CHAPTER 8

Inter-Sectoral Fisheries Governance Issues and Solutions on the Cauvery River, India

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Abstract Home to some of the world's most iconic rivers and large numbers of lakes, ponds, wetlands and canals, India is the third largest producer of inland fish in the world. The freshwater resources of India feature high biodiversity and endemism, collectively threatened by increasing numbers of invasive species, pollution, water diversion, fragmentation, and habitat loss. Fishers and local communities that rely on inland water resources in India represent an equally wide-ranging human landscape, speaking over 300 languages and coming from diverse religious, economic, and social backgrounds. These communities face severe challenges regarding resource access and livelihood security in a complex governance system. In South India, numerous fishing communities manage to combine traditional and formal management techniques in various ways, including through panchayat-style decision-making processes, government programs, and community cooperatives. We discuss the fishery characteristics, governance attributes, looming threats and potential solutions for the Cauvery River commercial, subsistence, and recreational fisheries, as well as explore the ways governance structures address community participation and socio-political equality.

1. Introduction

India is home to some of the world's most iconic rivers, an exceptional diversity of fishes, and a complex cultural landscape. India's freshwater resources include 197,024 km of rivers and canals, 31,000 km^2 of reservoirs, 2,350,000 km^2 of ponds and tanks, and 28,300 km^2 of other

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inland sources, including wetlands, brackish waters, estuaries, and lakes (Meenakumari 2005; International Collective in Support of Fishworkers [ICSF], 2016). Throughout the country, there are over 300 languages spoken at local, state, and regional scales, and 24 languages that are spoken by at least a million people (Brenkert and Malone 2005).

1.1. Indian inland fisheries

Estimates for inland capture and harvest at the national scale vary widely in India (FAO 2014). Combined fisheries sectors (inland and marine) account for between 0.75 % (Sathiadhas et al. 2014) and 1 % of national GDP (360 billion Indian rupees [INR]; Sugunan 2010). Inland fisheries capture estimates range from 781,846 t in 2007 (ICSF 2016) to 1.3 mt in 2012 (FAO 2014). In addition to wild harvest, inland aquaculture is considered a major contributor to fisheries production in India (Sathiadhas et al. 2014). Governance strategies have favoured aquaculture over capture fisheries since the mid 1980's, owing to concerns regarding the ability of capture-based fisheries to realize production potential (Sathiadhas et al. 2014). Sugunan (2010) suggested that including aquaculture and fisheries enhancements in the inland capture and harvest estimate would lead to a more accurate representation of overall inland production, which he estimated at 4.6 $mt \cdot yr^{-1}$. These estimates rank India as the third-largest inland fish producer in the world (FAO 2014).

A wide variety of gears are employed in the inland fisheries of India, including rod and reel, handlines, set lines (whether from boats or stationary objects such as trees), drop lines attached to floats, cast nets, and gill nets (Meenakumari 2005). 'Gearless' fishing practices can include traditional 'grouping' methods, where fish are encouraged into congregations and handpicked from the water, pots, traps and fish barriers, and various forms of stupefaction (including electrocution, dynamite, poison; Meenakumari 2005).

As an activity, fishing is associated with poverty and a lack of education in many parts of India (Sathiadhas et al. 2014), yet there is little information available on socio-economic attributes of Indian inland fishers. Income distribution in fisheries appears to favour the mechanized and retail parts of the sector (Sathiadhas et al. 2014), but the proportion of these economic benefits that reach local communities is unknown and likely highly variable. Further, literacy rates are also highly variable among fishing communities, and indeed, among fishers (there are no stable trends in differential literacy rates among male and female fishers across communities; Sathiadhas et al. 2014).

1.2. Productivity and stocking regimes

In India, man-made reservoirs (including tanks and ponds) produce the most harvest for inland fisheries, and are considered to have the most growth potential (Sugunan 2000). Small reservoirs require intensive stocking and are essentially culture-based fisheries, while large reservoirs are supported by wild stock and more closely resemble capture-based fisheries (Sugunan 2000). This reliance on reservoirs for inland capture has resulted in a multi-decade stocking program throughout India that was initially intended to boost production and social

equity among fishers, but has also led to various social and ecological impacts (see Invasive Species in 'Issues and Constraints' below; Raj 1941; Sehgal 1999; Sugunan 2010).

Stocking activities are generally undertaken at the state-level, and previously meant to stock native species in natural rivers (Sugunan 2010; but see also Sreenivasan 1976 for descriptions of deliberate introductions of non-native species to avoid overfishing of native species). The rearing process for fish stocking has at times included the spawning and fertilization of multiple species in a common pool (i.e. broadcast and common pool spawning techniques), potentially resulting in hybrid progeny (Sehgal 1999; Sugunan 2010). *Catla catla*, *Cirrhinus mrigala*, and *Labeo rohita* have been the most commonly stocked species in Indian rivers since the 1970s, though introductions of *Tilapia* spp. have also occurred (Sugunan 2010). Several of India's most popular recreationally fished species are currently listed as threatened (e.g., mahseer, *Tor* spp.; see various species accounts in the International Union for the Conservation of Nature Red List of Threatened Species; IUCN 2016), but stocked mahseer populations are suspected to also play a role in localized endangerment of other species (see 'Invasive Species in "Issues and Constraints' below).

1.3. National fisheries governance

Indian fisheries governance systems play out across multiple scales and requires the cooperation of numerous agencies. Throughout India, and including all fisheries sectors, communities have been organized into over 11,000 fisheries cooperatives, 70 district/regional federations, 15 state-level federations and 1 national level federation (Sinha and Katiha 2002). The Department of Animal Husbandry manages the financial and institutional support of fisheries policy at the national level and coordinates with the Departments of Fisheries at the state level (Sugunan 2010). A number of additional agencies, such as the National Fisheries Development Board, Fish Farmers' Development Agency, and Fisheries Research Institutes have also been developed to support fishers' needs (Sinha and Katiha 2002; Sugunan 2010). In some instances, cooperation with other national departments such as the Ministry of Home Affairs, Defence and External Affairs, and Commerce is also required (Sugunan 2010). In areas where reliance on fishing for livelihoods is high, state fisheries departments may also provide housing and equipment such as coolers and nets (Joshi et al. 2012). Legal pluralism and traditional forms of governance such as caste panchayats, a group of elders in a community responsible for making decisions, also occur throughout the country (Bavinck 2001).

The national and state governments own all inland waters other than small ponds, but fishing rights are allocated to individuals, groups, and communities (Sugunan 2010). These rights are managed in various ways according to international water law, locally-, regionally- and state-specific regulations and cultural practices, under the legislation described in the Indian Fisheries Act 1897, though a comprehensive account of water laws at the national scale is lacking (Cullet 2007). Rivers are ostensibly managed as a common pool resource, except in a few states (e.g., Karnataka) where leases may be held or purchased (Sugunan 2010).

2. The Cauvery River

Along with the Godavari and the Krishna, the Cauvery is one of the principle river systems originating from the Western Ghats (Sehgal 1999; Figure 8.1). It is one of few rivers known to be affected by both monsoonal directions, North-East in early summer, and South-West in late fall, though the summer monsoon sometimes fails in the area (Raj 1941). River flows return to dry season levels in the fall, typically September or October (Raj 1941). Annual average flows in the Cauvery are 21.36 $km^3 \cdot yr^{-1}$ (compared to some of the larger rivers likes the Ganges 525.02 $km^3 \cdot yr^{-1}$, or the Indus 73.31 $km^3 \cdot yr^{-1}$; Kumar, Singh & Sharma 2005). In terms of biodiversity and fisheries yield, the Cauvery is not the most productive river in India, but it is among the most heavily used rivers for irrigation and is culturally, spiritually and economically significant in the states through which it passes: Karnataka and Tamil Nadu (tributaries of the Cauvery also pass through the neighbouring states of Kerala and Puducherry). Further, the Western Ghats (where the Cauvery headwaters begin) is part of a global biodiversity hotspot (the Western Ghats-Sri Lanka), implying that significant loss of biodiversity in this region could lead to large losses of endemic species (Indian Institute of Science 2004).

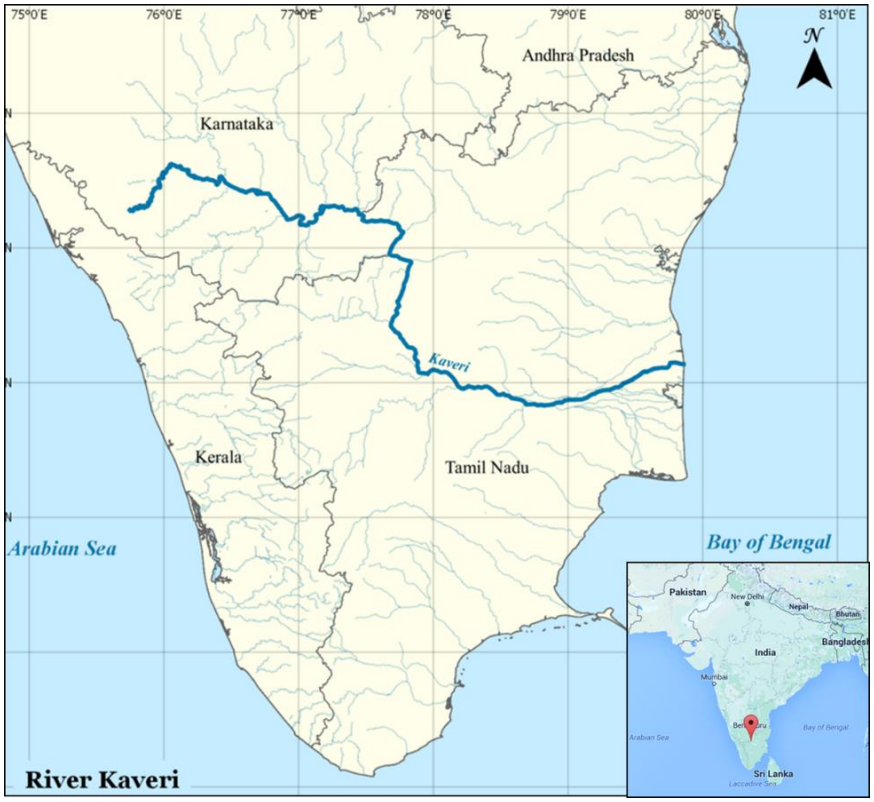

Figure 8.1. Map of state borders and rivers in South India, with the Cauvery (Kaveri) highlighted in darker blue. Inset indicates the location of the Cauvery River relative to the whole of India.

The Cauvery is known to host at least 100 fin fish species and over seven prawn species (Srivasatava et al. 2009; Sugunan 2010; FishBase 2015), though additional species may yet be undiscovered. Cyprinids are the dominant group of fishes in the Cauvery, which includes *Tor*

spp., *Neolissochilus* spp., *Labeo* spp., and *Cirrhinus* spp. (Sehgal 1999). In years when the monsoon is weak or non-existent, losses of young of the year and failed spawning can occur in the major carps (Sreenivisan 1976). Species known to be have been stocked in the Cauvery over time include: *Cyprinus carpio*, *C. catla*, *L. rohita*, *Tinca tinca*, *Oreochromis mossambicus*, *Oncorhynchus mykiss* and *Tor khudree*, though there are reports of fishers landing *Clarias gariepinus* as well (Raj 1941; Sehgal 1999; Indian Institute of Science 2004).

2.1. Inland fisheries of the Cauvery River

Fisheries in the Cauvery River occur across commercial (mainly small-scale, artisanal), subsistence, and recreational sectors. Commercial fisheries mainly occupy the floodplains and low lying areas of the river (Sehgal 1999), targeting a diversity of species and using a variety of gears (as described in 'Inland Fishers of India', above). In Tamil Nadu, freshwater prawns are fished in the Cauvery (Mariappan, Balamurugan and Balasundaram 2002). Statistics from Karnataka and Tamil Nadu Fisheries Departments estimate that 13,900,000 (Karnataka) and 225,804 (Tamil Nadu) fishers are active in the inland fishing sector, though the estimated number of fishers active on the Cauvery is not available (Government of Tamil Nadu 2015; Government of Karnataka 2016).

Subsistence fishers on the Cauvery River commonly use cast nets (see Photo 8.1) and gill nets (see Photo 8.2), and preferentially target medium-sized *Barbodes carnaticus*, *Systomus sarana*, *Labeo spp., Cirrhinus fulungee*, *Crossocheilus latius*, *Garra spp., Mystus malabaricus*, *M. vittatus*, *Xenetodon cancila*, *Channa gachua*, and *Mastacembelus armatus* (Sehgal 1999). An important distinction is made between subsistence fishing and poaching by management organizations: poaching being the term used to refer to subsistence or commercial harvest in prohibited areas or using destructive gears. Indian Institute of Science (2004) suggest that the trend of use for destructive fishing methods is increasing. These methods include dynamiting and poisoning, but may also include fishing outside of open seasons, use of small-meshed nets, harvest of gravid fishes (during closed season), and targeted harvest of fish at congregation sites (e.g., dams; Indian Institute of Science 2004). Mariappan, Balamurugan and Balasundaram (2002) note that prawns are collected during breeding season, where 'berried' females are harvested and the eggs are either discarded or sold to hatcheries.

Recreational anglers typically fish either from a coracle (traditional round-bottomed boat) or from shore, using mainly rod and reel, but in some instances with handline (using fishing line tied to a stick). In the two main fishing areas of the Cauvery River, Valnur (Coorg) is open for mandatory catch-and-release (C&R) fishing from October until May and WASI Lakes (Shivanasamudra) is open for mandatory C&R year-round. Anglers must purchase a membership to the relevant organization, either Cauvery Wildlife Society in Coorg or the Wildlife Association of South India at WASI Lakes, and a daily fishing license. Rod and reel is the only gear permitted for use by recreational anglers in these areas (Sehgal, 1999). Anglers typically target *Tor* spp. (Gupta et al. 2016), *C. catla*, *L. rohita*, and *Channa marulius* using a variety of baits and lures, though other species, such as *Neolissochilus wynaadensis*, *C. gariepinus*, and other cyprinids such as *C. Carpio*, *Barbodes carnaticus*, *Hypselobarbus* spp., *Osteochilichthy*s spp. are also targeted or caught as bycatch on occasion. WASI maintains

data on recreational fishing activities within its management zone, including keeping angler log books describing the number and the weight of fish caught.

Photo 8.1. A small-scale fisher throws a cast net on the Cauvery River (Photo credit: Raja PK, metophoronline.in, and Pelagic Tribe).

Photo 8.2. A small-scale fisher checks a gill net set on the Cauvery River from a coracle (a round, flat-bottom boat) (Photo credit: Raja PK, metophoronline.in, and Pelagic Tribe).

2.2. Fisheries governance on the Cauvery River

Fisheries on the Cauvery River are currently governed and managed according to national legislation (as described in the introduction) and the applicable state department policies, and also by non-government organizations (NGO), and local communities. Prior to British colonization, fisheries in Tamil Nadu were mainly governed by sabhas (assemblies), which

appointed committees to manage distinct areas (Bhushan 2009). Under this type of management, misuse of common property was noted and offenders were punished. Reports indicate that similar strategies were used to manage Cauvery River fisheries in Karnataka. During colonial times, there was a breakdown of this form of communal governance as the British instituted various forms of top-down governance structures. Post-colonial Tamil Nadu has also seen a shift to multi-scale forms of governance. An attempt to reinstitute panchayats (Madras Panchayat Bill of 1958) was not overly successful, but forms of community management do continue to occur (Bhushan 2009).

Currently, community cooperatives and state-level support systems are in place for inland fishers of Karnataka and Tamil Nadu. There are 455 active community cooperatives (both marine and inland) in the state of Karnataka, including one state-level cooperative for inland fishers (Government of Karnataka 2016). The Karnataka Fisheries Department additionally reports the availability of a number of support schemes for inland fishers, including the Distress Relief Fund, Group Accidental Insurance Scheme, CCS Housing Scheme, Matsya Ashraya Yojane (housing scheme), and additional sources of funding to support financing for cooperatives, marketing development, caste welfare and tribal fisher supports (Government of Karnataka 2016). The government of Tamil Nadu reports that there are 369 fisheries cooperative societies currently supporting 86,481 inland fishers, of which 303 offer membership to men (79,110 members) and 66 offer membership to women (7,371 members; Government of Tamil Nadu 2015).

A large degree of cooperation is required among a multitude of government departments on issues of water management. For example, in addition to local communities and cooperatives, fish are managed by state fisheries departments, riparian areas and enclosed waters surrounded by forest reserve are managed by the state forest departments, and sand or mineable materials are managed by the state treasury departments. This also applies to water tanks, which are large reservoirs (some dating back over 2000 years) that hold and supply drinking and irrigation water to numerous towns and villages. Tanks may be home to numerous species of migratory birds and other wildlife; as such, many have been deemed sanctuaries and are now under control of the Forest Department (Bhushan 2009).

3. Issues and Constraints

The more pressing problems constraining the sustainability and resiliency of Cauvery River fisheries are similar to those issues faced throughout the freshwater systems of India, namely water security, invasive species, and inter-sectoral conflict. These are broad-scale issues that encompass additional threats, including water diversions, destructive fishing methods, stocking and intentional introductions of invasive species, and sand mining.

3.1. Water security

Water withdrawals, hydropower development, pollution, and climate change are most commonly cited as major threats to riverine health in India (Brenkert and Malone 2005;

Jayaram 2005; Dahanukar et al. 2011; Everard and Kataria 2011). The heavy reliance of a large human population on the main river stem and tributaries of the Cauvery River basin has led to a number of potential and realized conflicts. The level of water diversion is high: the Cauvery River provides the main source of drinking water to Bangalore, the 3rd largest city in India. Numerous farms and tourist operations (e.g., hotels) rely on the Cauvery for irrigation, and recent instability in monsoon patterns has led to uncertainty regarding the sustainability of withdrawals. Run off from industry, farms, and plantations, a lack of water treatment for sewage, and submersion of land during the flood cycle all contribute to delivering pollutants into the Cauvery River.

Hydropower development has played a strong role in water security along the Cauvery. Numerous dams on the Karnataka side of the Cauvery have led to tension between the states of Karnataka and Tamil Nadu, whose population also relies heavily on the Cauvery for drinking water and irrigation (Sinha and Katiha 2002). In addition to the issues surrounding the equity of water distribution, hydropower development along the Cauvery has led to impacts such as the displacement of local communities in reservoir areas and is believed to have contributed to the loss of the hilsa (*Tenualosa ilisha*) fishery since the construction of the Mettur Dam in the 1930's (Raj 1941; Sreenivasan 1976). Sreenivasan (1976) suggested early hydropower developments were also a factor in the loss of the indigenous *Hypselobarbus dubius* fishery in the 1940's and 1950's.

Any of these issues may be further exacerbated by changes to the hydrological cycle (including monsoonal patterns) arising from climate change. The state of Karnataka is expected to be vulnerable to climate change issues compared to most inland states, but Brenkert and Malone (2005) note that the heavy reliance on agriculture in Karnataka renders the population most heavily dependent on this sector particularly vulnerable. Tamil Nadu was one of six states identified as being highly vulnerable to the effects of climate change, and this can be tied directly to concerns regarding water shortages and ecosystem sensitivities (Brenkert and Malone 2005).

3.2. Invasive species

Many of the threats currently impacting the Cauvery River are complicated by the issue of introduced and invasive species. As noted above, stocking practices in India began with the intention of improving fisheries productivity and supporting livelihoods. Some species that were believed to occur throughout India were stocked in areas where they were not native. Three commonly widely-stocked species, *C. catla*, *L. rohita*, and *C. mrigala*, are native to some areas of India, but have been widely introduced in many areas to which they are not native (Sreenivasan 1976). In rivers such as the Cauvery, and in the reservoirs of Karnataka and Tamil Nadu, these species have become very abundant in some locations, while native species have possibly been outcompeted (Sreenivasan 1976). This concern was reinforced by Pinder, Raghavan and Britton (2015), who describe possible near extinction of a local species of mahseer in the Cauvery River and suggest stocked *T. khudree* may have played a role in the decline. These introductions are further complicated by a lack of regulation or enforcement in some areas regarding the culture of invasive species. For example, the culture of *C.*

gariepinus has been prohibited in all Indian states, but no prevention mechanisms have been established in Karnataka (Indian Institute of Science 2004). Currently, the focus of Fisheries Department activities in both states (Karnataka and Tamil Nadu) continues to be the production and release of fingerlings to inland waters.

3.3. Inter-sectoral conflict

Inter-sectoral conflict plays out in a number of different ways on the Cauvery River, many of them subtle. There tends to be little obvious resource-based conflict as subsistence fishers and recreational anglers typically target species differently: recreational fishers tend to target specific species, while subsistence fishers will target any species available. Where target species overlap, recreational anglers fishing in the more popular areas will often practice C&R (mostly for *Tor*, *Catla* and *Labeo* spp.) and/or specifically target larger bodied individuals, while subsistence fishers often catch smaller fish using different gears. Sehgal (1999) noted that commercial fisheries target larger bodied fishes, including *Tor* spp., and exotics such as rainbow trout and common carp, similar to recreational fisheries, suggesting that there may be potential for resource based conflict among these sectors. However, while commercial and recreational fishers may have similar targets, they are also usually separated geographically (the more common recreational fishing locations are not conducive to commercial harvest). When they do co-occur, conflict among these sectors may arise.

Access-based conflict may be more of an issue than resource-based conflict on the Cauvery River. Research into issues regarding equitable access of all sector fishers to resources is recommended by Joshi et al. (2012), who note as an example that a switch in the licensing system requiring individual licensing (from family licensing) has discouraged some commercial and subsistence fishers from fishing at the Mettur Dam reservoir by favouring fishers with more money for licenses. Many of these fishers have migrated to other fishing grounds, such as the Sharavathi Basin. Joshi et al. (2012) also allude to the perceived conflict surrounding migrant fishers, often those who have been displaced (as above), or those who travel among states for work and fish for sustenance. Migrant fisher populations are marginalized voices in Indian small-scale fisheries, and are often blamed for real or perceived malpractice if they employ gears that are considered inappropriate in their new location (e.g., dynamiting). These collective potential conflicts could have important ramifications for many individuals relying on small-scale fisheries for nutrition and livelihoods.

Conflict among recreational fishers and subsistence fishers using destructive fishing methods is less subtle. Both angling organizations on the Cauvery hire ghillies (guards) to work as guides and monitor fishing activities along their leased reaches of the river. Individuals caught poaching in recreationally fished areas are reported, and gear may or may not be confiscated. This has occasionally led to tension between angling organizations and local communities in the past, and research examining these relationships more closely is warranted.

The increase in recreational fishing activity in recent decades has generated mixed opinions among local communities. Anecdotal reports in Chennai, Tamil Nadu suggest local commercial and subsistence fishers are not widely supportive of C&R activities as the concept

of C&R is viewed as wasteful. In addition, though recent studies have indicated that the main recreationally-targeted species on the Cauvery, *Tor khudree*, is physiologically resilient to the practice of C&R (Bower et al. 2016), more research is needed to understand the social context of the fishery (i.e., to evaluate community support and benefits).

Included here under the auspices of inter-sectoral conflict are potential access- and resource-based conflict issues surrounding the sustainability of harvest. While few species targeted for fishing in India are listed by the IUCN as threatened (e.g. the four commonly recreationally fished *Tor* spp., see IUCN Red List 2016), the conservation status of many other species remain unevaluated and reports suggest that catch rates in the Cauvery are declining (e.g., see Sehgal 1999). These decreased catch rates suggest that potential for resource-based conflict between all fishing sectors may rise if populations continue to decline.

Another issue that falls under the category of inter-sectoral conflict is that of sand mining. Sand mining is known to occur along the banks of the Cauvery River in both Karnataka and Tamil Nadu. Recent increases in the price of sand have reportedly made it challenging for community members to purchase sand for building materials at reasonable prices, and the high prices have encouraged the development of what is being termed 'a sand mining mafia'. Sand mining operations are known to negatively impact aquatic habitats and river flows, but the cumulative biological and social impacts of sand mining in this area are not well-studied.

4. Synergies and Solutions

Fisheries researchers in India have suggested a number of solutions to the threats currently faced by small-scale fishers in India, including the development of fisheries policy that supports conservation and sustainability through national leadership (Sathiadhas et al. 2014), enforcement of strategies against overfishing, and community engagement. National strategies for fisheries are incorporated into a series of Five Year plans; however, these plans focus on strategies for growth, not sustainability or resiliency, emphasizing a short-term vision. Joshi et al. (2012) recommend instituting preventions to guard against overfishing and fishing during breeding season. This call was echoed by Mariappan, Balamurugan and Balasundaram (2002), who specifically suggest placing restrictions on prawn harvest during breeding season in Tamil Nadu. Still others propose that protected areas have a strong role to play in conserving fish populations. Some areas where fish are known to congregate are protected as sanctuaries (Indian Institute of Science 2004), with the intention of engaging and educating local communities as to the need for protection and to encourage voluntary compliance. Similarly, some angling organizations are working to promote conservation of aquatic systems through implementing protected areas in their managed reaches and through education of anglers, and many anglers themselves indicate their willingness to pay to support these initiatives (Gupta et al. 2016).

Researchers also note the need to focus on themes of equity in access and governance, and cooperation among stakeholders (Bavinck et al. 2008; Sugunan 2010; Sathiadhas et al. 2014). Among the actionable solutions presented have been calls to afford aquaculturists the same support as agricultural workers (Sathiadhas et al. 2014), including *a priori* valuation of

freshwater losses and community impacts during decision-making processes for development and irrigation proposals (Sugunan 2010), and increased pursuit of co-management and participatory regimes to promote equity among fishing communities (Bavinck et al. 2008; Sugunan 2010).

The complex nature of fisheries governance in India may itself be one of the solutions. The combination of modern and traditional governance forms operating at multiple scales affords a rare degree of precision and adaptability in fisheries decision-making. National-level agencies are able to address the need for enforcement and have the capacity to develop long-term plans, while local-level agencies have the ability to make swift decisions based on the immediate needs of the community. However, to maximize the potential benefits from such a system, certain improvements could be made. For example, fisheries strategies (including the 5 Year Plans) should include policies for maintaining sustainable harvest indefinitely, enforcing existing regulations, and regulations controlling the stocking of fingerlings. Additionally, local and traditional methods for fisheries management could be formally recognized, and strategies for cooperation should be implemented at an official level. Care should also be taken to guard against unevenness in application of local regulations, as there are reported instances in which local policies that favour powerful individuals in the community are enforced strongly, while those that favour the marginalized are not.

Further research into some of the issues threatening the future of small-scale fisheries on the Cauvery River is pressing, including studies examining ontogenetic differences in behaviour and habitat use of target species to support prioritization of habitat types for conservation and restoration activities. Additional research examining the impacts and options for managing invasive species is also warranted. Many of these crucial issues also provide a degree of opportunity, however. For example, India may be perfectly poised to become a world leader in fishway research and design, capable of passing a multitude of species effectively, or conversely, capable of restraining the passage of invasive species.

5. Conclusion

The communities, NGOs, and government organizations managing the Cauvery River resources face numerous challenges. Fishers, fishes, and riparian and aquatic habitats are threatened by a high number of anthropogenic threats that render the long-term future of the fisheries uncertain. While many of the existing conflicts initially appear subtle, there is potential for the size and scope of these conflicts to increase. Currently, there are many NGOs and local community groups hard at work engaging and educating community members and the general public as to the threats faced by aquatic species and fishing communities, and research projects attempting to quantify various aspects of Cauvery River fisheries are underway.

The very nature of the fisheries governance structure along the Cauvery may represent the most important tool for addressing these myriad issues, and may serve as an important example of multi-level governance globally. The combination of top-down bureaucratic

structure and bottom-up community-level processes and actions may prove sufficiently adaptable to restore resilience to the Cauvery River system, and address the pressing need for improved sustainability and equity in the river's fisheries.

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