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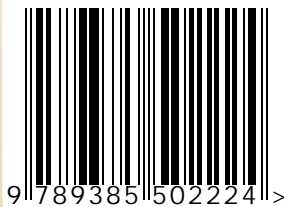
- ❖ Bitan Mondal, Assistant Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.
- ❖ Debashis Sarkar, Associate Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.
- ❖ Siddhartha Dev Mukhopadhyay, Associate Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.
- ❖ Souvik Ghosh, Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.
- ❖ Bidhan Chandra Roy, Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.
- ❖ Sarthak Chowdhury, Professor, Institute of Agriculture, Visva-Bharati, Sriniketan-731236, West Bengal.



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Challenges and Opportunities

Family Farming

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# Family Farming Challenges and Opportunities

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❖ Bitan Mondal ❖ Debashis Sarkar ❖ Siddhartha Dev Mukhopadhyay  
❖ Souvik Ghosh ❖ Bidhan Chandra Roy ❖ Sarthak Chowdhury

# Family Farming: Challenges and Opportunities

Bitan Mondal  
Debashis Sarkar  
Siddhartha Dev Mukhopadhyay  
Souvik Ghosh  
Bidhan Chandra Roy  
Sarthak Chowdhury

© Author

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# Conservation of Small Indigenous Fish (SIF): A roadmap to ensure food and nutritional security in coastal Sunderbans

**Aparna Roy, R. K. Manna, Archana Sinha , S. K. Das , Sucheta Majumder,  
D.K. Biswas, C. N. Mukherjee, Arunava Mitra and Abhijita Sengupta**

*Central Inland Fisheries Research Institute, Barrackpore, Kolkata- 700120*  
**Email:** [aparnandrister@gmail.com](mailto:aparnandrister@gmail.com)

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Indian Sunderban is part of the world's largest delta formed by deposition of sediments of three grand rivers, the Ganges, Brahmaputra and Meghna. The Sundarban region in India is unique for a combination of estuarine and mangrove forest ecosystems dotted with fresh water bodies. It is sandwiched between shallow marine ecosystem in the south and agricultural landscape in the north (Basu, 2013). Sundarban region is composed of 102 islands of which 48 are still under the cover of forest and rest of the 54 have already been deforested with subsequent conversion to arable land studded with human settlements, orchards, tanks, creeks, rivers, canals and water channels. Illiteracy coupled with limited access to support services, social exclusion have made the condition multifaceted for the natives of Sunderbans and securing the livelihood by ending up their hunger and poverty of this vulnerable community is a challenge. Sunderban is a bio-diversity hotspot as it filled with luxuriant vegetation, islands of salt-tolerant mangrove forests, wide range of flora and fauna, including a total of 172 species of fish (Jhingran, 1977), 20 species of prawn and 44 species of crabs and numerous other species (estimated to be 400) that are known to use mangrove swamps as nursery grounds (Lowe-McConnell, 1987). But, due to human interventions and many other reasons like climatic hazards, the mangroves are heavily destructed which leads to near extinction of many fish species. After extreme cyclonic storm Aila during 2009, the availability of Small Indigenous Fishes (SIF) has been drastically reduced in Sunderban (particularly in lower Sunderbans) due to ingress of salt water as reported by 60-70% of the people of Sunderban (Sinha *et. al.*, 2014). Impact of excessive use of chemical fertilizers, pesticides and insecticides in the paddy and vegetable cultivation in the last two-three decades also causing the disappearance of many fresh water small fishes in Sunderbans as reported by Joygopalpur Gram Vikash Kendra in 2010.

Food Security is the “adequate access to food for all people at all times for an active, healthy life” (Gross *et al.*, 2010). Food security exists when all people at all times have physical and economic access to



sufficient, safe drinking water and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Dimensions of food and nutritional security are:

- Availability
- Access
- Utilization
- Stability

Inadequate food and poor health are two direct factors contributing to under nutrition/ malnutrition. But, sometimes the people receive sufficient food to meet their energy requirements, but that food cannot provide nutrition to the people. So, availability of quality food; access to food (due to proper income, purchasing power, own production, distribution), utilization of safe nutritious food (embody the food and care-related aspects of good nutrition) and stability (can be hampered by political, economical and natural factors) are the four important dimensions of food and nutritional security.

Most of the SIFs are having high nutritional value (Give reference). The people of Sunderbans also depend on SIFs for their livelihood. The present study is an attempt to find out the steps and importance of conservation of SIFs for ensuring food and nutritional security in Sunderban areas.

### Database and Methodology

The study was undertaken in lower part of Sunderbans covering three blocks, Kakdwip, Namkhana and Sagar of South 24-Pargana district. Data was collected from 300 fishers through semi-structured interview schedule during 2012 to 2014. Data was collected on Health, Nutritional Status, Dietary Pattern, and Living Standard of the respondents from fishermen community. Body Mass Index (BMI) is an indicator of nutritional status. The nutritional status of the women of fishermen community was surveyed with a schedule prepared for this purpose. Regarding abundance of small fishes in coastal Sunderbans, hundred people of various age groups ranging from 27 -65 years, involved in various occupations were interviewed personally to know about the status of small indigenous fishes in that zone after *Aila*. Market survey, was also conducted, in peri-urban and rural fish markets of lower Sunderban area *viz.* Ukiler bazaar (Village market), Dasmile market (Village market), Namkhana bazaar (peri urban market), Kakdwip market (peri urban market) for enquiring the abundance of small fishes. Participatory Matrix ranking was used to identify the reasons as perceived by the respondents regarding the depletion of target fish population *i.e.* SIF in that area. Considering the age and experience profiles above 40 years of 30 respondents, the process of interaction was triggered in Madangaj Area of Namkhana block. Rank Based Quotient (RBQ) was applied to re-rank the identified causes in relation to declining of SIF population. The formula followed was

$$RBQ = \frac{\sum_n f_i(n+1-i) \times 100}{Nn}$$

## Results and Discussion

Fishery comprises three components in Sunderban: the ecology and environment, the fish and the human. The human/fisherman sits with in the complex web of social, financial, ecological and administrative influence.

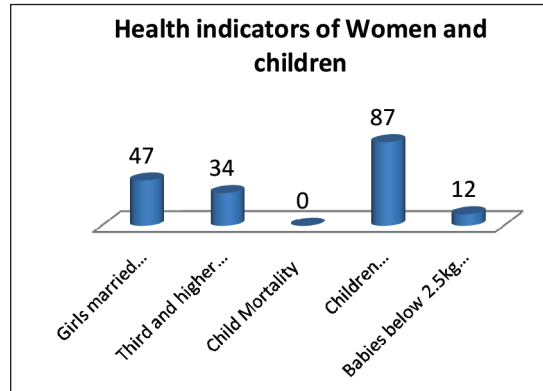


Fig. 1: Health indicators of women and children of fishermen community in lower Sunderbans (n=300)

Table 1: Meal and menu pattern of fishermen community

Time	Type of Diet	Items
6.00-6.30 AM	Tea	Tea
8.00-9.00AM	Break fast	Puffed rice and tea
1.30-2.00PM	Lunch	Rice (previous day rice, little fermented), boiled potato/fried potato, onion and chilly, small quantity of fish with tamarind or mombins (local name <i>Amra</i> ) or with other vegetables
4.30-5.00PM	Tea	Tea
7.30-8.00 PM	Dinner	Fresh rice, vegetables, half Egg (not daily)

Table 2: Frequency of food taken by the fishermen community (%)

Name of food stuffs	Daily	Thrice a week	Twice a week	Weekly	Monthly	Very Rare
Rice	100	-	-	-	-	-
Wheat	-	-	-	80	-	-
Lentil	-	85	12	3	-	-
Green gram	-	-	-	-	100	-
Black gram	-	-	34	12	23	31
Khesari dal	-	-	56	-	-	44
Green leafy veg.	82	7	6	4	-	-
Other vegetables	56	23	19	-	-	-

Roots & tubers	100	-	-	-	-	-
Fruits	-	-	-	3	7	90
Milk & its products	3	-	-	11	6	80
Fats and oils	100	-	-	-	-	-
Sugar and jaggery	100	-	-	-	-	-
Fish/egg	11	72	15	2	-	-
Fleshy foods	-	-	-	-	48	52

Health is the most important human development indicator which is crucial in determining the level of welfare of individuals and a community. The health infrastructure in Sunderban with respect to population pressure is less *i.e.* Seven Doctors/ One lakh population (as per District Human Development report, South 24 Parganas, Development & Planning Department Government of West Bengal, 2009). From the present study, it was found that members of fishermen community, specially the women involved in *meen* (prawn seed) collection suffering from various diseases like skin diseases, leucorrhoea, and psychological tensions etc due to long hours of work inside river/seawater. Moreover, 47% of girls of fishermen community are married within 18 years of age. It was reported by the respondents that 87% of the Children were completely immunized that means vaccinated with DPT-3, Polio-3, BCG, Measles. But, 12% of the children were underweight during birth as reported by the respondents.

A survey was conducted on dietary pattern or on 'meal or menu' pattern of the people of Sunderbans, fisherfolk in particular is presented in Table 1 and frequency of consumption of different food was presented in Table 2. The daily meal or menu patterns of the fishers were found to be similar to the pattern prevalent in rural Bengals among the agricultural labourers. But, it was found that most of the people of fishermen community are non-vegetarian. It was observed that fisherfolk of Sunderbans follow three meals a day pattern and had no variation in their breakfast, only puffed rice and tea is taken by them. The menu pattern is monotonous which is followed by most of the fishermen households. The staple food is rice (100%) followed by wheat occasionally. The lentil is more preferred pulse by the fishermen community as 85% reported that they take it at least thrice a week. Khesari dal (*Lathyrus*) is also included in their diet pattern as it is available in the market in low cost. Potato is taken by all the members of fishermen community regularly. But, fishes and milk or milk products are consumed occasionally by the fisherfolk. Only, 3% of the people of that community reported that they take milk / milk product regularly, as they are rearing milch animals. As, Sunderban area is enriched with natural water resources- ponds, creeks, rivers, canals and water channels. So, fish is relatively more available to them. Sometimes, fishermen/ fisher women kept some portion of their harvest for their own consumption purpose. Thus, 72% fishermen reported that they consume fish thrice a week followed by 15% twice a week and 11% reported that they consume fish daily. Fish is the main source of protein for them. But, the quantity is too small, so, desirable quantity of protein is not meeting. In Sunderbans, in fishermen's households the frequency of food consumption is translated into increased intake of staple food *i.e.* rice. Thus nutritional or appropriate diet is not available to them.

Under nutrition and malnutrition is prevalent among the women of the fisherfolk community. Based on the ICMR-NIN norm more than two-thirds of population in rural households in India was undernourished

during 2009-10 (Chand and Jumrani, 2013). Majority of the Indian rural women face nutritional deprivation since their childhood which is the major cause of malnutrition and under-nourishment of the women (Roy *et al.*, 2015). Socio-cultural values are also biased against women (Anonymous, 1997) is one of the major reason of this. In Sundarban region the gender discrimination is common (Roy *et al.*, 2013). Nutritional taboos are also very common among the women in Bengal (Basu, 2011) like:

- Consumption of papaya and pineapple is believed to lead to abortion.
- Hen's egg should not be consumed by women.
- Eggs are thought to cause baldness, sterility and hence not consumed by pregnant women.
- Milk and fish should not be taken same time, as this combination is poisonous.
- Adults don't need milk.
- Infants (1-5 yrs) should be never fed eggs, as they are 'hot' foods.
- Only meat gives energy.
- Baby food (tinned) is better than mother's milk.
- Tonic is good for health than normal food.

Body size of Adult is widely used as an indicator of overall health and nutritional status of a community (Manson *et al.*, 1977; Srikantia, 1989). BMI is an indicator of nutritional status. The nutritional status of the fisherwomen was surveyed with a schedule prepared for this purpose. The fisher women of age ranging from 20-30 years, married and having children were surveyed with little modification of the questionnaire format of Basu (2011) (Table 3). It was found from the survey that the women of the fishermen community are in thinner side with an average height of 156 cm. The chronic energy deficiency assessed in terms of body mass index (BMI) and it was found 22.66% of the women of fishermen community are having chronic energy deficiency.

**Table 3: Anthropometric measurements and Nutritional Status (BMI)**

n=75

Measurement/Index	Mean± SD	Range
Height(cm)	156±15.2	143-168
Weight(kg)	52±9.4	41-57
BMI	20±2.2	
<b>BMI Classification</b>	N (%)	
17-18.49	17 (22.66%)	
18.5-24.9 (Normal)	56 (74.66%)	
25-30 (Over weight)	2 (2.66%)	

Most of the fishers live in a very poor housing condition. Kachha houses (67%) made of mud, bamboo, tin, paddy straw or *hogla* thatching is a common among the fishermen community. Houses made of

brick and tin (33%) is also found among some of the members of fishermen community. The average family size of the fishers live in Sunderbans is 5.2. Most of the fishermen (48%) in that area are landless, own only their homestead with a small pond. Shortage of quality/clean drinking water is also an issue. Most of the fishermen households (57%) do not have any electricity connection. The Sunderbans is vulnerable to natural calamity like cyclone and flood and the populace generally pay a lot in terms of physical and human capital during the natural disaster.

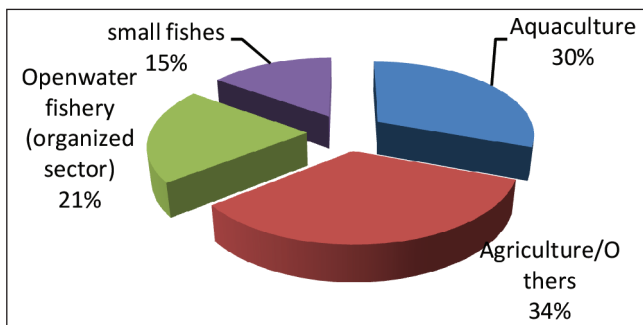


Fig. 2: Contribution of livelihood activities (in percentage) in fishers' household income (n=300)

Decline in fish catch due to overfishing and destruction of fish juveniles through destructive fishing gears has made natural fisheries from rives no more a profitable venture. Migration from Sunderbans in search of job to the cities or to the other states has become a burning issue in Sunderban. The analysis of the surveyed data shows that small fishes from the water channels, canals, water bodies, paddy fields contribute 15.65 in the household income of the fishermen. As the demand and price of the SIF is higher in the market. So, producing SIF in adequate quantity could be a good opportunity for earning alternate livelihood by the fishers of Sunderbans.

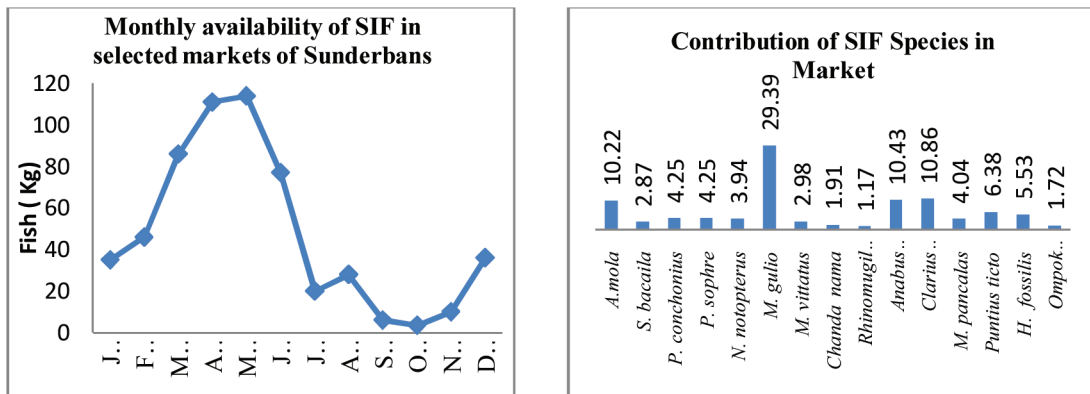


Fig. 3: SIF abundance in lower Sunderbans

A field survey was conducted regarding the status of small indigenous fishes after *Aila* in Sunderban region, particularly in Kakkdwp, Namkhana and Sagar block, which was badly affected by cyclone *Aila*

in the year 2009. Hundred people of various age groups ranging from 27 -65 years and involved in various occupations were interviewed personally to know about the present status of small indigenous fishes in that zone after *Aila*. Survey in selected areas of Sunderbans revealed drastic reduction in native fish species, e.g. *Ompok pabda*, *Heteropneustes fossilis*, *Clarias batrachus*, *Glossogobius sp.*, *Anguilla bengalensis*, *Amblypharyngodon mola*, *Colisa fasciata*, *Notopterus notopterus*, *Mystus vittatus*, *Channa marulius*, *C. striata*, *C. punctata*, *C. gachua*, *Mastacembelus armatus*, *Macrognathus pancalus*, *Puntius sarana*, *P. ticto*, *Chanda nama*, *Nandus nandus*, etc. A market survey conducted in peri-urban and rural fish markets of lower Sunderban area; Ukiler bazaar (village market), Dasmile market (village market), Namkhana bazaar (peri urban market), Kakdwip market (peri urban market) is also supporting the fact that the supply of SIF of fish in the rural and peri urban fish markets was very low. During the month of April – June, SIF has the maximum supply in the fish market because of their higher availability in low volume natural water. Average monthly supply in the selected markets is 11.92 kg. So, the contribution of SIF in market is very low as compared to the IMCs and other Marine fishes. Maximum contribution in the market is *Mytus gulio* (Nona tengra 29.39%) followed by *Clarias batrachus* (Magur 10.86%), *Anabus testudineus* (Koi 10.43%), *A. mola* (Mourala 10.22%), *Puntius ticto* (Puti 6.38%) *H. fossilis* (Singi 5.53%) and others (Sinha *et al.*, 2014).

**Table 4: Identification of the causal factors responsible for depletion of SIF in Sunderban**

S. No	Causal factors	Identification of the causal factors								RBQ Values	Ranking of Causal factors
		I	II	III	IV	V	VI	VII	VIII		
1	Excessive abstraction of water for agriculture from fresh water habitat	2	3	3	5	2	2	3	0	71.59	I
2	Use of chemical pesticides in the paddy fields	4	3	5	3	2		3	0	44.99	II
3	Use of small meshed nets(mashari jaal)	1	2	5	6	4	1	1	0	42.9	III
4	Natural calamity	5	2	0	4	3	1	0	5	37.9	IV
5	Intensive aquaculture	2	4	0	3	5	2	1	3	37.48	V
6	Wanton destruction of brooder fishes	0	2	3	4	3	2	4	2	35.82	VI
7	Lack of awareness of fish conservation as well as the nutritional value of the SIFs	3	2	3	3	2	1	3	3	32.88	VII
8	Predator habit of carnivorous fishes	0	1	0	3	2	2	4	8	18.32	VIII

A focused group discussion was organized with 30 fishermen of having 30 years experience in capture and culture fishery, to collect information on the factors responsible for the depletion of SIF in lower part of Sunderbans. They were asked to rank the factors responsible for decline in the population of SIF. Several factors were listed out by the fishermen and through RBQ the factors were re-ranked.

It was found that excessive abstraction of water for from fresh water habitat was ranked as first by the fishermen. And the reason behind this was, SIFs are commonly available in canals, ponds, water channels. But, abstraction of water is done for irrigation purpose, for that reason, most of time small fishes cannot get ideal condition to breed even to survive. Use of chemical pesticides in the paddy fields is perceived as 2<sup>nd</sup> reason by the fishers. Joygopalpur Gram Vikash Kendra in 2010 also reported that, pesticide is one of the major reason of disappearance the SIFs in Sunderbans. Use of small meshed nets (mashari jaal) was ranked as third, as small meshed nets often destroy the eggs and spawns of small fishes. Natural calamity is often perceived as major reason of depletion of SIFs and ranked as fourth. For example, calamity like Aila has increased the salinity of the waterbodies which has adverse effect on freshwater SIF population, many fishes has disappeared (Sinha et al, 2014). Intensive aquaculture is also a major reason of reduction of SIFs in Sunderbans and it was ranked fifth. In aquaculture all this small fishes are thought as trash fish or weed fish and are killed by application of Mahua oil cake or netted out, the SIF population has declined in several village ponds in Sunderbans. Wanton destruction of SIF brooder fishes, Lack of awareness of fish conservation as well as the nutritional value of the SIFs and Predator habit of fishes were other major reasons as perceived by the fishers for depletion of SIFs in Sunderbans.

As reported by of Sinha *et al.* (2014), there is significant reduction in availability of *Amblypharyngodon mola*, *S. bacalia*, *Mystus vittatus*, *Puntius sarana*, *Nandus nandus* in the water channels of Sunderbans. Patra *et al.* (2005) reported that SIFs like *H. fossilis*, *A. gagora*, *M. vittatus*, *P. canius*, *A. coila*, *C. batrachus* are vulnerable species in Sunderbans. So, there is an urgent need for conservation and revival of the small fishes to maintain ecological as well as social and economical equilibrium. Possible conservation measures can be taken up:

- ❑ **In situ conservation** can be done through their maintenance within natural or man-made ecosystem in which they occur. A trial was conducted for initiating in-situ conservation in Madangaj, Namkhana, Sunderban in a village community pond. Fishes were collected from the rain fed canals of local area and were stocked in the pond. For ensuring the community participation in conserving the small indigenous fishes two Farmer Interest Groups (FIGs) were formed to look after. Encouraging results has been obtained in partial harvesting after six month rearing: *Amblypharyngodon mola* (9.6 kg) yields 15 kg, *Macrornathus pancalus* (1.6 kg) yields 3 kg, *Puntius conchoni* (0.95 kg) yield 2.5 kg, *Puntius ticto* (0.6 kg) yields 2 kg, *Salmostoma bacaila* (3.4 kg) yields 5.4 kg and *Mystus vittatus* (1.8 kg) yields 3.2 kg without supplementation of additional feed (Sinha & Roy, 2016). These small fishes have again been distributed to 20 fisherwomen having small pond in their homestead to culture. Thus, in-situ conservation with community participation can be encouraged for conserving SIF.
- ❑ **Eco-restoration** is a practice of renewing and restoring degraded, or destroyed ecosystems and habitats by active human intervention. Ranching of SIFs through active people's participation can be done in the fresh water canals or water channels.
- ❑ Enforcement of laws and regulation to protect SIFs particularly in breeding season is necessary to conserve the SIFs in natural habitat.
- ❑ Regulation of small meshed nets can also help in conserving small fishes

- ❑ Declaration of selected water bodies as sanctuaries can also be done for SIF conservation
- ❑ Intensive aquaculture and introduction of exotic fishes should be reduced
- ❑ Mass awareness generation about nutritional benefit of SIF
- ❑ Institutional mechanism to popularize SIF for nutritional security as well as alternative livelihood

Fish is a nutritious food; provides high level animal protein, micronutrients and essential fatty acids. Most of the SIF are rich in essential nutrients like Vitamin A, calcium, iron, zinc (Thilsted, S.H., 2012); so consumption of SIF will secure the nutritional need of the fish dependent communities. Even it can also provide livelihood to people thus indirectly can assure food security.

- ❑ SIF vis-à-vis Sustainable livelihood: Fishery is already an important means of livelihood for the people Sunderbans. But, if SIFs are conserved, then people of Sunderban will get sustainable livelihood from it as these fishes are in high demand for consumption purpose. So, these fishes can be exported to the domestic city markets for better earning, thus the fishers will have better income. Sustainable income leads to food and nutritional security of the people.
- ❑ Increase of purchasing power: Sustainable livelihood increase the purchasing power of the people, which ultimately increase accessibility of food.
- ❑ Small fish for own consumption: There are numbers of literatures are available in support of small scale fisheries where some portion of fish catch is kept for own consumption (Garaway, 2005). In Sunderbans also it is observed that the low value small fishes are often kept for consumption purpose by the fishermen and thus nutritional security can be secured.
- ❑ Lowering market price for food and nutritional security: Increase supply of SIF by conserving small fishes can also increase the supply of small fishes in markets. This will also cause lowering market price of SIF and ultimately will increase the availability of SIF to the people of Sunderbans which will lead to nutritional security.
- ❑ Small fish as alternate livelihood for the people of Sunderbans: SIFs are available in creeks, water channels, wetlands, paddy fields of Sunderbans. Thus, if SIF is conserved properly, sustainable fisheries based on small indigenous fishes can provide additional income or a source of alternate income to the people other than fishermen community in Sunderbans. Thus, food and nutritional security can also be ensured.

SIF has the potential to increase the income of the fishermen community, which will empower the community to access education, health, nutrition and better living standards which ultimately can ensure food and nutritional security of the people of Sunderbans. So, conservation of SIF is an urgent need towards ending up malnutrition and ensuring food security of the people of Sunderbans.

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