International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133; Print ISSN: 2664-7125; Impact Factor: RJIF 5.28
Received: 20-08-2020; Accepted: 05-09-2020; ; Published: 21-09-2020
Volume 2; Issue 3; 2020; Page No. 300-306

Enhancing livelihood of rural tribal of Sagar Island, Sundarbans through fisheries management in derelict open waters

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Abstract

The Sagar Island, situated at the mouth of Hoogly River and known as Ganga Sagar, is a part of Indian Sundarbans and rich in rivulets, creeks and mangrove swamps. The low-lying Sagar Island is cyclone prone but inhibited by many settlements flanking the coastline. Tribal population particularly, Santhal and Munda clans are settled in some pockets of Sagar Island. Poverty, illiteracy and financial exclusion made the tribal community vulnerable to economic shock. An attempt was made to improve the livelihoods of the rural poor through improved fish culture practices in derelict water bodies in Khan Saheber Abad village of Sagar Islands. Fish seed, feed, fertilizers, nets etc. were distributed to fifteen numbers of households to encourage them for fish culture in the derelict waters in the village. After a culture period of eleven months, a total of 1,057 kg fish was harvested from an area of 1.017 ha of derelict water bodies. Fish species named *Scatophagus argus*, *Liza parsia, Liza tade*, *Rhinomugil corsula*, *Mystus gulio* were cultured in brackish water while, fresh waters were stocked *by Catla catla*, *Labeo rohita, Cirrhimus mrigala*, *Labeo bata*, *Puntius sarana and* small indigenous fish *viz.*, *Amblypharyngodon mola*, *Puntius ticto and Salmostomo bacaila* for continuous availability of fishes for nutritional security of the poor villagers. Cost benefit ratio1.39 was achieved which show that utilization of derelict waters could be an alternative livelihood for the rural tribal's of Sagar Island.

Keywords: capacity building, derelict water, tribal community, Sagar Island

Introduction

Indian Sundarbans, a world Heritage is located at the mouth of Bay of Bengal. It is a unique deltaic system multifaceted network of tidal waterways has separated the islands from the mainland and support 4.43 million strong population. Freshwater resource is limited and of great concern in the Sundarbans though it is privileged to receive a huge amount of precipitation during the monsoon months (Hazra *et al.*, 2015) [7] by numerous creeks and rivulets. Sagar Island, widely known as Ganga Sagar is situated at the mouth of the river Hooghly and comes under the estuarine ecosystem. The deltaic Sagar Island, a part of Indian Sundarbans is especially important due to its isolation, geographical and administrative location, formation, legends, myths, history of settlement, environment etc. It is a part of Ganga –Brahmaputra Delta which was formed by deposition and this island is prone to various environmental hazards like erosion cyclones, tidal surges, floods etc.

Socio-economic upliftment of the resource poor tribals is a real challenge in that island. The economy of Sagar Island is completely dependent on rain fed agriculture, estuarine fisheries and to some extent tourism. The land less and backward community people, especially the women of these community use to catch fishes from the creeks and waters channels to earn their livelihoods. After extreme cyclonic storm '*Aila'* in 2009, the availability of fishes has been reduced considerably by 60-70% in Sundarbans as reported by Sinha and Das (2014) [7]. Towards reducing vulnerability and increasing resilience in tribal communities, identification and provision of appropriate alternative livelihood options are thus important steps.

However, illiteracy, poor financial status, stagnant or declining population identified for the vulnerable situation of the tribal communities living at Sagar Island (Sinha *et al.*, 2017) [9]. The total population of the Sagar Islands was 1, 85,644 covering 31,461 families spread over 43 mouzas in 2011. The scheduled caste population comprising 27.8 per cent of the total population of which 0.4 per cent was only scheduled tribe and around 23 per cent was Muslim population. Derelict water bodies in the Sagar Island could be an important source to boost the fish production for meeting up the future fish demand of the country (Dash *et al.*, 2008) [5]. There is a vast scope for expanding some of the activities like rain water harvesting and fishery. But lack of awareness, and poor extension contacts led the people of those vulnerable groups to live in abject poverty. There is immense scope of inland fisheries to support the livelihoods of the backward community people (Roy *et al*., 2016) [9]. The need of suitable alternative livelihood options is thus important steps to reduce vulnerability and increase resilience in tribal communities. The purpose of this intervention was to provide the livelihoods to the poorest tribal community inhabiting Sagar Island, including the community whose livelihoods was affected or threatened by sea erosion and tidal floods. The paper also addressed strategies to build up significant resilience against potential impacts of sea level rise, flooding, erosion and accretion affected the life and livelihoods of the community in the island. The methods and tools were also discussed to build up the current social capital to adapt livelihood activities that result in increasing the income levels of the targeted people.

Methodology

Study area

The intervention was conducted in the 'Khansaheb Abad' village in Sagar Island where the ICAR-CIFRI made attempt to enhance the livelihood by scientifically exploiting the derelict water bodies. The total households of the village is 1,212 (year?) and the village is covering geographical area of 703.38 ha (Table 1). The intervention was undertaken during August 2015 to June 2017 to utilize the natural derelict water resources in two phases. A pre-tested questionnaire was designed to collect the primary data to assess the impact of this intervention. Secondary data were collected from different sources including 'Gram Panchayat' and 'Krishnagar Youth Cultural Society'. The map of the study area is shown in Fig. 1.

Lack of awareness in the tribal community with regard to good management practices (GMP) including culture technologies of judicious and eco-friendly value was documented. Emphasis was given on identification of location-specific culture systems, environment impact assessment, maintenance of high quality feed and seed, use of bio fertilizers, adoption of organic farming, stock entry control and stocking with desired species for supporting the livelihood of the tribal community. Hence, study was conducted on natural resource identification and inventorization, stocking of small indigenous fish (SIF) of self-recruiting nature with carps to get continuous availability of nutritive fish for the poor family, on farm prepared low cost feed, azolla culture, application of vermi-compost, biofloc and periphyton to get a better yield and proper record keeping in the intervention.

Awareness and capacity building programme

A series of skill development and Mass awareness programmes were conducted to sensitize the group on "Ecology and fish Diversity Conservation". The need based capacity building programme and input distribution (seed, feed, lime, nets, and water pumps) played major role to attract the villagers. Focus was on harvesting of small quantity of small fishes at regular interval for household consumption, especially for nutrition of women and young children and sale of carps for household income.

Innovative fish culture of carps with indigenous fish

Earth work for strengthening embankment, seed stocking, feeding and partial harvesting was the activities during the study. A total of fifteen household water bodies were selected in varying sizes for this study in Sagar Island (Table 2 and 3). Derelict water bodies were developed by pre-management steps such as dewatering, bottom soil removal, liming, manuring and de-weeding to ensure suitable environment in the water bodies, just before to release the fish seeds. Pre-stocking management of selected water bodies were done for allowing to grow the natural fish food organisms in sufficient quantity and, also maintained conducive water quality parameters at the possible level.

Water quality parameters

The water samples (0.5 m depth) from all the selected water bodies were collected in pre-cleaned acid washed polyethylene bottles of one liter capacity. Physico-chemical parameters like temperature, pH, transparency were measured in situ using thermometer, digital pH meter (HANNA instruments) and Secchi disc (Strickland and Parsons, 1972) respectively. Dissolved oxygen (DO), salinity and total alkalinity were also determined in situ by standard titrimetric methods (APHA, 2012).

Socio-economic data collection

Socio-economic data of the tribal fishers were collected through personal interview method by using semi-structured interview schedule.

Results

Two phase intervention on utilization of derelict water bodies were done. In Phase I, five derelict water bodies of assorted size (0.06 to 0.11 ha) of total area 0.4 ha, and in Phase II, ten derelict water bodies of total area 0.607 ha (0.027 to 0.195 ha) were selected for livelihood improvement using improved governance pattern and co-management participatory mode. The village 'Khan Saheber Abad' is primarily inhabited by tribal population, located in Sagar Island of South 24 Parganas district, West Bengal. There are tribal people belonging to '*Santhal'* community, having low level of literacy, declining or stagnant population, economically backward but they are very close to the nature. The villagers were dependent on their daily earning as a labour. Therefore, they were facing hardship for their daily needs during the bad weather or their ill health. The fishery was not the primary livelihood options for the villagers. However, for their family consumption were catching fish from the natural low-lying water bodies. It was observed that most of the households were having one or two ponds. But, theses ponds were silted and water holding capacity of such ponds was decreased. Most of the ponds were even getting dried up during summer. The island received very good precipitation during monsoon season, but major quantum of rain-fall was lost as surface run-off to the sea. This run-off water could be arrested by deepening the ponds and canals to conserve water to mitigate in large extent. Water conservation was identified as a tool to minimize the run-off of rain fall. The conserved rain water in the domestic ponds could be used for indigenous fish culture also. The cluster organizations as well as its associated local youth clubs could develop expertise in fish culture through skilled training, mobilization of resources, technologies and management learning to implement the multifarious activities of project with regular technical support and guidance, whenever required. The demographic pattern of the village is shown in Table 1.

Physico-chemical properties of soil and water

The Sundarbans delta alluvium is formed out of the silt brought down from the Himalayas by the river Ganges, Brahmaputra and their tributaries. Clay-loam predominating with or without muck soils occurred in the swamps and alluvial lakes. Alluvial soils along with coast and especially in the Sundarbans area showed white efflorescence of sodium chloride, as they were impregnated with this and other salts by tidal estuaries. Soils of this area were locally called '*Nonamati'*, a wet saline soil, which could not dry up enough to permit cultivation. It becomes possible only when the rains are late and allows it to dry up sufficiently for cultivation. Soil pH was alkaline in nature, and it varied from 7.07 to 7.43 throughout the study period. High range of specific conductivity (7.21 to 7.34 mS cm^{-1}) and organic carbon (0.60 to 1.58%) were recorded. This was indicative of probable role of litterfall from the planted trees in the bank of the water bodies. Available nitrogen estimated within the range between3.23 to

5.23 µg g^{-1}, hinted rich nutrients, suitable for fish culture. The mean percentage fraction soil was recorded *viz.*, clay (6.66%), silt (35%) and sand (57%).

The water remained alkaline throughout the study period within the range between 7.8 - 8.3. Surface water temperature varied significantly from post-monsoon to pre-monsoon season and it ranged from 21.1 to 31.4 ^{0}C. Gradual increase in salinity was observed from post-monsoon to pre-monsoon. However, the salinity was found to be low within the range from 0.36 to 4.16 ppt across the study sites. Moderate concentrations of dissolved oxygen were recorded across the water bodies (4.8 to 6.2 mgl^{-1}). Turbidity was estimated from 26.9-77.5 NTU with its maximum during monsoon and lowest in post-monsoon. Total alkalinity also showed similar trend and found to have ranged from 54 to134 mgl^{-1}.

First phase

Five derelict water bodies available (Table 2) in the village were selected (in which year?) to rear indigenous fish species. Three fresh water bodies, with a total water area of 0.41 ha were identified to stock the fish seeds of *Clarias batrachus* (magur), *Puntius sophore* (punti), *Amblypharyngodon mola* (Mola), *Anabas testudineus* (koi), *Mystus vittatus* (tengra), *Ompok pabda* (pabda), *C. mrigala, C. catla, L. rohita* and *L bata* as per the availability without taking into any ratio and proportion. Similarly, in two brackish water bodies covering total water area of 0.12 hectare, seeds of *Liza parsia, (*Parse*), Scatophagus argus* (Domra), *Sillago sihama* (tul), *Velamugil cunnesius* (bhangar), *Pseudapocryptes lanceolatus* (guley) were stocked (Table 1). Water quality was monitored regularly with active participation of tribal community. Inflow and outflow of water were maintained through sluice gate and bamboo pole for the control supply of natural food organisms. In addition, feed was prepared with locally available ingredients like mustard oil cake, rice bran and dry fish was given after a certain period of time. A total of 100 kg of lime and 100 kg of fish feed were supplied to tribal fishers for supplementary liming and feeding in to the cultured ponds. After two and a half months of rearing period the fishes were partially harvested. Reasonable increase in growth of fishes was observed. A total of 321 kg of fish were partially harvested generating a revenue of Rs.62, 270 /-. About 80% of the harvest was sold and 20% has been distributed among the tribal farmers to release the seeds in their own ponds as well as in canals adjoining to the village, so that these fish species can be established in the local.

Second phase

After completion of the first phase of fish culture, next phase was repeated by selecting ten numbers of water bodies in the village as mentioned in Table 3.

Socio-economic profile of the group

The study revealed that majority of the members of target group was casual laborers from medium and small income groups respectively. The respondents are either landless or belong to small farmers' group. Most of them are agricultural laborers or wage laborers (79%). Some of the tribal respondents were involved in construction works or work in mangrove plantation by the side of Mooriganga River. Only 15% of the tribal respondents engage in prawn/shrimp seed collection or with fisheries. About 68% of the tribal respondents' average earning ranges from 32,430-Rs.44, 590 in a year (Table 4).

The impact assessment study revealed that the effect of the intervention is quite visible in that area. The attitude of the villagers towards fish farming in derelict waters has been changed and now they are keener to stock fish in the water bodies on time. Due to sensitization, mass awareness and capacity building programmes respondents become aware about improved fish culture practices in the derelict waters. And Panchayat Members are now interested to adopt fisheries in available water bodies lying fallow. After adopting the technology and follow better management practices, the productivity of the derelict waters have increased considerably. Our results revealed that a total water area of 1.017 ha, a production of 1,057 kg fish was achieved without semi-intensive culture management for fish production from the village derelict water bodies with having B: C ratio 1.39 (Table 5). Hence, it signifies the productivity enhancement also act as 'safety net' for the rural poor.

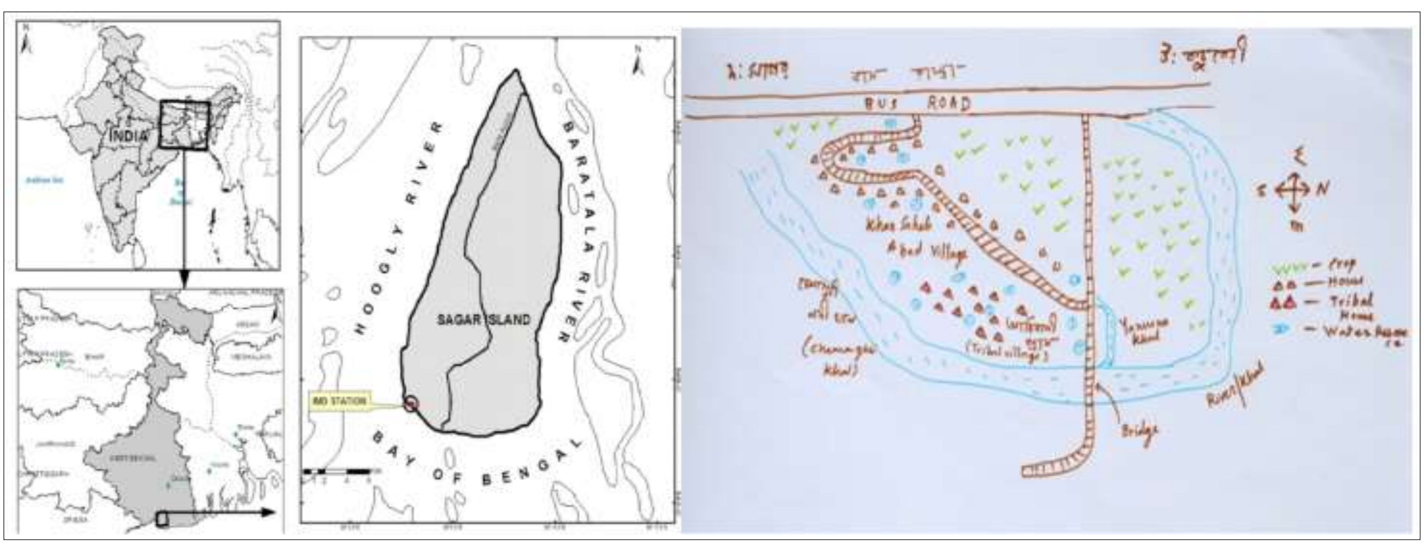

Fig 1: Map shows the study area

Table 1: Socio-demographic details of the Khansaheb Abad village

Block/Tehsil	**Sagar**
District	South 24 Parganas
State	West Bengal Situated 4.8 km away from sub-district headquarter, Rudranagar and 99.6 km away from district headquarter Alipore
Total geographical area of village	703.38 ha
Total households (year?)	1,212
Total population (year?)	6082
Male population	3118
Female population	2964
SC Population	230
Connectivity type	Public bus service: 5-10 km distance
Nearest Town	Diamond Harbour (68 km)

Table 2: List of derelict water bodies, stocking materials and the expenditure incurred (1st phase)

Sl No.	**Water Type**	**Area of water body**	**Stocking details**		**Phase harvest**	
			Fish spp	**Seed cost (Rs)**	**Weight (kg)**	**Return(Rs)**
1	FW	0.11 ha	*Catla catla* (300 pcs.), *Labeo rohita* (200 pcs), *Cirrhimus mrigala* (200 pcs), *Labeo bata* (200 pcs), *Puntius sarana (400 pcs) A. Mola (400 pc) Clarias magur (125 pc)*	5025/-	110 @ Rs. 165/-	18,150/-
2	FW	0.09 ha	*Catla catla* (250 pcs), *Labeo rohita* (200 pcs), *Cirrhimus mrigala* (200 pcs), *Labeo bata* (125 pcs), *Puntius sarana* (300pcs) *Ompok pabda* (120 pc) *Mystus vittatus* (175 pc)	4,500/-	87 @ Rs. 160/-	13,920/-
3	FW	0.09 hc	*Catla catla* (300 pcs.), *Labeo rohita* (300 pcs), *Cirrhimus mrigala* (175 pcs), *Puntius sarana* (250 pcs) *Ompok pabda* (170 pc) *A. Mola* (300 pc) *M. vittatus* (150 pc)	4,100/-	85 @ Rs. 160/-	13,600/-
4	BW	0.06 ha	*Scatophagus argus* (100 pcs.) *Liza parsia* (450 pcs) *Velamugil cunnesius* (240 pcs) *Mystus gulio* (150 pcs) *Sillago sihama* (125 pcs)	3,100/-	21@ Rs. 300/-	6,300/-
5	BW	0.06 ha	*Scatophagus argus* (50 pcs.) *Liza parsia (600 pcs), Velamugil cunnesius* (250 pcs), *Mystus gulio* (250 pcs)	2,900/-	18 @ Rs. 300/-	5,400/-
Total area 0.41 ha				19625/-	321	57,370/-

Note: FW: fresh water, BW: Brackish water

Table 3: List of derelict water bodies, stocking materials and the expenditure incurred (2nd phase)

Sl No.	**Water Type**	**Area of water body (in ha)**	**Stocking details**		**Phase harvest**	
			Fish spp	**Seed cost (Rs)**	**Weight (kg)**	**Cost (Rs)**
1	BW	0.097	*Scatophagus argus* (55 pcs.), *Liza parsia* (500 pcs), *Liza tade* (200pcs), *Rhinomugil corsula* (140 pcs), *Mystu sgulio* (165 pcs)	2705	28 @300/-	8,400
2	BW	0.027	*Liza parsia* (250 pcs), *Liza tade* (100 pcs), *Rhinomugil corsula* (100 pcs), *Mystus gulio* (75 pcs)	1425	11.3 @300/-	3,390
3	FW	0.195	*Catla catla* (300 pcs.), *Labeo rohita* (300 pcs), *Cirrhimus mrigala* (125 pcs), Labeobata (450 pcs), *Puntiussarana* (350 pcs)	4025	145 @150/-	21,850
4	FW	0.052	*Catla catla* (275 pcs), *Labeo rohita* (275 pcs), *Cirrhimus mrigala* (100 pcs), *Labeo bata* (400 pcs), *Puntius sarana* (300 pcs)	3600	95 @152/-	14,450
5	FW	0.038	*Labeo rohita* (100 pcs), *Cirrhimus mrigala* (75 pcs), *Labeo bata* (300 pcs) *Puntius sarana* (275 pcs)	1693	145 @150/-	21,850
6	FW	0.055	*Catla catla* (200 pcs), *Labeo rohita* (200 pcs), *Cirrhimus mrigala* (125 pcs), *Labeo bata* (275 pcs), *Puntius sarana* (125 pcs)	2743	85 @151/-	12,850
7	FW	0.075	*Catla catla* (250 pcs), *Labeo rohita* (250 pcs), *Cirrhimus mrigala* (125 pcs), *Labeo bata* (275 pcs), *Puntius sarana* (255 pcs)	3175	95 @151/-	14,350
8	BW	0.061	*Liza parsia* (450pcs), *Liza tade* (150pcs), *Rhinomugil corsula* (150pcs), *Mystus gulio* (100 pcs)	2295	16 @300/-	4,800
9	BW	0.029	*Liza parsia* (300 pcs), *Liza tade* (150 pcs), *Rhinomugil corsula* (110 pcs), *Mystusgulio* (90 pcs)	1875	16 @300	4,800
10	FW	0.033	*Catla catla* (75 pcs), *Labeo rohita* (75 pcs), *Cirrhimus mrigala* (50 pcs), *Labeo bata* (200 pcs), *Puntiu ssarana* (125 pcs)	1264	100 @152/-	15,200
Total area 0.607				24800	736.3	1,21,940

Table 4: Socio-economic profile of the beneficiaries

No	Characteristics	Categories	Frequency (%)
1.	Age	Young (<34)	18
		Middle-Aged (34-54)	58
		Old (> 54)	24
2.	Education	Illiterate	27
		Can read only	21
		Primary education	41
		Secondary Education	11
3.	Occupation (Main)	Agriculture	6
		Fishery	15
		Landless Labour	79
4.	Family Type	Nuclear	28
		Joint	72
	Family Size	Small (up to 5 members)	31
		Large (>5 members)	69
5.	Land- holding including water area and homestead	Small (<1 acres)	92
		Medium (1-2 acres)	6
		Large (>2 acres)	2
7.	Family Income(in Rupees per Annum)	Low Income(<Rs.32,430)	15
		Medium Income(Rs.32,430-Rs.44,590)	68
		High Income(>Rs.44,590)	17

Table 5: Economic analysis of fish production in derelict water bodies of Sagar

Sr. No.	Items	For the full production period	Per ha/year
	Total area (ha)	1.017	
	Production period	1 year	
A.	Fixed cost		
A1.	Pond reclamation/major repairs		
A2.	Pump	4435	4435
A3.	Net	5490	5490
	Total	9925	9925
A4.	Interest on fixed capital	695	683
A5.	Depreciation	2274	2235
B.	Variable cost		
B1.	Lease amount of ponds	7000	6883
B2.	Cleaning and maintenance of ponds	20000	19666
B3.	Seed	44425	43682
B4.	Fertilizer, Lime	10700	10521
B	Total Variable cost	82125	80752
C.	Labor cost	40000	39331
D.	Misc cost (including interest on working capital)	4106	4038
E.	Total cost (A4+A5+B+C+D)	129200	127040
F.	Fish production (kg) (including self-consumption)	1057	987.85
G.	Average market price (Rs./kg)	@Rs 170/-	@Rs 170/-
H.	Gross return (Rs.)	179310	176313
I.	Net return (Rs.)	50110	49273
J.	B:C ratio	1.39	1.36

(The figures are rounded off to their nearest whole number).

Discussions

Derelict water bodies were found immensely useful and one of the important resources to boost up fish production for meeting the future demands of the country (Jayasankar, 2018) [6]. Fisheries development in these will enhance fish production immensely and now of fisheries enhancement in these water bodies is one of the focus areas of the government for increasing fish production (DADF, 2017). Sagar Island was identified as one of the highly clean pieces of land, despite its clayey soil (Chand *et al*., 2012) [3]. Less or no use of chemicals in culturing fish in these water bodies can graduate the island towards a bio-island. However, lack of proper awareness, technical know-how, linkages, input availability is major constraints for fisheries development in the derelict waters of Sagar Island.

A range of adaptive strategies need to be considered by minimum capital investment and application of simple technology to mitigate the climatic change effects on coastal agricultural production and productivity. Irrigation system was not well developed in the study area. Most of the canals and creeks were full of brackish or saline water as their scope of utility is less for irrigation. Ponds and excavated canals are only variable source of irrigation in this island, which cover 7.51% and 14.25% of total cultivable upland and midland respectively. Mondal and Mandal (2013) observed lowest EC value (0.43-0.91 dsm^{-1}) for pond water followed by internal canal water (EC 12.24 to 19.36 dsm^{-1}) and river water (EC 16.09 to 21.96 dsm^{-1}). It was observed that the rain water was the major freshwater source in Sundarbans which receive rain mainly from South-West monsoon. It generally starts in the middle of June and withdraws during the second week of October. The average annual rainfall is 1625 mm but this may increase to 2000 mm in the high rainfall year and drop to 1300 mm in lowest rainfall year. The people at Sagar Block predominantly depended on monsoon for irrigation. Annual rainfall was considered to be adequate for harvesting a successful crop during monsoon season (Gayen and Zaman, 2013). The stored rain water in their own ponds/ditches or from artificial *khals* (canals) and tanks were used later. The Tribal Sub-Plan Project, aimed to diversify livelihood options especially for resource-poor tribal communities in the Khansaheb abad village of Sagar Island, Sundarbans. The irrigation system in the area was based on the existing ponds and canals. Most households own ponds to store substantial amount of rainwater during monsoon season. Siltation was a major cause to reduce the storage capacity of these water bodies. In this context, rainwater conservation by the existing ponds and canals could be identified as an alternate option to develop the agricultural growth and fisheries. Storage capacity of theses existing water bodies could be increased through renovation/ rejuvenation. Fish production technologies were introduced to a total of 120 resource-poor tribal households. Baseline and end-line surveys were applied to assess the changes in their livelihoods following intervention. Household incomes of beneficiaries significantly rose which was attributed to the increased share of fish culture and related activities from 15% in 2013 to nearly 30% in 2017 in terms of annual household incomes. From the derelict waters people are getting high return which has cost benefit ratio of 1:1.39, so, people are interested to adopt it as their alternative source of income which will ultimately help them in enhancing their socio-economic status. The participatory planning, implementation and follow-up processes form the fulcrum of the study. It is observed that the concept of polyculture practice in derelict water of the tribal village of Sagar Island has the potential for both poverty alleviation and nutritional security programme. Dash *et al*. (2008) [5] also observed the boost of fish production from the derelict water bodies in rural areas and drawn the inferences that such water bodies can also provide much needed impetus to the growth and diversification of rural economy. These water bodies were found productive and presence of sufficient nutrients, suitable pH, phytoplankton, zooplankton, plants, and fishes were the indication of healthy and balanced ecosystem. Parveen *et al.* (2009) [8] also concluded that though these water bodies called derelict but could be useful water resource for fish culture after adopting proper pond management strategies. The present study could also derive that the derelict water bodies need to be exploited for both running water fish culture as well as enclosure culture to enhance the fish production.

Conclusion
The interventions under the Tribal Sub-Plan Project implemented during 2015–17 was successful in achieving a good impact and enhanced the livelihood of the resource-poor tribal communities in the Khansaheb abad village of Sagar Island, Sundarbans was. A good return was achieved from the derelict waters with a cost benefit ratio of 1.39. The present study concluded that these water bodies are suitable for fish production. Observing the success of the study, people of nearby areas are interested to adopt it as their alternative source of income which will ultimately help them in enhancing their socio-economic status. The intervention also shows that the participatory planning, implementation and follow-up processes may help in adoption process faster. It is observed that the concept of polyculture practice in derelict water of the tribal village of Sagar Island has the potential for both poverty alleviation and nutritional security programme. Derelict waters in millions of hectares, lying unutilized, in the country and such untapped water bodies with potential for aquaculture production may be reclaimed and made suitable for fish culture by adopting more or less similar procedures.

Acknowledgements
Authors are sincerely expressing their gratitude to the tribal community of Sagar Island, Sundarbans (W.B.). We are privileged to extend our thanks to Indian Council of Agricultural Research, New Delhi to provide fund under Tribal Sub Plan (TSP). Technical and supporting helps are also acknowledged.

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