundriyal and Kumar (n 89); Rajpoot, personal communication (on file with the authors).

[115]Singh et al (n 90); Sundriyal and Kumar (n 89).

[116]W Habib, 'What Is the Maun Festival? A Deep Dive Into Uttarakhand's 150-Year-Old Fish-Catching Tradition. Heritage' <https://www.outlooktraveller.com/experiences/heritage/what-is-the-maun-festival-a-deep-dive-into-uttarakhands-150yearold-fishcatching-tradition>.

conducting awareness campaigns and workshops on sustainable community fishing (9). Even though interest in conservation and moral responsibility is gradually increasing among the local youth (6), changing practices of the community may take a long time (10). Therefore, promoting regulated community fishing using traditional gear and recognising these events as socio-ecological heritage and a catalyst for eco-tourism, engaging local youth, Jaunpuri community members, and NGOs in overseeing it, leveraging youth–elder relationships and encouraging news media to highlight sustainable, culturally grounded practices which form an integral part of Jaunpuri identity and culture (17) are a pressing priority to foster ecosystem responsibility (10).

Staff members from different government departments varied in the values they attributed to the mahseer. Fisheries department staff members expressed concern over mahseer decline and actively participated in conservation programmes. Their job-related instrumental values (8) were clearly evident in their focus on linking aquaculture with livelihood (8) for the locals. Many acknowledged the cultural and heritage significance (relational; 8) that mahseers have in their area and a positive intent (8) to protect them. Officials from the forest department were also committed to the protection of biodiversity (job-linked instrumental values; 8) and recognised the cultural importance of this fish and its connection with local identity (8; relational), but were not as vocal about mahseer-specific conservation plans as the members of fisheries department. Nonetheless, staff members from both departments were more open to working with researchers (16). Although both departments reported self-efficacy (PBC 16) for mahseer conservation, they also admitted that action on the ground was undermined by particular constraints in the form of limited finance (16), human resources (16), heavy workloads (16), restricted decision-making autonomy (16), and poor knowledge sharing (16; Figure 13). This misalignment between PBC and ABC could hinder effective governance and monitoring and hence the conservation outcomes.

4. Discussion

This study revealed several commonalities in mahseer conservation across the three geographically and socio-culturally distinct regions of southern, northeastern, and northern India, while highlighting local initiatives that could be potentially replicated to safeguard aquatic biodiversity in general and mahseers in particular. The integration of CPF, TPB, and social value analysis uncovered a broad stakeholder consensus on the decline of mahseer populations and the urgent need to implement conservation measures in Karnataka, Assam, and Uttarakhand. The stakeholders also urged the mitigation of widely acknowledged threats faced by the natural mahseer

populations, such as dam construction, siltation, riverbed mining, and invasive alien fishes.

It is well understood that achieving a broad consensus among stakeholders is challenging but essential for any conservation interventions.[117] Identifying points of agreement alongside state-specific points of divergence offers promising opportunities to formulate long- and short-term conservation goals at the regional, state, and national levels, as well as identifying the steps for achieving them.[118] Policymakers and aquatic ecosystem managers should therefore work towards translating this shared understanding present amongst diverse stakeholders into conservation actions.

At the same time, topics where multistakeholder agreement emerged only in selected states—notably taxonomic status, species endemism and research leadership (Karnataka), jurisdictional overlaps (Karnataka and Assam), prioritisation of livelihood-oriented aquaculture (Assam), and penalties for illegal fishing (Uttarakhand)—demand further research, keeping the socio-cultural uniqueness of these regions in the background. Mapping such factors at the micro-levels and integrating them into interventions can strengthen trust, support, and acceptance by the parties involved in mahseer conservation, improve cooperation between them and reduce negotiation barriers.[119] Moreover, this understanding can also help address inter- and intra-stakeholder conflict, a major impediment to conservation success,[120] and can incorporate area-specific considerations into conservation strategies.

Although the mahseer is a prized food fish and a popular recreational target across the focal states, stakeholders expressed strong social values, moral responsibility, and perceived behavioural control (PBC) toward protecting them. In Karnataka, multi-generational anglers and local communities displayed cultural and religious reverence for mahseers, and in Assam, conservation values were grounded in cultural and tribal identity as well as long-standing fishing traditions. Meanwhile in Uttarakhand, the

[117]MS Reed, 'Stakeholder Participation for Environmental Management: A Literature Review' (2008) 141 *Biological Conservation* 2417.

[118]Reed ibid; Reed et al (n 58).

[119]Pretty and Smith (n 105); J Brooks, KA Waylen and MB Mulder, 'Assessing Community-Based Conservation Projects: A Systematic Review and Multilevel Analysis of Attitudinal, Behavioral, Ecological, and Economic Outcomes' (2013) 2 *Environmental Evidence* 2; Reed et al (n 58); EA Beever, D Simberloff, SL Crowley, R Al-Chokhachy, HA Jackson and SL Petersen, 'Social–Ecological Mismatches Create Conservation Challenges in Introduced Species Management' (2019) 17 *Frontiers in Ecology and the Environment* 117.

[120]Pretty and Smith (n 105); Reed et al (n 58); T Meierová, 'Conflicts Between Farmers and Conservationists: The Role of Communication in the Management of Natural Resources' (2020) 13 *Journal of Landscape Ecology* 129; DM Doley and P Barman, 'Importance of Communicating Biodiversity for Sustainable Wildlife Management: A Review' (2023) 13 *Journal of Environmental Studies and Sciences* 321.

mahseer held more layered meanings as a heritage symbol (state fish), a renowned sport fish, a food resource, and a sacred entity (in a few regions).

In spite of the fact that India has undergone colonial rule for centuries and its conservation mindset and policies still bear the influence of the Western utilitarian views[121] and human superiority over nature,[122] stakeholders including tribals, local communities and recreational anglers viewed fish, wildlife and nature as equal partners of humans, and distanced themselves from more anthropocentric and exploitative concepts.[123] A large body of literature is available to demonstrate that values embedded in indigenous worldviews can unite diverse actors through knowledge systems rooted in cultural norms, traditions, and sustainable practices,[124] and guide integrated socio-ecological solutions for coexistence.[125]

However, even when attitudes, subjective norms, and PBC are strong, conservation behaviour remains limited when actual behavioural control (ABC) is constrained,[126] and fostering meaningful pro-conservation behaviour requires addressing decision-making power, adequate incorporation of stakeholder inputs, and structural constraints encountered by all parties involved, particularly the ground-level actors. As revealed by the present study, government officials across the focal states displayed lower ABC due to heavy workload, time limitation, and competing administrative priorities. Addressing these constraints through capacity building and establishing dedicated mahseer conservation teams actively collaborating with anglers, NGOs, and community leaders could reduce the gap existing between PBC and ABC.

[121]M Rangarajan, *Fencing the Forest: Conservation and Ecological Change in India's Central Provinces 1860–1914* (Oxford University Press 1999); R Guha, 'Radical American Environmentalism and Wilderness Preservation: A Third World Critique' in R Attfield (ed), *The Ethics of the Environment* (Routledge 2008) 179–191.

[122]K Anderson and C Perrin, (2018). '"Removed From Nature": The Modern Idea of Human Exceptionality' (2018) 10 *Environmental Humanities* 447; V Fiasco, and K Massarella, 'Human–Wildlife Coexistence: Business as Usual Conservation or an Opportunity for Transformative Change?' (2022) 20 *Conservation and Society* 167.

[123]JD Jyrwa et al, 'Dimensions of Changing Perception Towards Wildlife Conservation in East Siang District of Arunachal Pradesh, Eastern Himalayas' (2020) 24 *Global Ecology and Conservation* e01265; Iqbal et al (n 55).

[124]Dhee et al (n 57); Jolly and Stronza (n 55); Iqbal et al (n 55).

[125]A Tsing, 'Unruly Edges: Mushrooms as Companion Species: For Donna Haraway' (2012) 1 *Environmental Humanities* 141; T Ingold, 'Anthropology Beyond Humanity' (2013) 38 *Suomen Antropologi: Journal of the Finnish Anthropological Society* 5; D Haraway, 'Staying with the Trouble for Multispecies Environmental Justice' (2018) 8 *Dialogues in Human Geography* 102; S Ogilvie et al, 'Matauranga Maori Driving Innovation in the New Zealand Scampifishery' (2018) 52 *New Zealand Journal of Marine and Freshwater Research* 590; Jolly et al (n 57); RAR Shawon et al, 'Knowledge, Perception, and Practices of Wildlife Conservation and Biodiversity Management in Bangladesh' (2025) 15 *Animals* 296; Iqbal et al (n 55).

[126]Ullah et al (n 44); Karimi and Ataei (n 50).

Despite these strengths, the mahseer conservation ecosystems in all three states studied were not free of shortcomings or conflicts, meaning that consensus on ecological problems did not always translate into agreement on solutions.[127] Misaligned values, ambiguity over jurisdiction, political interference, and so on frequently triggered inter-stakeholder conflicts. In Assam, although cultural and tribal identity-based values supported mahseer conservation, inter-stakeholder frictions often emerged when livelihood security and socio-economic priorities clashed with conservation goals. In Uttarakhand, the promotion of angling-based ecotourism and the establishment of temple-based fish sanctuaries[128] worked positively for mahseers, while heavy penalties for fishing in the lakes and rivers advised by the Uttarakhand Fisheries Act, 2003[129] were a reason for fisherfolks and locals not cooperating with and frequently being involved in disputes with the authorities. In Karnataka, community associations and collaborative efforts between recreational anglers, researchers, the fisheries and forest departments, and local communities have had a positive influence on mahseer conservation.

However, conflicts have emerged due to differing views on mahseer endemicity and jurisdictional overlaps between the forest and fisheries departments, resulting in divergent opinions and management challenges. Our results reiterate the need to balance livelihood options and community rights with conservation efforts to ensure genuine stakeholder participation, so as to foster long-term stewardship and sustainability.[130] According to Reed, conservation plans must consider entire riverine ecosystems, aligning species-level interventions with community well-being to achieve this goal.[131] When conservation is perceived as externally imposed or culturally misaligned, compliance with species management strategies and policies becomes superficial and short-lived.[132]

Hence in Assam, a zoning approach allocating certain *beel* for aquaculture while reserving others for conservation breeding can accommodate the pursuit of both livelihoods and mahseer protection. Recognising traditional subsistence fishing rights in National Park buffer zones in Assam

[127]C Coglianese, 'The Limits of Consensus: The Environmental Protection System in Transition: Toward a More Desirable Future' (1999) 41 *Environment: Science and Policy for Sustainable Development* 28.

[128]Dandekar (n 92); Baruah et al (n 92).

[129]See (n 21).

[130]H Newing et al, '"Participatory" Conservation Research Involving Indigenous Peoples and Local Communities: Fourteen Principles for Good Practice' (2024) 296 *Biological Conservation* 110708.

[131]Reed (n 117).

[132]Pimid et al (n 33).

and in the lakes and rivers of Uttarakhand, while maintaining bans on destructive methods and strengthening anti-poaching measures, could help reconcile competing interests. Reintroducing regulated angling-based ecotourism in Assam and establishing guidelines on permissible gear and catch limits, along with licensing systems for subsistence fishing, may further support this goal. Formally recognising researchers and recreational anglers as intermediary stakeholders can help mitigate jurisdictional conflicts between the fisheries and forest departments. Furthermore, institutionalising collaborative research and structured knowledge-sharing mechanisms among all stakeholders can address the existing lack of consensus on mahseer species endemicity in Karnataka and support more coherent conservation governance.

Collaboration (and communication) was another critical theme generating notable interstate variation. Karnataka demonstrated robust micro-level partnerships among anglers, government departments, and local communities,[133] supported by breeding and ranching programmes, regulated angling, ghillie-led river patrolling, and fish sanctuaries declared under the Karnataka Inland Fisheries (Conservation, Development and Regulation) Act, 1996. In contrast, collaborations in Assam and Uttarakhand were limited and often ineffective due to poor interdepartmental coordination, political interference, bureaucratic challenges, the exclusion of key actors from decision-making and an inconsistent involvement of local communities and NGOs.

Such fragmentation could undermine trust and hinder knowledge exchange between stakeholders, leading to the collapse of conservation interventions, as observed in the cases of the Nameri eco-camp and hatchery shutting down and the low impact of 'mahseer watching' in Assam. However, many success stories demonstrating the strength of active collaboration in promoting conservation are available from one of the focal states, Karnataka, as well as the neighbouring states of Assam and Uttarakhand. Karnataka has successfully implemented regulated ecotourism and community monitoring of rivers in many areas of mahseers conservation importance, generating benefits for local communities and helping the mitigation of human–human conflict.[134] Similarly, in Meghalaya, a state located in northeastern India, a government–community partnership has led to the establishment of 54 fish sanctuaries since 2012 under the Meghalaya State Aquaculture Mission (MASM). Alongside playing a crucial role in conserving the endangered golden mahseer (*T. putitora*) and near

[133]Pinder and Raghavan (n 16); Roy and Sreenivasan (n 30).

[134]Pinder and Raghaven (n 16); Roy and Sreenivasan (n 30).

threatened chocolate mahseer (*N. hexagonolepis*), these community-led sanctuaries are also contributing to the protection of local rivers. With clear waters and thriving mahseer populations, these sanctuaries attract tourists, thereby generating income for local communities that have been efficiently monitoring and managing these water bodies.[135]

Another collaborative initiative for fish conservation worth mentioning at this point is the '*Matsya Mitras*' (Friends of Fishes) launched by the Jharkhand state government in 2007. Here, volunteers selected from the community and remunerated by the government work as a bridge between the fisheries department, local fishing communities and NGOs. These volunteers disseminate new knowledge and techniques of aquaculture with fishers and villagers interested in fish farming, document village-level water resources, and thereby significantly enhance fish production and strengthen aquaculture development in the state.[136] *Matsya Mitras*, with local adaptation focusing on the mahseer, could be useful for other states as well.

Finally, validating the roles of non-state actors, reinforcing relational and moral values and environmental stewardship,[137] and recognising and rewarding NGOs and community groups engaged in pro-conservation activities, through incentives, public visibility, or media coverage, can also strengthen stakeholder participation and accountability.[138]

Although effective communication between stakeholders is the backbone of the consensus, collaboration, and maintaining or modifying social values carried by the mahseer for positive changes in the behaviours of the stakeholders, across states we observed departmental silos, communication gaps and the absence of a common platform for sharing perspectives. The presence of an active communication system is also essential for reducing

[135]P Dash, R Tandel, D Baruah and D Sarma, 'Mahseer Sanctuaries of Meghalaya: A Conservation and Recreational Perspective' (2020) 24 *Aquaculture Asia Magazine* 3; Rahman (n 9); S Jumani, V Hull, P Dandekar and N Mahesh, 'Community-Based Fish Sanctuaries: Untapped Potential for Freshwater Fish Conservation' (2023) 57 *Oryx* 522

[136]NITI Aayog, 'Jharkhand's Matsya Mitra Initiative Promotes Aquaculture and Increases Fish Production' <https://www.nitiforstates.gov.in/best-practice-detail?id=104000>; S Shweta, 'Extension Approach for an Effective Fisheries Extension Services by Governmental and Non-Governmental Organizations in Jharkhand' (2024) 8 *International Journal of Advanced Biochemistry Research* 51.

[137]Chan et al (n 36); EB Ewane, 'Understanding Community Participation in Tree Planting and Management in Deforested Areas in Cameroon's Western Highlands' (2024) 74 *Environmental Management* 274; M Wato, R Mulwa and M Jama, 'Does Governance Influence Community Support in Conservation and Ecological Sustainability of Wildlife Conservancies? Lessons from Northern Kenya' (2025) 17 *Sustainability* 7181.

[138]ML Kipkeu, SW Mwangi and J Njogu, 'Community Participation in Wildlife Conservation in Amboseli Ecosystem, Kenya' (2014) 8 *Journal of Environmental Science, Taxicology and Food Technology* 68; J Rode, E Gómez-Baggethun and T Krause, 'Motivation Crowding by Economic Incentives in Conservation Policy: A Review of the Empirical Evidence' (2015) 117 *Ecological Economics* 270; Ewane (n 137).

human–human conflict[139] and promoting conservation action.[140] Furthermore, transparent communication with and between government departments is necessary to support informed decision-making and to frame effective policies. The Conservation Leadership Programme (CLP) in Baagi Village, Nayar River Valley in Uttarakhand stands out as an exception in this context.[141] Through the development of 'mahseer schools' and fostering an educational culture and curriculum that connects children to the fishes and nurtures a conservation ethic, this initiative has shaped pathways for the long-term restoration of golden mahseer (*T. putitora*) in the Ganga–Nayar river system.[142]

In this state, many NGOs and government departments have employed creative communication strategies such as street plays, local radio broadcasts, newspaper articles, and wall graffiti to spread mahseer conservation messages. Expanding these approaches across states, together with organising regular inter-stakeholder meetings, could help counter existing communication gaps and build the trust and conservation literacy required for supporting mahseer and other indigenous fishes.[143] A recent study exploring the mental models of multiple stakeholders related to mahseer conservation in Assam and Uttarakhand also highlighted the need for improved communication to facilitate inter-stakeholder collaboration, enhance efficacy of hatchery and conservation breeding operations, resolve human–human conflict, reduce illegal destructive fishing, and promote social values.[144]

In this context it is also important to remember the Targets 21 and 22 (Section H) and Section K of the Kunming-Montreal Global Biodiversity Framework that respectively emphasise participatory and inclusive biodiversity governance, and recognise the importance of communication strategies that go beyond awareness raising to fostering behavioural change

[139]J Huang, Z Tang, D Liu, and J He, (2020) 'Ecological Response to Urban Development in a Changing Socio-Economic and Climate Context: Policy Implications for Balancing Regional Development and Habitat Conservation' (2020) 97 *Land Use Policy* 104772; J Wu, Y Guo and J Zhou, 'Nexus Between Ecological Conservation and Socio-Economic Development and its Dynamics: Insights from a Case in China' (2020) 12 *Water* 663.

[140]Bickford et al (n 100).

[141]S Dewan, 'Mahseer School to Protect 'School of Mahseers': Nurturing a Conservation Ethic in Children of Baagi Village, Nayar River Valley, Uttarakhand, India' <https://www.conservationleadershipprogramme.org/project/mahseer-school-to-protect-school-of-mahseers-nurturing-a-conservation-ethic-in-children-of-baagi-village-nayar-river-valley-uttarakhand-india>.

[142]Ibid.

[143]K Schultz and KC McGinn, '"No One Cares About This Community More Than Us": The Role of Listening, Participation, and Trust in a Small Urban District' (2013) 48 *Urban Education* 767.

[144]Das and Binoy, 'Mapping Minds to Manage the "Tiger of Rivers"'(n 65).

through multiple-stakeholder engagement and effective messaging.[145] Therefore, each state should consider forming mahseer and river conservation councils with units at different administrative levels and involving members from government departments, researchers, anglers, NGOs, and community representatives to improve coordination, resolve jurisdictional overlaps, and promote bottom-up decision-making.

These organisations could also be developed as an inclusive platform for the stakeholders to exchange scientific information, discuss failures, and reconcile differences.[146] Such forums can cultivate and inculcate moral responsibility, promote wildlife value orientations (WVOs) of mutualism and respect amongst the stakeholders,[147] and help fisheries department to communicate concerns about illegal fishing and local communities to voice livelihood-related challenges and bureaucratic obstacles they face. Furthermore, researchers should expand their circle of communication beyond academic publishing and share their findings and knowledge (Bagla and Binoy 2017) on mahseers with the public through social and traditional media in vernacular languages to improve mahseer and aquatic ecosystem conservation literacy.[148]

Our study also highlighted the importance of projecting the mahseer's religious and cultural significance in developing communication programmes, and the importance of integrating local/tribal identity with such attempts.[149] Societal norms possess the power to override clear scientific evidence and hence a two-way engagement reflecting local socio-ecological realities, and converging traditional knowledge with scientific insights is essential to foster shared ownership and more effective mahseer conservation.[150]

By connecting the structural steps of planning (conservation planning framework, CPF) with the social and psychological drivers of behaviour at the level of individuals (theory of planned behaviour, TPB) and the

[145]Conference of the Parties to the Convention on Biological Diversity. (2022). Decision 15/4: Kunming-Montreal Global Biodiversity Framework (CBD/COP/DEC/15/4) <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>.

[146]Bickford et al (n 100).

[147]Fulton et al (n 101); Gomez et al (n 101).

[148]P Bagla and VV Binoy (eds), *Bridging the Communication Gap in Science and Technology. Lessons from India* (Springer 2017).

[149]R Clements, R Foo, S Othman, U Rahman, SRS Mustafa and R Zulkifli, 'Islam, Turtle Conservation, and Coastal Communities' (2009) 23 *Conservation Biology* 516; Bickford et al (n 100).

[150]R St. Clair, 'Words for the World: Creating Critical Environmental Literacy for Adults' (2003) 99 *New Directions for Adult and Continuing Education* 69; D Kahan, 'Fixing the Communications Failure' (2010) 463(7279) *Nature* 296.

cultural and social values with the potential to influence them,[151] our study revealed that an approach integrating these frameworks can offer a holistic picture of the situation for designing and implementing conservation action plans. While CPF outlines the stages of assessment, decision-making, and implementation, this alone cannot capture stakeholders' attitudes, subjective norms, or perceived behavioural control (TPB), which are critical for understanding why individuals or communities behave in a particular way.

The addition of the details of social values, particularly relational values that reinforce moral responsibility and pro-conservation attitudes and hence the motivation for cooperation, and instrumental values shaping willingness to follow the changes advised by the conservation managers when livelihood and other benefits are at stake, makes our framework valuable. For instance, in Karnataka, Assam and Uttarakhand, while governance and regulatory clarity were the central drivers (CPF), their effectiveness depended heavily on attitudes and perceived and actual control of behaviours (TPB) of the stakeholders, as well as the alignment that the conservation plans had with their livelihoods, cultural identity (social value), moral responsibility and stewardship (subjective norms, TPB). Furthermore, even when intentions were positive, low actual behavioural control (ABC, TPB) constrained many stakeholders from active participation in the conservation interventions resulting in suboptimal outcomes.

Although the present study offers valuable insights into the human dimensions of mahseer conservation across particular states through a novel, integrated approach, it is not without limitations. Since the current study is the first of its kind to integrate CPF, TPB and social value, more empirical and modelling studies should be conducted, keeping different socio-ecosystems as their focus, in order to strengthen the validity and applicability of this framework. Increasing the number of stakeholders from each group studied and ensuring that the views of all stakeholder groups are equally represented are also essential. Furthermore, there is a possibility of confirmation bias that may arise due to unequal power relationships existing amongst the stakeholders and the political situations present in the focal communities,[152] which will also need to be managed to avoid reaching wrong conclusions. In spite of these limitations, our study has demonstrated that bridging CPF, TPB and social value frameworks helps to identify the points at which social value orientations support or hinder behavioural intentions and hence offer insights to design

[151]Chan et al (n 36); Marchini et al (n 32); Pimid et al (n 33).

[152]T Yeazitzis, K Weger, B Mesmer, J Clerkin and D Van Bossuyt, 'Biases in Stakeholder Elicitation as a Precursor to the Systems Architecting Process' (2023) 11 *Systems* 499.

technically sound interventions that are socially acceptable and capable of catalysing sustainable behavioural change, ultimately enhancing the effectiveness of mahseer conservation.

4.1. Stakeholder Recommendations

Stakeholders across all three states proposed multiple recommendations for strengthening mahseer conservation through participatory, science-driven, and culturally grounded approaches, reflecting both shared and state-specific priorities. These recommendations are pointers for policy makers, authorities, conservation managers, and local governance bodies to develop effective policies and programmes for protecting the mahseer with national, state and regional implications. Jurisdictional confusion, reducing workload of government staff, involving NGOs and anglers in decision-making, improving interdepartmental coordination, institutionalisation of the community-based co-management, promotion of culturally rooted stewardship, and more emerged as the topics demanding immediate attention.

Other suggestions included establishing green no-fishing zones or fish sanctuaries on the line of Mahseer Conservation Reserve at Badi Lake, Udaipur,[153] ensuring legal protection for mahseers, enhancing inter-stakeholder communication, promoting transparent, bottom-up decision-making and allowing regulated subsistent fishing rights with clear limits and licensing to the local communities. Many advised the inclusion of the temple-based sanctuaries and community-supported no-fishing zones within the respective State Fisheries Acts to align conservation targets with local practices. Expanding sustainable catch-and-release angling-based eco-tourism and aqua-tourism as livelihood incentives for the stakeholders dependent on the mahseer, strengthening and modernising mahseer breeding and ranching programmes, and undertaking detailed mahseer distribution studies were also counted by many stakeholders as pressing needs.

Many suggested that awareness campaigns should move beyond one-way messaging and that communicators should adopt culturally resonant, locally grounded strategies such as street theatre/*nukkad natak*, traditional songs, and so on, to strengthen the societal salience of the mahseers. Support for reframing traditional community fishing festivals as heritage events and transforming them into an opportunity to promote local-identify dependent mahseer conservation was also observed.

[153]Rajasthan High Court, High Court of Judicature for Rajasthan at Jodhpur, D.B. Civil Writ Petition No. 7077/2OL4. Rajasthan High Court, 4th April 2017.

Recommendations that were specific for each focal state were as follows: Stakeholders from Karnataka highlighted the need for expanding citizen science and community-based initiatives, legitimising recreational angling as a conservation tool, strengthening training for forest guards, monitoring and managing the IAF and promoting collaborations between government departments, NGOs and researchers. They also emphasised declaring the humpback mahseer (*T. remadevii*) as the state fish and developing a captive breeding programme for ensuring the seed availability of this endangered species, conducting genetic studies of different mahseer species present in the state, developing transitional pond ecosystems, and integrating the mahseer's cultural significance into conservation programmes.

Conducting outreach through street plays and social media, issuing angling licences, allocating river beats to NGOs, and forming Indian researchers-led mahseer conservation groups were the suggestions recorded from Uttarakhand. Many stakeholders from this state also advised discouraging proposals for including the mahseer under the Wildlife Protection Act 1972, in order to safeguard the livelihoods of locals, and balancing strict penalties to encourage positive conservation behaviour. Mitigating political and bureaucratic challenges, empowering communities with fishing rights in buffer zones, licensing and training anglers for mahseer habitat monitoring roles, reframing community fishing events as heritage activities, and linking conservation with livelihood opportunities were the recommendations from Assam.

All of these suggestions reiterate that mahseer conservation policies should prioritise community-based and culturally grounded habitat management and discuss more rigorously the possibilities of integrating region-specific aspects of freshwater ecosystem and aquatic biodiversity into the existing fisheries and wildlife protection Acts.[154]

5. Conclusion

Human dimensions of successful conservation, especially those of freshwater ecosystems and the diversity it harbours, are deeply rooted in managing inter-stakeholder relationships through coordinated actions, inclusive communication, community empowerment, equitable resource allocation, and properly addressing the dynamics of the economic and political relationships present in the socio-ecosystems. Studying such complex scenarios demand an interdisciplinary approach integrating knowledge from the ecological, societal, cultural and individual dimensions. The present study

[154]Brooks et al (n 119); JA Oldekop, G Holmes, WE Harris and KL Evans, 'A Global Assessment of the Social and Conservation Outcomes of Protected Areas' (2016) 30 *Conservation Biology* 133.

was an attempt along these lines to integrate the stages of the conservation planning framework (CPF) with the theory of planned behaviour (TPB) and social values to illustrate the conservation of charismatic megafishes, mahseer, in three culturally and geographically different states of India.

Along with highlighting points of consensus, our study also illuminated the misalignment of values and the topics on which inter- and intra-stakeholder disagreement was conspicuous. Our analysis pointed out that addressing challenges of mahseer conservation requires inclusive, bottom-up decision-making and culturally embedded communication strategies that acknowledge the moral and relational value dimensions of human–mahseer relationships. Furthermore, strengthening perceived behavioural control (PBC) and actual behavioural control (ABC) is also important, as positive attitudes and norms alone are insufficient if actors lack autonomy, resources, or authority.

Our findings demonstrated that integrating social values and individualistic behavioural dimensions into CPF can provide insights to foster human–mahseer coexistence, counter the possible risks of the biological and societal extinction of this iconic species, and develop a national mahseer conservation policy with the scope to include region-specific demands and to involve other socio-culturally and ecologically significant species across India and beyond.

Acknowledgments

Prantik Das acknowledges the Human Research Development Group (HRDG)—Council of Scientific and Industrial Research (CSIR), New Delhi, India (09/1320(0001)/2020-EMR-I), for providing the research fellowship and the annual contingency grant for field-work related expenses. He extends his sincere appreciation and gratitude to all the respondents who took part in the interviews and FGDs across districts in all three study states. He also expresses his gratitude to Mrs. Bubu Sarkar Das, Mr. Subhashis Das, Dr. Monideepa Mitra and Mr. Mahendra Singh Rawat for their assistance in facilitating stakeholder contacts and data collection in Uttarakhand; to Ms. Ankita Sharma, Dr. Achyut Malakar, Mr. Abhijit Konwar and Mr. Dhireswar Sarma in Assam for additional assistance with Assamese translations, and to Mr. Balaraj Hiremath in Karnataka for additional assistance with Kannada translations.

Author Contributions

Prantik Das: Conceptualisation; methodology; investigation; data curation; formal analysis; visualisation; funding acquisition; writing - original draft; writing - review and editing. **V. V. Binoy:** Conceptualisation; methodology; visualisation; writing - review and editing; supervision.

Disclosure Statement

The authors report there are no competing or conflicting interests to declare.

Ethical Statement

All interviews and FGDs were undertaken in compliance with the institutional ethical guidelines for conducting non-invasive research involving human participants, as approved by the Institutional Ethics Committees (IEC) of The University of Trans-Disciplinary Health Sciences and Technology (TDU; Protocol Number: TDU/IEC/16E/2025/PR72) and the National Institute of Advanced Studies (NIAS; Letter Number: NIAS-EC-11/03/2022). In addition, the field study carried out in the Kosi Forest Range, Ramnagar, Nainital, was undertaken after obtaining formal permission from the Divisional Forest Officer (DFO), Ramnagar Forest Division, Nainital, Uttarakhand (Letter Number: 2873/61), in accordance with the rules of the forest department for this specific region.

Informed Consent Statement

Prior to the participation, all respondents were made fully aware about the objectives of the study, and it was emphasised that their participation was completely voluntary, with the option to withdraw from interviews or FGDs at any stage. The data collection through audio-recordings, note-taking and photography was carried out only after obtaining oral/audio-recorded or written informed consent. The participants were also assured that their names and other personal details that could be used to identify them would remain confidential and anonymous to protect their identity and privacy.

Funding

This work was supported by the Human Research Development Group (HRDG)—Council of Scientific and Industrial Research (CSIR), New Delhi, India, under Award Number 09/1320(0001)/2020-EMR-I.

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Data Availability Statement

In order to maintain the privacy of the respondents, the datasets have not been made publicly available, as they contain information that could compromise research participant consent. Accordingly, the data used in this study remain confidential.