



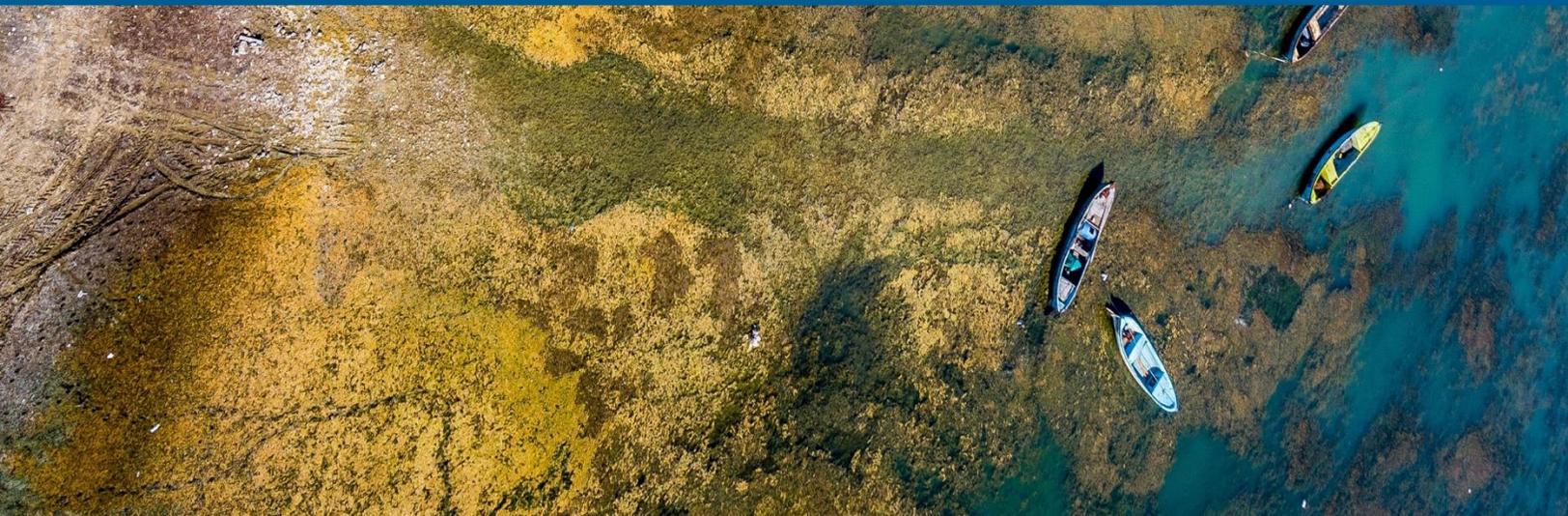
VULNERABILITY TO VIABILITY  
GLOBAL PARTNERSHIP

# A Situational Analysis of Small-Scale Fisheries in the Sundarbans, India: From Vulnerability to Viability

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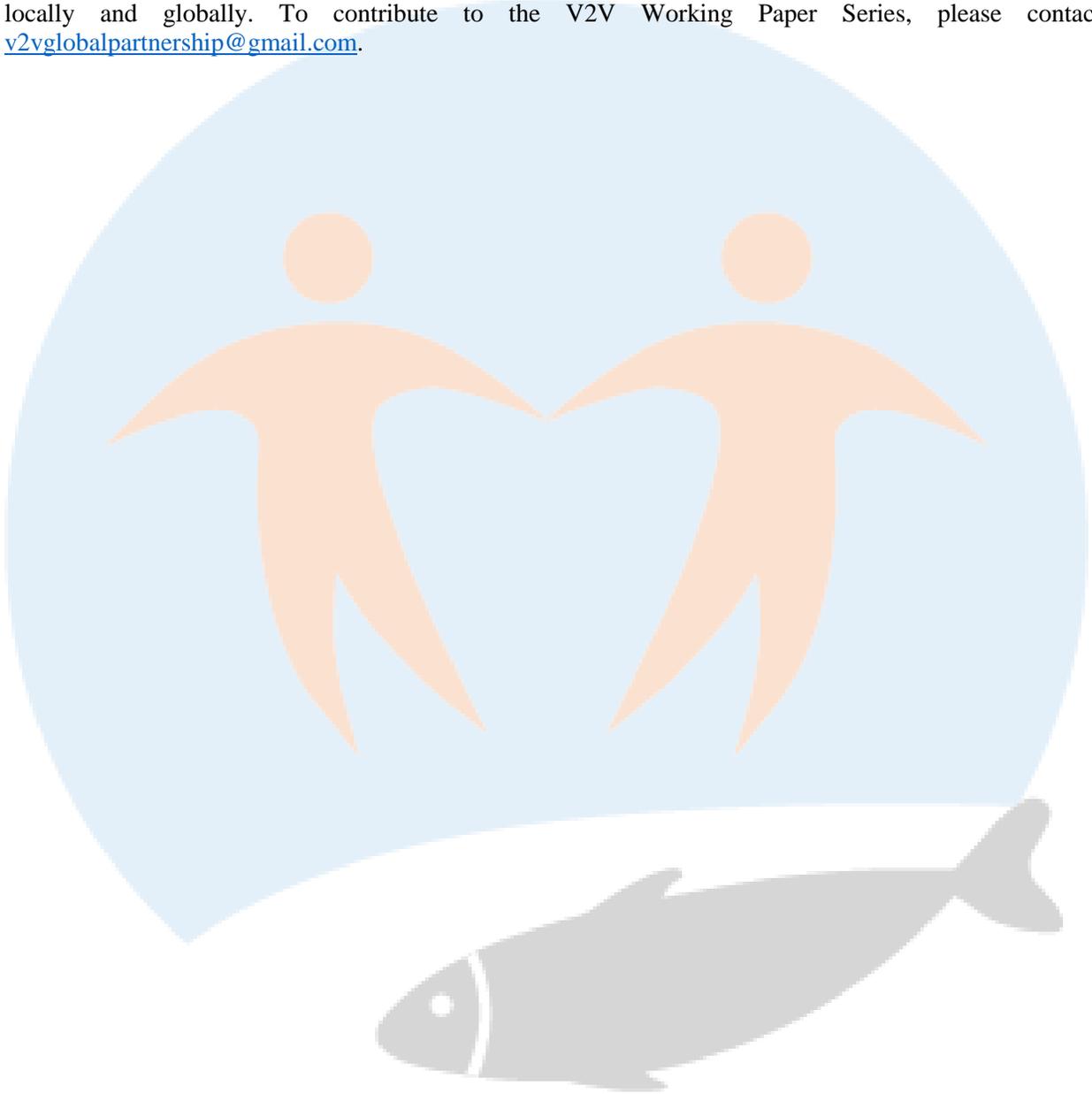
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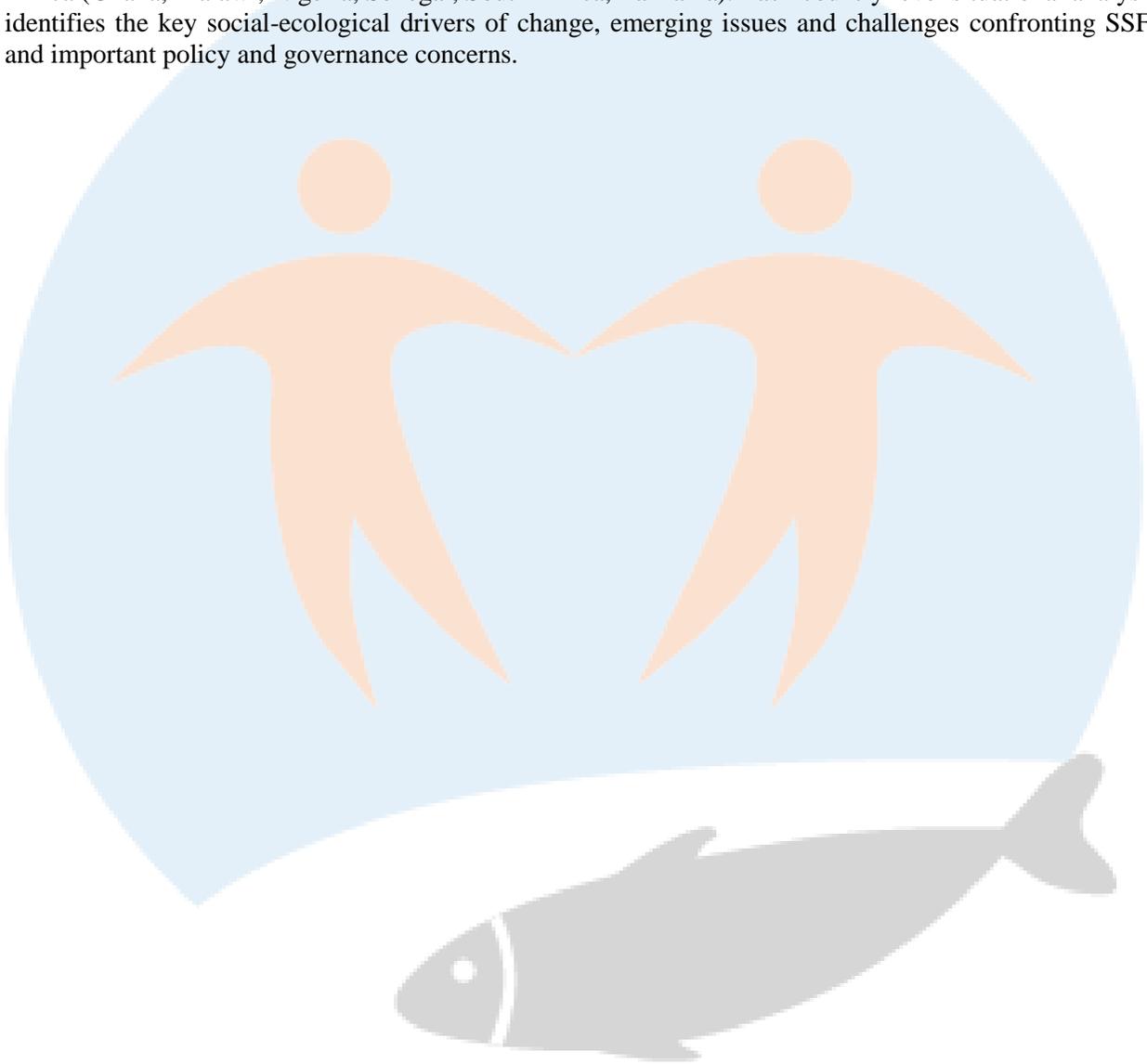
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V2V Global Partnership “Working Paper Series” aims to facilitate the exchange of ideas, mobilize knowledge and generate broad-based discussions on vulnerability-viability themes within the context of small-scale fisheries. The Working Paper Series will provide a collaborative and interactive platform for academics, practitioners, representatives of civil society, and individuals interested in making written contributions to the theoretical, methodological, practical, and policy aspects of small-scale fisheries, both locally and globally. To contribute to the V2V Working Paper Series, please contact [v2vglobalpartnership@gmail.com](mailto:v2vglobalpartnership@gmail.com).



## **A V2V Situational Analysis of Small-Scale Fisheries**

Small-scale fisheries (SSF) are an important economic resource, both at the local and global level. The depletion of SSF has ramifications on fundamental aspects of life, spanning from food security to society's wellbeing and culture. On the global scale, SSF provide food security and a source of livelihoods and income for more than 100 million people. The objective of the V2V Situational Analysis is to build a global perspective on key vulnerabilities and opportunities associated with SSF viability across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand) and six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania). Each country level situational analysis identifies the key social-ecological drivers of change, emerging issues and challenges confronting SSF, and important policy and governance concerns.



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# A Situational Analysis of Small-Scale Fisheries in the Sundarbans, India: From Vulnerability to Viability

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## 1. Introduction

Small-scale fishing involves a small amount of capital and traditional crafts which make nearshore fishing trips, mainly for local consumption and community economic regeneration purposes (Jadhav, 2018; Smith & Basurto, 2019). They often rely on intergenerationally transmitted ecological knowledge in fishing practices, even in the face of numerous economic and ecological challenges. Small-scale fisheries (SSF) not only contribute to nutrition, food security, and the national economy, but also the livelihoods of millions of fishers and fish workers across India and Southeast Asia (Kanthiah, 2010). On account of several descriptors of SSF such as artisanal, traditional, community-based, or subsistence, Charles writes; “the many categorizations of small-scale fisheries (subsistence, artisanal etc.) and their diversity of forms imply that any broad discussion of these fisheries cannot deal with all the nuances of specific situations – a small-scale fishery in one location will not necessarily look similar to one elsewhere.” (Charles, 2011, p. 85–86).

Among others, Subramanian (2009) traces the history of South Indian fishers making rights-based claims in legal domains during the colonial period. Prior to government intervention, India’s fisheries were thriving as low-tech enterprises, often supported by community-based organizations (Bavnick, 2011). According to Pillai and Katiha (2004), marine fishing activity was conducted at a subsistence level with the indigenous crafts and gears such as cast nets, small seines, and traps, which were operated at the nearshore zone of the coastal belts of India before state’s interventions in the 1950s. Indeed, majority of Indian fisheries in those decades appeared to be “small-scale,” particularly to the government technocrats (ibid). In current times, the large-scale marine fisheries sector that is equipped with engines generating hundreds of horsepower, synthetic nets, and semi-industrial boats, is conquering both the national and transnational markets. Many “successful fishers” of the mechanised sector are now capital owners with little history of fishing, whereas labour has flowed into this commercial sphere both from intra- and inter-state traditional fishing sectors (Jadhav, 2018).

Fish is an integral part of local diets in West Bengal state in India, the second largest fish producing country in the world, with the contribution of 5.43% of the total global fish production. Bengal ranks second after Andhra Pradesh, sharing 16% of the total production (Sahu et al., 2018). In Bengal, about 78% of the total fish catch is consumed in fresh condition, 6% is used as dried fish, and the rest is used as frozen fish (ibid). The riverine plains of Bengal nurture a wide variety of fish - the northern part hosts abundant freshwater fish, whereas the southern catchment area sustains diverse fish species at the convergence of saline water and freshwater. West Bengal has a coastline of about 158 km, extending along the southern edge of its two maritime districts - South 24 Parganas and Medinipur (Centre for Coastal Zone Management and Coastal Shelter Belt, Government of India). As per the 2014 report, the total number of fishermen in West Bengal is around 350,000, comprised of persons involved in marine fisheries as well as small-scale traditional fishers, making a living from inland freshwater and brackish water resources (Handbook on Fisheries Statistics, 2014).

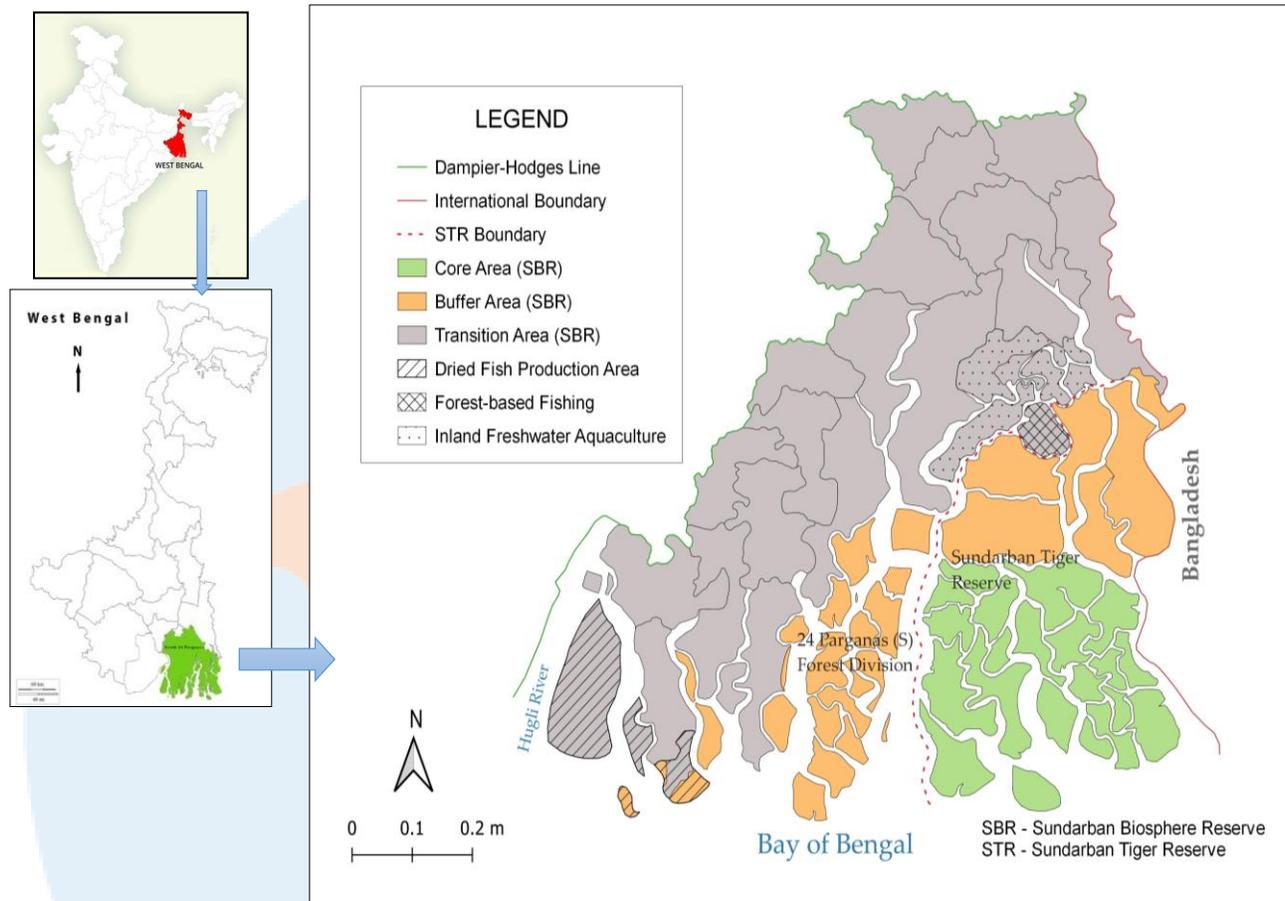
Fishing has been the most common and staple livelihood option for the people of Sundarbans since the beginning of human habitation in the region (Chacraverti, 2014; Bhattacharya, 2011). The networked roots of mangroves on the clayey substrate, play a crucial role in nutrifying the water, harnessing the food web with invertebrates, and acting as nursery grounds for nearly 90% of the important commercial aquatic species of entire eastern coast of India (Chandra & Sagar, 2003; Nishat, 2019). Alongside mangroves, the deltaic substrate of Sundarbans nurtures diverse ecosystem types such as - tidal mudflats, interdunal wetlands, estuaries, salt marshes, and riverine ecosystems which, along with being ecologically productive, have provided a range of ecosystem services to the coastal inhabitants. Nearly 0.1 percent of the global population, amongst the poorest in the region, is directly reliant on the “ecosystem services” of Sundarbans for earning their livelihoods (Nishat, 2019). The estimated total number of households in the Sundarbans that have enlisted “fishing” as one of the family occupations is 11% of the households in the area (Sánchez-Triana et al., 2018) whereas this share elevates up to 60-70% in areas with easy access to rivers and forests (Sen & Pattanaik, 2017). The historical and socioecological architecture of this ‘shifting terrain’ is largely defined by the many layers of hierarchical relationships based on resource access and livelihood practices; collective economies; cultural traditions and beliefs; power-laden spaces and unique social interactions (Bhattacharya 2011, Jalais, 2014). Sundarbans is a fragile and vulnerable ecosystem, prone to intense and incessant real-life threats. In the recent years, the threat has increased due to devastating effects of cyclones. Rise in the sea level accompanied by stronger tidal waves have inundated and eroded away landmass, along with depletion of mangroves. The saline water is gulping on the inhabited lands and forcing the fishers to resign to a future of submergence. This report aims at exploring the situational complexities, emerging challenges, and opportunities within SSF, an integral part of the socioecological setting of the Indian Sundarbans (South 24 Parganas district, West Bengal).

## **2. Historical, socio-ecological and ethno-cultural contexts of Sundarbans, India**

The Sundarbans Biosphere Reserve (SBR, Figure 1), or Sundarbans as it is officially known as in India, has assumed the global attention due to its wide and exotic range of biodiversity, wildlife, and marine resources. Home to the world’s largest mangrove forests, the Sundarbans covers about 9630 km<sup>2</sup> between 21°30’ and 22°30’ N latitude and 89° and 90° E longitude in India (Danda et al., 2011, Sen, 2021). ‘Sundarbans’ has been named in two ways: first is that Sundarbans derives its name after a once dominating mangrove species Sundari (*Heritiera fomes*), while others think that the name ‘Sundarban’ is coined from the meaning ‘beautiful forest’ in Bengali (*Sundari* meaning beautiful and *ban* meaning forest). Sundarbans is the largest remaining tract of the ‘celebrated species’ Royal Bengal Tiger, which occupies an integral core of the terrestrial food-chain and is known globally for its human eating trait. The eminence of the tiger, coupled with a range of other wildlife, mangrove species, and aquatic resources, has given the region a status of the ‘reserved forest’ since 1878. This was followed by other landmark provisions of conservation in the aftermath of India’s independence: tiger reserve, national park, wildlife sanctuary, Critical Tiger Habitat, and Biosphere Reserve. In 1987, the Sundarban National Park in India, and in 1997, a section of the Sundarbans in Bangladesh, were declared as the World Heritage site for its unique biophysical attributes. Human settlements in the fringe areas of the forest and their livelihood claims on the forest are considered by the state as the principal threat to the forests (Sen & Pattanaik, 2017).

**Figure 1**

*The Sundarbans Archipelago*



*Note.* Adapted from Ghosh, R. (2021).

The SBR is defined by River Hugli River at its West and River Baleshwar at the East whereas the River Harinbhanga (also known as Raimangal in Bangladesh) demarcates the (fluid) boundary between India and Bangladesh (Gopal & Chauhan, 2006). SBR constitutes 48 inhabited and 54 forested islands which are interspersed by a maze of rivulets, estuaries, and narrow creeks. These islands are inundated twice daily during the high tides and are exposed during ebb tides with average tidal amplitude between 3.5-5 metres. Of the eight large rivers that sustain the landscape, only the Hugli, Harinbhanga, and Baleshwar carry freshwater flux of some significance (Danda et al., 2011; Nishat, 2019). The alluvial islands of Sundarbans are still in the process of being formed, reformed, and eroded under the agencies of tidal currents, waves, and siltation. Of over 4.4 million people dwelling the corridors of the creeks and forests in SBR, roughly 2.5 million people inhabit the southern or ‘down’ islands (Jalais, 2014). The extreme northern limits of SBR have well-woven settlements found in abundance, while they also share close proximity with the city of Kolkata. These settlements have a stable land surface since they are away from the forests and the rivers, and consequently from the threats of erosion resulting from the intermittent change in the course of the rivers. These settlements are largely dissected by the rivulets and are situated on a relatively unstable land surface. In the words of Jalais (2014), “If the stable delta, just south of Kolkata, has agglomerate, compact settlements; the active delta contrasts sharply to it with its semi-nucleated, dispersed settlements.”

Indian Sundarbans Delta (ISD) has a fairly recent geological history reflecting on a nexus of fluvial and geomorphic processes. Much of the present tidal delta only stabilized as late as 5th–7th century AD. As the Indian plate penetrated into the Eurasian plate in the mid-Eocene, all of what later became the world’s largest Ganga-Brahmaputra delta laid below sea level (Allison et al., 2003). Formation of the lower delta plain started during the mid-Holocene and most of the presently occupied area of 10,017 km<sup>2</sup> in India and Bangladesh, was formed over the course of the last 6,000 years (Chacraverti, 2014). The first human settlers who may have been the *Veddoids*, are believed to arrive in a vast terrain of grassland and saline marshes by 5th Century BC, albeit the first archaeological evidence of human civilization dates back to around 400-300 BC. During this time, the “Pods” and the *Chandals* were considered as indigenous fishing tribes of the region (Nishat, 2019). During the reign of the Bengal sultanate (1204-1575), the ISD was discovered by Islamic Sufi *Pirs* (prophets) who practiced wet-rice cultivation by clearing the mangrove thickets (Bhattacharya, 2011). The process of bringing virgin forest under cultivation continued unabated during the Mughal era (1575–1765). The onset of mid-18<sup>th</sup> century bears the testimony of colonial commands over the socioecologies in the region. The policy pursuit of the colonial masters was activated with the intervention of Bengali landlords, intending to include more areas under cultivation (Richards & Flint, 1990; Hunter, 1877). In 1828, the British Government assumed proprietary rights to the forest and initiated leasing out tracts of the forests for reclamation, a process which continued until 1875-76 dotting a great decline in the biodiversity of the region.

## 2.1 The settlers

The SBR is inhabited by two distinctive groups of communities: people who possess agricultural lands, and communities who have a meagre amount of land including their homestead. These landless traditional communities, residing in the forest-fringed villages of Gosaba, Kultali, and Basanti blocks, have been earning their livelihoods by capturing fish and crabs in the mangrove forest, rivers, and creeks using simple artisanal methods (Jalais, 2014). Earning a livelihood, however, has been difficult for this community as they are not “indigenous” to the region unlike the migrants from Bangladesh, northern part of Sundarbans and 24 Parganas. During the colonial era, many people from Ranchi and Santhal Pargana areas joined the queue of mangrove forest clearance for the *zamindars* (landlords) to aggravate the land reclamation process. Folks from 24 Parganas, Jessore, Khulna, Bakargunj (now in Bangladesh), *Uriyas* from Orissa, *Bunos* from Chhotanagpur, and parts of West Bengal migrated to ISD as woodcutters (Bhattacharya, 2011). Indeed, the present-day social-cultural plurality of ISD is primarily shaped by cultural practices and survival strategies of both the natives and the “settlers” who have learned to live sustainably near the tidal forests. Sen and Pattnaik (2019) explained a form of conflict which was crystallized due to the state’s turn towards an “indigenist-regionalist sort of environmentalism”, mediating against the forest rights of the “non-natives”, since they do not account for an “authentic local” with “legitimate” forest rights. Resource claims of these people have never been acknowledged despite their socio-economic relationships with the forest.

Fisherfolk in the ISD generally belong to the *Paundra Kshatriya*, *Namasudra*, and *Jele* castes which are recognized as “scheduled” castes by the government of India. In the nineteenth and twentieth centuries, two major fishing castes, *Paundras*, and *Namasudras*, migrated to the SBR from the present-day Bangladesh (Chacraverti, 2014). Because of the current context of Sundarbans, Danda et al. (2011) are of the opinion that “The Muslim and Hindu (non-fishing castes) alike still display the aversion towards fishing and only in dire straits do they take to fishing”. Nonetheless, there is quite a large number of dwelling ethnic groups in the Sundarbans. *Bagdi*, *Maal*, *Tiyaor*, *Pod*, *Kaibarta*, *Namahshudra*, *Bedia*, *Haari*, *Muchi*, *Dhopa*, *Munda*, *Turi*, *Kandra*, and *Bhuina* are the majorities who practice fishing as a profession (Chacraverti, 2014; Bhattacharya, 2011). Beliefs, rites, and rituals as an ancestral thread of the ethnic groups, can be drawn by their reverence to the mystic stories and forest deity. *Bonbibi*, although being an Islamic deity, is worshipped by the fishers irrespective of their caste, creed, and religion. *Bonbibi* is worshipped annually, as well as before their visit to the drenched corridors of the forest, which is perceived as a sacred world, sauntered by *Dakshin Rai* (Sen,

2021). A sense of brotherhood and reciprocity prevails among the fishers who venture together into the forest. The ecological knowledge that they have earned from their ancestors, is reflected in the fishing process as well as their tidal and cosmological understanding. Within the forest fishing, many relationships are constituted through the interaction and coordination among people, as well as their connections to the nonhuman entities such as fish, river, boats, mangroves and so on. As the people migrated to ISD during different phases of history, the lives, livelihoods, social institutions, and traditions have been shaped by the opportunities and challenges generated in the surrounding ecologies along temporal trajectories, defining deep socioecological links in the region.

## 2.2 Small-scale fishing practices and methods

The Marine Fisheries Census has described “traditional fisherfolk” as those who are fishers by birth and fishing is their “traditional occupation” (CMFRI, 2010). In context of ISD, it spans as “ancestral occupation” which essentially adheres to ecological knowledge systems, artisanal methods, and fishing crafts. Boat seines, cast nets (locally called *khyapla*) (figure 3), and encircling gillnets or *galsha*, are three major types of nets used in estuaries, as well as marine small-scale fishing. Additionally, small bag nets as well as *handi* are employed for capturing fish and crabs from the creeks. Small bag nets or *behundi* are most often used for catching *bagda* (Tiger Prawn) seeds from the murky waters of the shore, a process known as *meendhara* (in Bengali, *meen* denotes seed). A labour-intensive practice, *meendhara*, is overwhelmingly carried out by women during low tide when the riverbed is exposed.

Prior to the establishment of Sundarban Tiger Reserve (STR), fishermen, wood, and honey collectors, continued with their livelihood practices in the forests with permits and registration certificates issued by the forest authorities (Chacravarti, 2014). As indicated the first Management Plan of STR, “Fishing is allowed free in tidal waters, provided that the fishing boats are registered in the Forest Directorate on payment of usual registration fees, and the royalty for dry firewood to be consumed on each fishing trip”. With the territorialization of STR, the region was divided into two distinct zones: (1) wilderness zone or core zone and, (2) buffer zone covering the remaining areas. The core zone is referred to as “no take zone” and is restricted to all forms of human activities, whereas the accessing buffer zone, locally known as “khola bada”, is allowed for restricted activities including fishing. Fishermen primarily use non-mechanized country boats and *bhutbhutis* (one-cylinder motorized boats) in the permissible zone for fishing.

Two types of fishing are prevalent in the villages of ISD – mangrove-based fish, crab, and seed collection, as well as inland freshwater aquaculture. The former involves a crew of three to four fishers entering the forests for seven days, with sufficient rations and fish food ingredients. Shouldering the continuous risk of being attacked by the mangrove-dweller tiger and crocodiles, they have been subsisting on forest and river-based fishing, honey, crab, and prawn-seed collection for past centuries (Figure 2a). Some fishers who do not possess their own boats, often labour in other’s paddy fields. Every fisher who enters to the STR for fishing is supposed to register their boats annually to the Forest Department. The department regulates a number of boats through Boat Licensing Certificate (BLC), which was first introduced by the State Forest Department in the 1980s for the entire reserve forest area including the STR (Ghosh, 2015). Fishing season begins in June and continues until the end of October. Five to six people sail off with a simple hand-rowed wooden boat and adequate foodstuffs, including rice (20 kg), potato (1 kg), and pulses (3 kg), for three persons to stay seven days in the forest. They also carry crab foods (Rs 400 per kg) and ample salt for preparing fish foods with initially caught fish. Not all the fishers are privileged to have their own boats and rent a boat for Rs 6,000. They are allowed to go to the forest only if they have a BLC permit, which is either issued by the forest department or rented from others. As noted by Sen (2021), “Due to the endless debt cycle of BLC rent to the *arataars*, bribes to the forest guards and confiscation of catches, fishers resort to illegal fishing”. During field surveys, a number of women who once used to go to the forests, remarked, “Forest officials are more dangerous than tigers”. Women enter the narrow forest creeks with simple bag nets for *bagda* (Tiger Prawn)

seeds which they sell the seeds to commercial aquaculture farms in the northern part of the ISD. Prawn seeds are captured while dragging the fishing nets along the bank of the rivers or from a boat. However, many fishers have shifted to inshore freshwater aquaculture as an alternative option.

**Figure 2**

*a) Fisherman and woman towards the mangrove forest for fishing, b) Inland freshwater pond used for fish cultivation, c) and d) Conversations with fishermen and women at Kumirmari village (Gosaba block).*



*Note.* The photos are captured by Raktima Ghosh in 2021.

On other hand, a distinctive SSF scenario prevails in some village islands wherein co-operative based culture fisheries is practiced at the inland freshwater ponds (Figure 2b). The fishers buy fish seeds from the local seed sellers as well as from State's aquaculture farms at Bankura and Hugli districts. Various species of freshwater fish are cultivated either at the household ponds or in cooperative "bheris" of disparate sizes and ownership patterns (Figure 2b). Aquaculture is also practiced at the household level by those who have lands (figure 3). Interestingly, a large number of fishers who were once involved in forest-based fishing practices, have now shifted to inland culture fisheries. This offers evidence to their adaptation tactics in the face of intensifying challenges such as increasing tiger attacks, ambiguous management of BLCs, and frequent patrolling of forest officials. Conflicts that emerge within mutually shaping social, institutional and ecological contexts, often relate to village panchayat tenders, poor freshwater quality of the unreformed ponds, insufficient as well as unhealthy fish-seeds, and distant markets. The cultivated fish is often sold to the local market in order to avoid transport and storage costs. Fishermen sell the fish to the "khotidar" (owner of village fish landing centres) who shares the fish to the stockist or "aratdar" in the nearby town markets such as Namkhana, Canning and Kakdwip (South 24 Parganas district).

**Figure 3**

*Inland fishing pond and household vegetable garden at Kumirmari village, Gosaba*



*Note.* Captured by Raktima Ghosh in 2021.

Marine fisheries of West Bengal contribute largely to gross national production. Prevalent primarily as a “male affair”, marine fishing is practiced with drift gillnetting and bottom-set *behundi jaal*, which are used in the estuary during summer, as well as in the open sea during the winter months. As a seasonal gear, shore seines are often used for marine fishing. Bengal occupied first position in the state-wise fish production in India during 2010–2011, with 17.6% of total fish production in Bengal and 6.2% of total annual marine production in India (Bhattacharya, 2011). The total fish production (marine and inland combined) of Bengal accounted for 1,615,313 metric tonnes (Dutta et al., 2011). SSF in ISD are apparently aimed at local and often state-level consumptions. The fishing season commences from mid-October and extends to mid-February with inland fishing being practiced throughout the year. Combined inland and marine fish production of West Bengal increased during 2017-18 rewarding second place to the state (Table 1).

State	Fish Production (in lakh tonnes)		
	Inland	Marine	Total
Andhra Pradesh	28.45	6.05	34.5
West Bengal	15.57	1.85	17.42
Gujarat	1.34	7.01	8.35
Kerala	5.34	1.51	6.85

*Note.* Handbook on Fisheries Statistics 2018

**Table 2**

*Names of the most common estuarine and marine fish species in the Bay of Bengal (Source: Bay of Bengal Programme Report, 1990)*

<b>Local Name</b>	<b>English Name</b>	<b>Scientific name</b>
<i>Tangra</i>	Catfish	<i>Arius spp</i>
<i>Bhekta</i>	Giant sea perch	<i>Lates calcarifer</i>
<i>Khoira</i>	Chacunda gizzard shad	<i>Anodontostoma chakunda</i>
<i>Phansha</i>	Smooth-back herring	<i>Raconda russeiana</i>
<i>Hilsa</i>	Hilsa shad	<i>Hilsa iiisha</i>
<i>Amadi</i>	Korua grenadier anchovy	<i>Coilia re ynaldi</i>
<i>Ruli</i>	Grenadier anchovy	<i>Coilia dussumieri</i>
<i>Samudrik chanda</i>	Whipfin mojarra	<i>Gerres filamentosus</i>
<i>Parse</i>	Borneo mullet	<i>Liza macroiepsis</i>
<i>Ban</i>	Pike conger	<i>Muraenesox spp.</i>
<i>Chabra</i>	Prawn	<i>Penaeus spp.</i>
<i>Bagda</i>	Giant tiger prawn	<i>Penaeus monodon</i>
<i>Chapda</i>	Indian white prawn	<i>Penaeus indicus</i>
<i>Kan-magur</i>	Canine catfish-eel	<i>Plo tosus canius</i>
<i>Tapshey mach</i>	Paradise threadfin	<i>Polynemus paradiseus</i>
<i>Gurjali</i>	Seven-finger threadfin	<i>Polydactylus heptadactylus</i>
<i>Bhola</i>	Two-bearded croaker	<i>Daysciaena albida</i>
<i>Samudrik belle</i>	Silver sillago	<i>Sillago sihama</i>
<i>Pomfret</i>	Silver pomfret	<i>Pampus argen teus</i>

### 3. Social ecological changes and key drivers

Small-scale livelihoods in ISD are currently challenged by a combination of socioecological factors, arising within the interface of environmental changes and multi-level socio-political contestations. Capture fishing is rooted to the splendid and copious pool of natural resources that is fish (table 2). The fish diversity is currently under grave endangerment emanating from the rise in sea-water temperature, downstream freshwater scarcity, pollution, and large-scale trawling. Inland fish cultivation is visibly impacted by land erosion, salt-water invasion due to embankment breaching, and frequent strikes of cyclones.

#### 3.1 Fish stock declination

The ISD is under the claims of rising sea levels as evidenced by severe land erosion (Hazra, 2010; Auerbach et al., 2015). The analysis of 50 years data of the Permanent Service for Mean Sea Level (PSMSL) from three of the four data stations in the Hugli estuary exhibits sea level increase of between +0.76mm/year and +5.22 mm/year at different locations in the ISD (Nandy & Bandypadhyay, 2008). As the rising water corrodes the edges of the islands, inhabitants are compelled to leave their homes and migrate to relatively safer islands. Many studies have showed that mean tide level varies in close correlation with sea surface temperature (SST) in the Bay of Bengal (Hazra, 2010; Auerbach et al., 2015; Nishat 2019). Notably, rise in SST has a bearing on chemical composition of sea water in terms of increased acidification and decreased dissolved oxygen levels. Surface air temperatures over the Bay of Bengal have been found to be rising at a rate of 0.019°C per year and a similar trend has been observed in the data collected from the ISD. Current projections of Hazra et al. (2002) show that the temperature in the ISD would rise by 1°C by 2050. The coupled increase in air temperature and sea water temperature is gradually altering aquatic habitats, triggering the declination of fish stocks and fish diversity. Additionally, the aquatic habitat is tainted by floating microplastics, outflow of toxic wastewater from commercial shrimp monoculture ponds, coupled with emissions from the river-side

industrial centres. These are further accompanied by siltation of rivers in the ISD in the result of large-scale dam installations upstream. Soaring salinity levels at the lower delta plain, caused by freshwater deficiency, has contributed to the loss of commercially significant fish species (Triana et al., 2018). Such exhaustion of fish stocks is one of the key threats for fishers as it reduces their daily catch. Many fishers have switched to crab fishing and temporary agricultural activities as fish stocks have declined.

On the other hand, large-scale trawling nets by commercial and mechanized fishing fleets, are seizing the juvenile fish stocks and larvae in the coastal waters. Modern bull trawlers with 120 horse power engines drag large trawl nets through the sea-bottom to chase tiger prawns, leading to destruction of on-bottom habitat of prawn, other shell fishes, marine algae, seaweeds, and plankton (Das, 2009). This is likely to have contributed to the recent crisis of prawn seedlings, fishes, and absence of some sea conch in the ISD. Intensive shrimp monoculture ponds discharging toxic water, taint the riparian water (ibid). Moreover, fish flocks surrounding the sand heads near Diamond Harbour are now-a-days moving away of the estuarine waters as evidenced by *Hilsa* population which is declining rapidly at Diamond Harbour, a site once famous for *Hilsa*.

### 3.2 Dealing with disasters

Among all the natural hazards at the tropical belt, cyclones are most severe and routine occurrences in the Bay of Bengal coast with life span averaging four days (Webster et al., 2005; Elsner et al., 2008). During last two decades, the northern Bay of Bengal has witnessed seven cyclones - Sidr, Nargis, Bijli, Aila and Amphan, Yaas and Jawad, inviting powerful storm surges, heavy showers, and floods that ravaged lives, livelihoods, and livestock in the delta (figure 4). Hard hits by the recurrent cyclonic surges, break the muddy embankment allowing the brackish water to take over the aquacultural ponds. Estimations for last 30 years unravel that about 7,000 people have been displaced from their homes and native islands in the Sundarbans due to the combined implications of sea level rise, coastal erosion, cyclones and saltwater flooding (Danda et al., 2011). Compounded with the pandemic lockdown, impacts of cyclones Amphan (2020) and Yaas (2021) left lives afloat over the stagnant floodwater for several days – young mothers along with their children abandoned their huts to move together to the brick shelters at a time when physical distancing was being promoted to prevent and control the pandemic. In the period following the disasters like floods and cyclones, the freshwater fishes are destroyed and *bheris* are salinized. After fetching the saline water out of the pond and applying an appropriate amount of *chun* (lime), the pond is left fallow until the monsoon, feeding the pond sweet water which is required for fish cultivation. They rebuild the hut with a meagre saving after every devastating cyclone.



**Figure 4**

*The 2019-cyclone Bulbul heavily hit the coasts of Indian Sundarbans and caused massive (is)land erosion in the coastal Frasergunj village.*



*Note.* The photo is captured by Swarnadeep Bhattacharjee in 2021.

### **3.3 Contested “identities”**

The forest-dependant fishing is especially challenged by the legal restrictions and contracts, posed by state forest department which introduced BLCs in the 1980s and issued certificates to boat owners who had been fishing for a long time in the ISD (Patel & Rajagopalan, 2009). This indirectly indicates that most of the BLC holders originally belonged to the traditional fishing castes who were the early settlers in the ISD. Moreover, BLCs can only be transferred to a blood relative and can be claimed by legal heirs, such as a wife or children, implying that a person is required to show the proof of his or her direct kinship in order to transfer a BLC to his or her name. During a field survey by Ghosh (2015), forest department officials explained that one traditional fisherman in the Sundarbans can rent his BLC to another traditional fisherman, as both of the have traditional fishing rights in the region. Interestingly, the department only considers those fishermen as “traditional” whose primary occupation is fishing and who are not involved in other economic activities, such as agriculture and wage labor. By issuing BLCs, the forest department aims to regulate and monitor the number of fishing boats in the tidal waters of the SBR (Chatterjee et al., 2009). However, the total number of BLCs did not increase in the STR whereas the population has increased substantially since 1980. For more than a million fisherfolk only around 706 BLCs are active out of total 923 BLCs (Ghosh, 2015). The regulation of fishing through BLCs has significant implications on the fishing communities as it opens an avenue of marginalization by creating a socio-economic division among fishermen. Relatively poor fishermen who possess neither boats nor BLCs are exploited by the wealthy, who have large land holdings, as well as BLC holders. During the field survey, the fishermen of Satjelia island (Gosaba block) explained that “khola bada” (open forest) is a very small area for fishing and it brings insufficient catch per person in the

crew, whereas fishing is prohibited at high-yielding “bandho bada” (core forest area). Fishing permits issued by the Forest Department are valid for six weeks, and a fine is charged for using an expired permit. Sometimes, when fishermen are found to be using expired permits, the forest guards seize their boats and other accessories, such as fishing nets (Chacraverti, 2014; Ghosh, 2013). Verbal abuse is common if the fishers are found to enter nearby the core areas. In ISD, conflicts are not limited to those between forest officials and fishermen; encounter to the forest-dweller Bengal tiger is a frequent occurrence (ibid). Fishermen, and crab collectors often fall prey to tigers lurking in the forests and often tigers come out of the forest in search of food; often they enter into villages and quietly make their way into the cowsheds for killing domestic animals. In recent years, such encounters have increased – tiger attacks have now become almost a regular phenomenon, occurring every alternate day.

#### **4. Emerging issues and challenges**

The “ecological wisdom” of the fisherfolk, supporting locally attuned economic practices and social accommodative systems, has seemingly been enervated by multiple actors who have sidestepped the Forest Rights Act (Government of India and UNDP, 2006) that confers the right to use, protect and conserve ‘community forest resources’ (Sen & Pattanaik, 2019; Bhullar, 2008; Bisong & Andrew-Essien, 2010) to the traditional forest-dwellers. Additionally, piracies and water-borne dacoities are daily events in the Sundarbans. Apart from being vulnerable to the vagaries of nature and wild animals, the fishermen face attacks from pirates, who sometimes capture their trawlers and boats, seize their catch and hold them hostage. According a report of DISHA, pirates often demand the ransom ranging from Rs.30,000 to over Rs.1 lakh. The abductions usually take place when they return with the catch (Chatterjee et al., 2009).

With the increase in population worldwide, there is an uprising demand of the farmed shrimp in comparison to wild caught shrimp. In order to expand the shrimp ponds and boost international exports, large-scale corporate shrimp farms not only invade agricultural tracts of the villagers, but also cause illegal clearance of the mangroves in the Sundarbans. As the looming regional and global markets are captured by commercial shrimp farms, small-scale fishers are left with limiting access to local resources and market opportunities. While the scientific attention has massively shifted to the incidence of overfishing and necessities for restoration of marine resources (Pauly et al., 2002), the stories of everyday challenges and confrontations of the fishers have remained unsung.

The inland freshwater fisheries are dealing with unknown fish diseases which are often caused by unhealthy fish seeds. Furthermore, many freshwater ponds have remained unreformed for several years due to dearth of initiatives from the village-level administration. Consequently, the fishers are compelled to bear substantial costs including the purchase of bleaching powder and lime (Calcium Hydroxide) in order to rejuvenate the ponds at their own. Much of the catch is often sold to local village markets at a low price because of inadequate storage and preservation infrastructures coupled with lack of prompt transport service to the “mainland” markets.

Furthermore, poor health care facilities, as well as problems with drinking water and sanitation, contribute to an increasing health risk. The degree of vulnerability has reached the tipping point with the creation of conducive atmosphere for women trafficking by both men and women traffickers, especially in the Kakdwip areas of Sundarbans.

## 5. Policy and governance

### 5.1 National-level policy regime

The Forest Rights Act (FRA, 2006), undertaken jointly by Government of India and UNDP, acknowledges the rights of forest-dwelling communities including their responsibilities and authorities for sustainable use of forest resources and conservation of biodiversity. It addresses the long-standing tenurial and access rights of forest-dwellers including those who have been forcibly relocated by state development projects. In essence, local communities residing in and around forests, were formally recognized either as the scheduled tribes or other traditional forest dwellers who earn the livelihoods from the forests for generations (Chacraverti, 2014). The law is also aimed at strengthening forest conservation methods by acknowledging forest dwellers' right to sustainably use and manage forests. On the other hand, it empowers Gram Sabhas (village-level local governance systems), responsible for the supervision of forest management, "to accept, verify and decide" about claims on forest lands by communities or individuals. Apparently, the FRA has been a long-suppressed framework within the institutional network of India. Today's forest and wildlife conservation schema does not correspond to the statements of the act. According to Sundarban Jana Sramjibi Manch (a Sundarban-based NGO and partner of IIT Kharagpur research team), about six lakh (600,000)<sup>1</sup> forest-dependent people in the islands are being denied the right to access the forests. Given the fact that a large number of indigenous species had faced decline due to commercial overfishing and unsustainable processing, the onus is borne by traditional small-scale fishers, who face legal barriers, challenges and often outright prohibition of their established practices. Conditions of FRA in the 'global conservation landscape' like Sundarbans subscribe to the decentralization of forest governance as a multi-layered socio-political process, wherein transnational companies and political cadres play together for larger investments, by institutionalizing community's rights and homogenizing their identities, involvements and struggles (Sen 2021).

In India, special provisions for coastal management are provided under the 1991 Coastal Regulation Zone (CRZ) of the Ministry of Environment and Forests. This covers all areas within 500 m of the high tide line and provides guidance and stipulates restrictions governing development of industries, management of waste, processing standards, mining of coastal resources, construction, and groundwater extraction (within 200 m of the high tide line). This notification highlights the entire SBR under different CRZ categories. The CRZ-I category is applied to: all the forested areas of the Sundarbans; all sand dunes; lands that lie within 100 m of a tidal creek; uninhabited islands, and Sagar Island. The rest of the ISD is under CRZ-III category. Inadequate implementation strategies and monitoring lead to the violation of CRZ rules by means of building infrastructures, ecotourism resorts and emission of industrial wastes.

The overall marine product exports account for the eleventh largest export item in India with 62.12 percent of the value coming from its burgeoning shrimp sector (MPEDA report 2018-19). Pradhan Matri Matsya Sampad Yojana (PMMSY), a 2020 fisheries scheme undertaken by Government of India, indicates to the intended beneficiaries of various interventions, such as - harnessing fisheries potential in sustainable and equitable manner, enhancing fish productivity as well as strengthening value chains, are the fishers, fish farmers, fish workers, vendors, fisheries cooperatives and fishery-based organizations. Interestingly, there is no specific account on SSF in the report. The vitalities, challenges of fishers and requirements within SSF sector has either been unrecognized or poorly addressed within the policy scripts. In response to the 2020 draft report of National Fisheries Policy (NFP, Government of India), the National Platform for Small Scale Fishworkers (NPSSFW, Convener- Pradip Chatterjee), aggrieved as the Department of Fisheries (Government of India) has taken no effort to facilitate stakeholders' consultation on the Draft NFP 2020. NPSSFW strongly advocates for inclusion of stakeholders in policy decisions. Moreover, the introduction section of the Draft NFP 2020 has failed to mention the central role of small-scale fish workers as by far the largest primary non-consumptive stakeholders and natural custodians of the waterbodies of the country. In

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<sup>1</sup> 1 lakh is equal to 100,000

this regard, it has also failed to mention that small-scale fisheries are more traditional, more sustainable and more equitable. NPSSFW further holds that the Draft NFP 2020 should not “aim at” but be “based on” overarching principles that would provide guidance and preclude divergence, not only for its present policy proposals but also in dealing with future policy requirements. The Draft NFP 2020 proposes to consider “seven pillars, namely sustainable development, socio-economic upliftment of fish workers, principle of subsidiarity, partnership, inter-generational equity, gender justice and precautionary approach with the aim for fostering inclusive development, promoting self-reliance and entrepreneurship and charting a road-map for the fisheries sector for the coming one decade”. Moreover, there is no mention about the livelihood security and wellbeing of women fish workers in the draft National Policy despite their explicit contribution to the whole fish farming sector.

## 5.2 State-level plans

The two departments that have the largest administrative influence over the ISD are the Sundarbans Affairs Department (SAD) and the Forest Department. The Sundarban Development Board (SDB) was created in 1973 in order to address the socio-economic backwardness of the region. In 1994, the SAD was developed as a dedicated department under which the SDB was subsumed (Danda et al., 2011). The original mandate of SDB was to coordinate activities of the various sectoral departments operating in the ecoregion. However, the SDB has since morphed into a parallel implementation agency with a range of divisions mirroring the departmental mandates of different state departments (e.g., Agriculture, Fisheries, Social Forestry, and Civil Engineering).

On other hand, the West Bengal Fisheries Policy is still overdue since 2015. The propositions surrounding ornamental fishery, encouragement for growing indigenous fish species, fish quality and related infrastructures, co-management, fish landing centres, livelihoods of fishermen, special assistance to SC/ST (Scheduled Caste/ Scheduled Tribe) people in fisheries, fiscal incentives, support for policy implementation, regular stock assessment programme and so on have rarely or partially been implemented and monitored within the SSF sector of ISD. In view of fish production sector, it mentions that “Development of improved fisheries sector infrastructure and equipment, including fishing boats, fish landing sites, fish stores, fish markets, and systems for the transport offish that contribute to maintaining the quality of harvested fish will be promoted. Measures as appropriate for ensuring the quality, wholesomeness, safety for human consumption and value of harvested fish and fishery products will be promoted and introduced in a phased manner, based on Hazard Analysis of Critical Control Points (HACCP) and Total Quality Management (TQM).” In lieu of crafting GDP plans, the policies predominantly aim to address the wellbeing of the small-scale fishers. it orates extensively about potential contributions of different aquaculture economies (fresh water, brackish water, marine) and advocates for the growth of indigenous fish varieties as an enriched source of low-cost protein and micro-nutrients.

West Bengal initiated a state disaster management policy and framework in 2005 which outlined strategies for: (a) pre-disaster, (b) disaster phase, and (c) post-disaster response (Department of Disaster Management, 2005). This encompasses the development of institutional mechanisms for implementation; a broad mitigation and prevention strategy that includes targets to develop a land-use planning framework; and disaster management planning down to the district and block levels including the ISD. However, this does not seem to have been operationalised as was evident in the inadequacy of the response to cyclone Aila and Amphan that devastated the Sundarban region in May 2009 and May 2020, respectively (Danda et al., 2011).

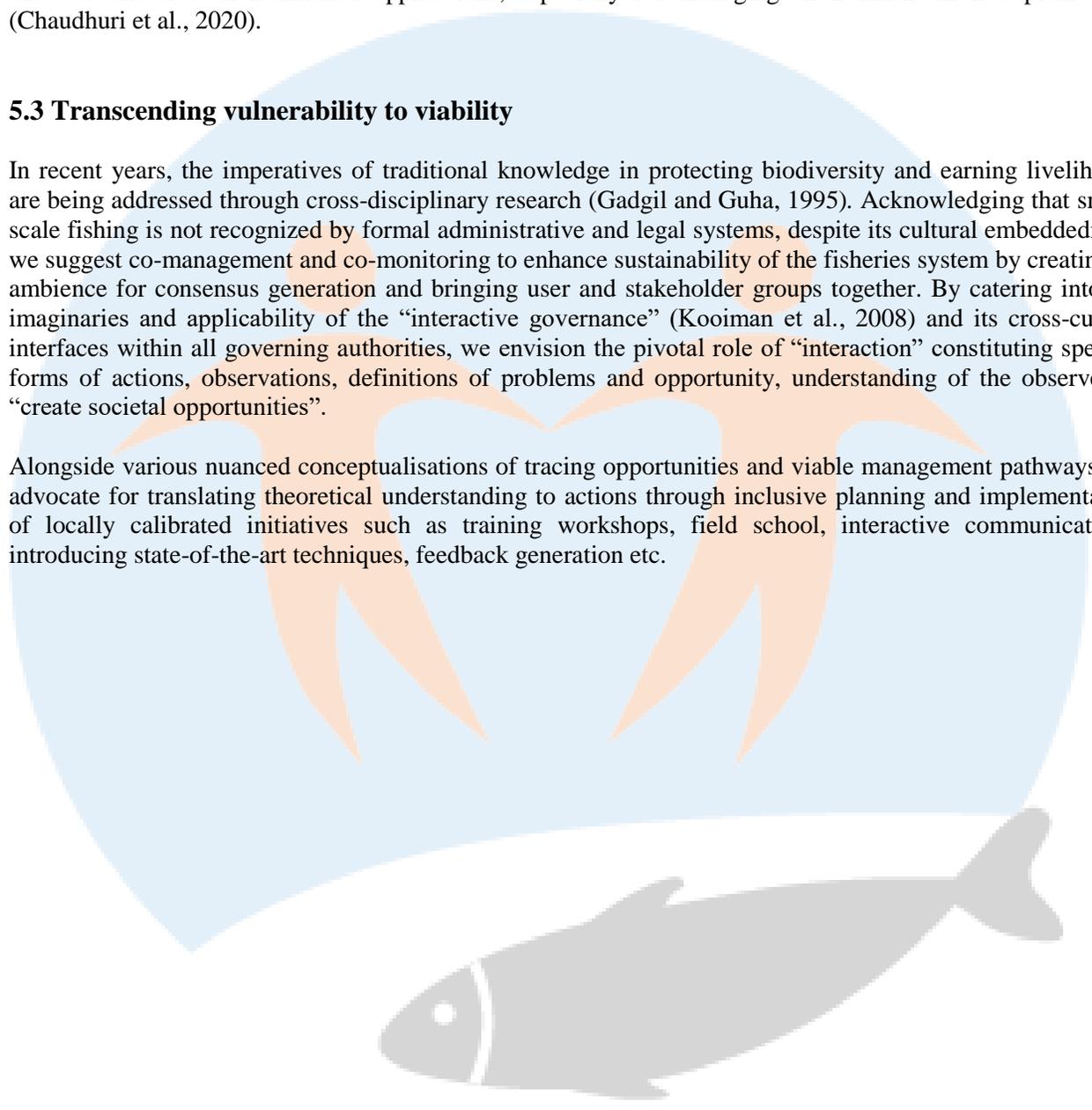
The management of the embankment system is vital for the protection and maintenance of inland freshwater fisheries and human habitation in the ISD. The responsibility for maintaining the embankment systems of the ISD was passed on to the Drainage Wing of the Irrigation Department, Government of West Bengal. This department has considerable experience in riverine flood embankment management but there is a lack of

expertise in the design, construction and maintenance of embankments in the very specific and different conditions of a macro-tidal regime like the ISD. Current understanding of how the embankment system should be managed is somewhat unclear at the policy level and debated at the technical level. According to some experts, planting mangroves on the artificially built sediment terraces alternated by brick blocks on the embankment slopes might occupy some amount of sediment as well as protect the banks. Additionally, geotextile as a state-of-the-art geosynthetic-reinforced structure is often considered to be one of the useful and cost-effective environmental applications, especially for managing environment in floodplain areas (Chaudhuri et al., 2020).

### **5.3 Transcending vulnerability to viability**

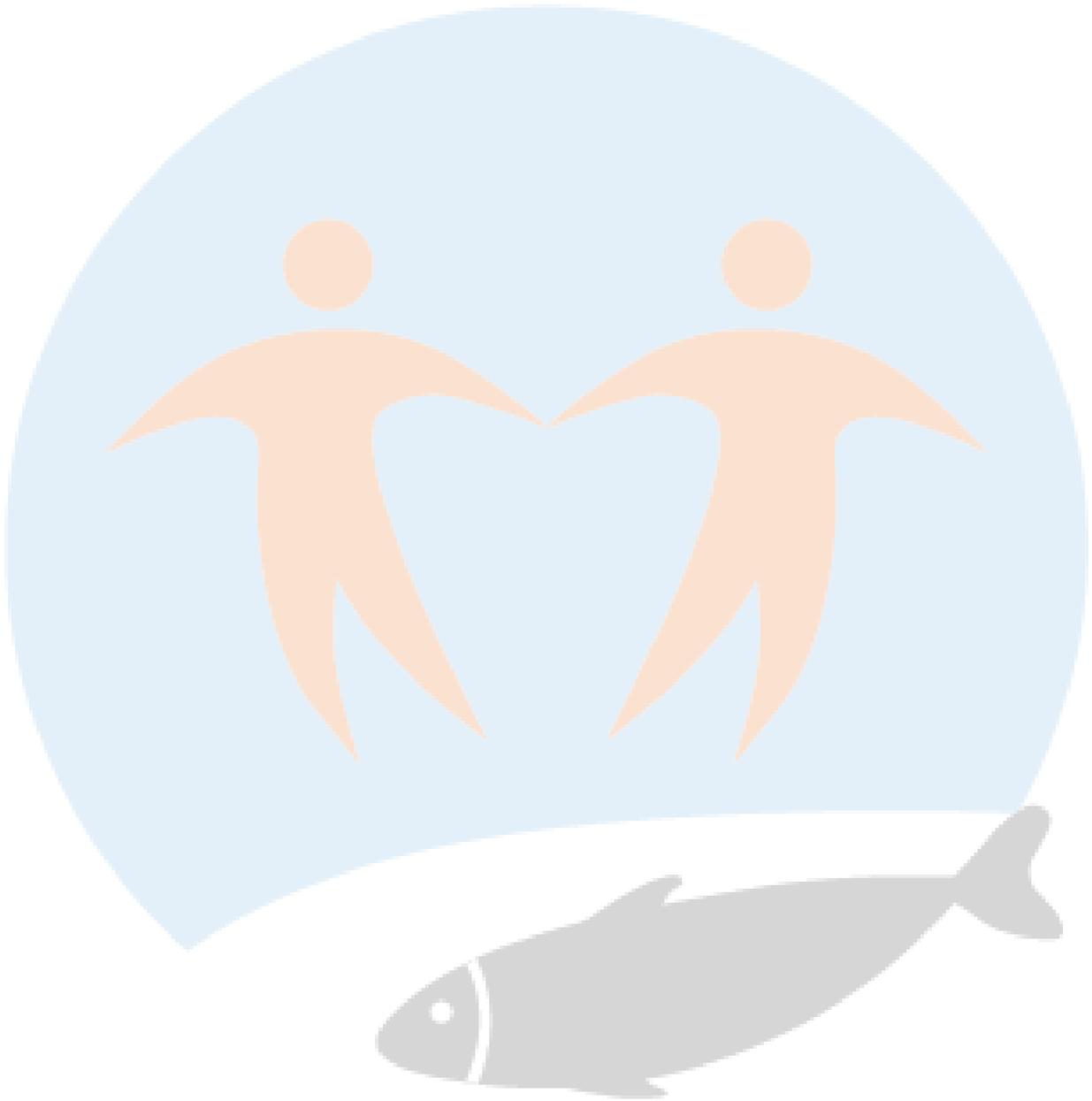
In recent years, the imperatives of traditional knowledge in protecting biodiversity and earning livelihoods are being addressed through cross-disciplinary research (Gadgil and Guha, 1995). Acknowledging that small-scale fishing is not recognized by formal administrative and legal systems, despite its cultural embeddedness, we suggest co-management and co-monitoring to enhance sustainability of the fisheries system by creating an ambience for consensus generation and bringing user and stakeholder groups together. By catering into the imaginaries and applicability of the “interactive governance” (Kooiman et al., 2008) and its cross-cutting interfaces within all governing authorities, we envision the pivotal role of “interaction” constituting specific forms of actions, observations, definitions of problems and opportunity, understanding of the observer to “create societal opportunities”.

Alongside various nuanced conceptualisations of tracing opportunities and viable management pathways, we advocate for translating theoretical understanding to actions through inclusive planning and implementation of locally calibrated initiatives such as training workshops, field school, interactive communications, introducing state-of-the-art techniques, feedback generation etc.



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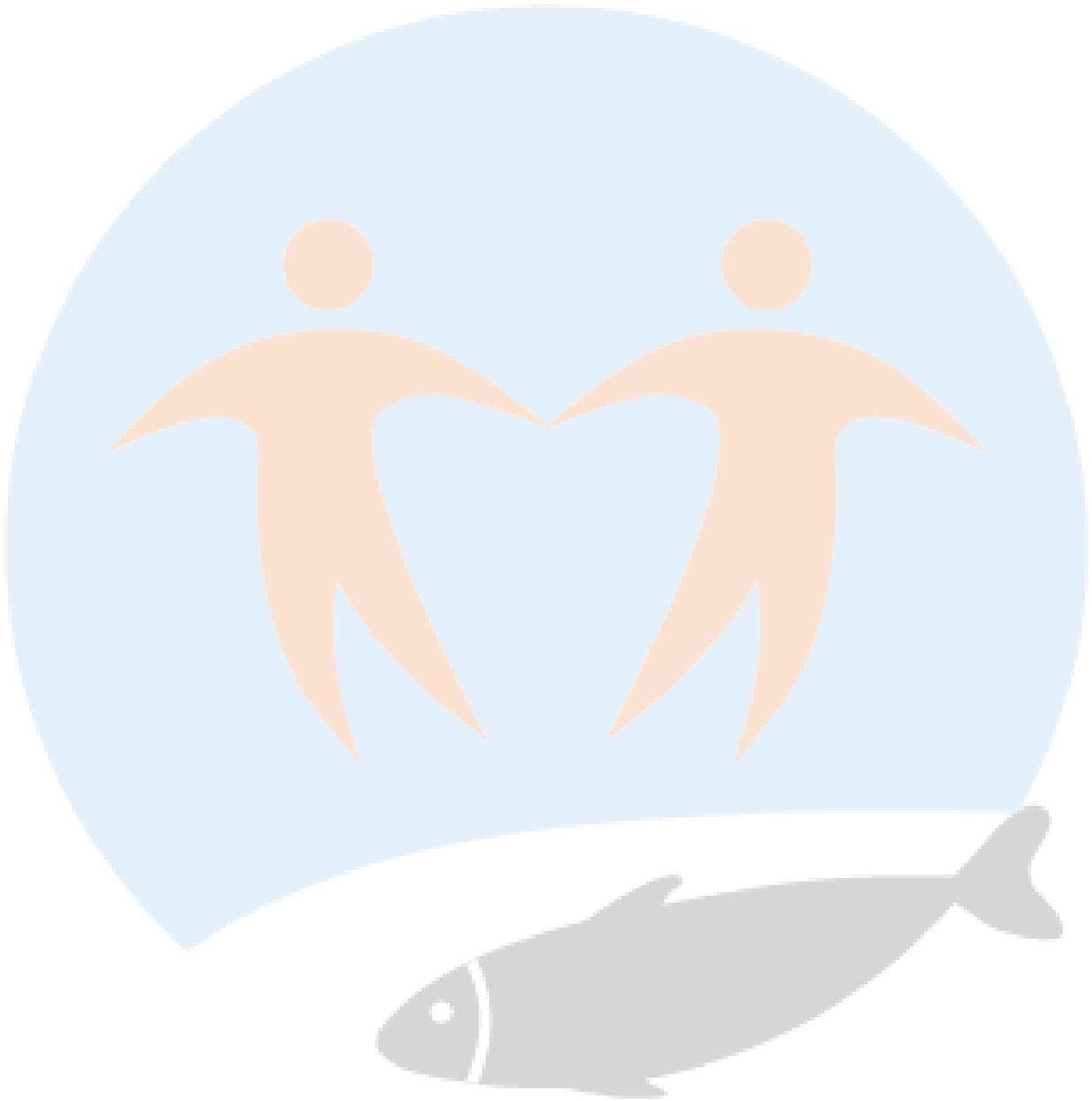


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## Vulnerability to Viability (V2V) Global Partnership

The Vulnerability to Viability (V2V) project is a transdisciplinary global partnership and knowledge network. Our aim is to support the transition of small-scale fisheries (SSF) from vulnerability to viability in Africa and Asia. Vulnerability is understood as a function of exposure, sensitivity and the capacity to respond to diverse drivers of change. We use the term viability not just in an its economic sense but also to include its social, political, and ecological dimensions.

The V2V partnership brings together approximately 150 people and 70 organizations across six countries in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Thailand), six countries in Africa (Ghana, Malawi, Nigeria, Senegal, South Africa, Tanzania), Canada and globally. This unique initiative is characterized by diverse cultural and disciplinary perspectives, extensive capacity building and graduate student training activities, and grounded case studies from two regions of the world to show how and when SSF communities can proactively respond to challenges and creatively engage in solutions that build their viability. Further information on the V2V Partnership is available here: [www.v2vglobalpartnership.org](http://www.v2vglobalpartnership.org).

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**VULNERABILITY TO VIABILITY  
GLOBAL PARTNERSHIP**

**V2V WORKING PAPER SERIES**