

The Prospects and Potentials Of Fisheries in Northeast India: Strengths, Weaknesses, Opportunities And Threats

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Introduction

Fisheries contribute immensely in the economic and livelihood development of India. As per the latest data published by the Handbook of Fishery Statistics (2020), its contribution is 1.24% to GDP and 7.28% to agricultural GDP of the country. It is one among the priority lending sectors for the development of *Atmanirbhar Bharat* and assuming its importance Govt. launched *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) on July 5, 2019 with an aim of enhancing fish production by an additional 0.7 MMT, increasing fisheries export earning to Rs. 1,00,000crores, doubling of farmers income, reducing post-harvest losses from 20-25% to about 10% and generation of additional 0.55 million employment opportunities in fisheries by 2024-25. The North-East (NE) India consists of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim, eight States with total geographical area 2.55 lakh km² (about 8% of the country), of which 43% is situated at the elevation of 300m, 30% in the elevation range of 300-1200m and 27% in the elevation of above 1200m above MSL. The mean temperature ranges from 18⁰C to 25⁰C and rainfall is 2000-4000 mm with local variations (1500-12000 mm). The soil type varies from chernictenosols on high plains and plateaus to orthic tenosols on hills and mountains with pH varies from 4.5 to 6.5. These diverse and dynamic environmental conditions make the NE India a 'global hotspot' for aquatic biodiversity and hub for fisheries and aquaculture enhancement.

Fisheries of North East India

Fisheries play an important role in the economic development and livelihood security of NE India. As per the latest data published by the Handbook of Fishery Statistics, 2020, more than 26.3 lakh people of the region are associated with the sector for livelihood. The

average fish productivity of NE India is estimated to be 1.5 MT/ha/year and it is below the national average of 3 MT/ha/year. The fish production of NE India was just 239790 MT/annum till 2004-05. Through systematic efforts and integrated approaches, it is now reached to 518380 MT/annum, which is approximately 5% of the total inland fish production in India. Still there is a shortage of 43000 MT fish in the production and requirement of fish and to bridge that shortage fish is imported from Bangladesh and other States like Andhra Pradesh, Tamil Nadu, West Bengal, etc.

The demand for fish is very high in NE India as more than 95% of populations are active fish consumers. Further the tendency of the people to consume fish more than nutritional requirement (12 kg/capita/annum) is a great challenge for the sector to overcome through technological interventions. Tripura is nutritionally self-sufficient in fish production but in an estimate, it was recorded that the state annually spends about Rs. 400 Crores for importing fish from outside to meet the local demand. Though a high yield potential has been realized in Fisheries, many challenges to sustain the production and productivity level and reduce the cost of production and carbon footprint are yet to be addressed. In this article, the strengths, weaknesses, opportunities and threats in Fisheries were identified by SWOT analysis so that possible interventions could be made either technological support or policy need to convert the weaknesses into the strengths and threats into opportunities for the inclusive development of the sector.

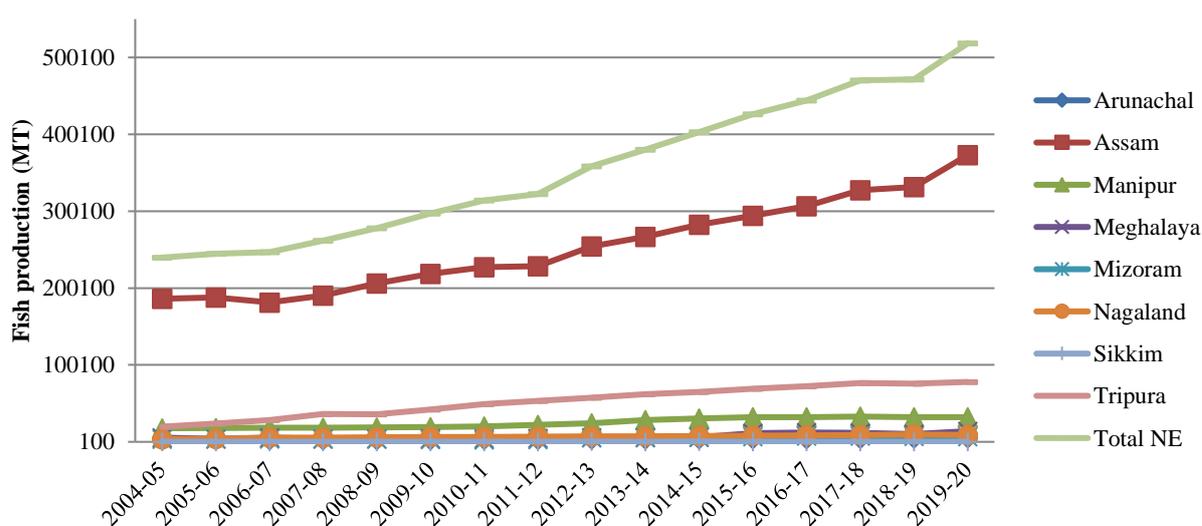
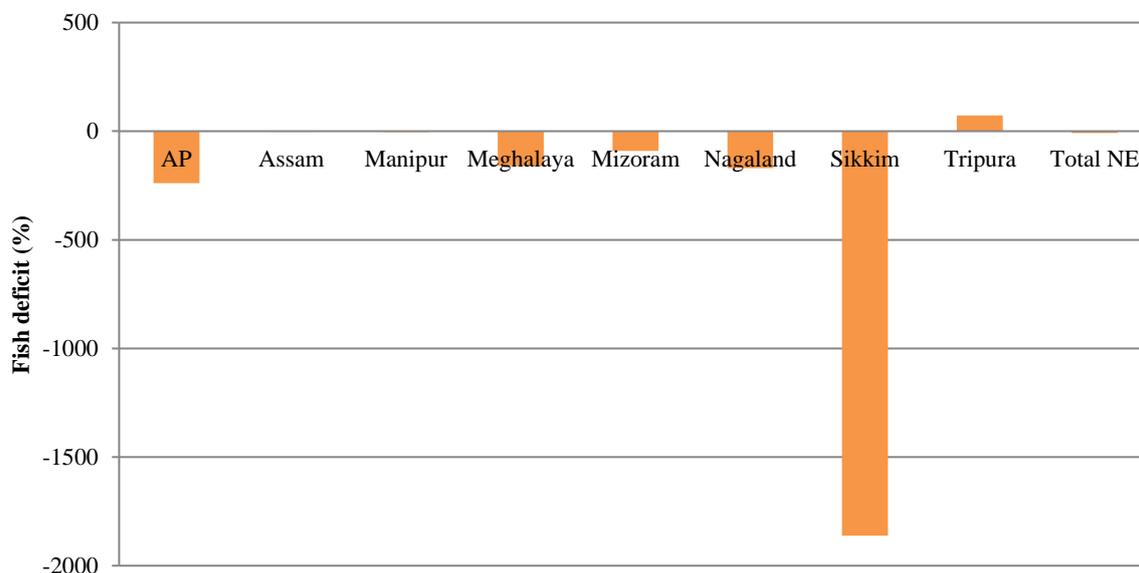


Figure 1: Fish production (in MT) in NE States of India (2004-05 to 2019-20)

Figure 2: Fish deficits in different NE States**Strengths**

- i. Fish is a health food, thus fish eating helps in fighting against malnutrition and hunger (mainly hidden hunger, the hunger of micronutrients) which have been increasing over the years in NE India. It is proven in the public domain by various on farm trials (OFTs) or frontline demonstrations (FLDs) that fish farming is a highly profitable enterprise with benefit-cost ratios vary from 1.5 to 4.0 and have the potential to address issues like livelihood insecurity, unemployment, etc.
- ii. Huge demands for fish as >95% of people are active fish consumers. Further, there is a competitive market price ranges from Rs. 150 to 500/ kilogram for carps to Rs. 500-1500/- for catfish like Pabda, Tengra, Magur, Singhi, etc. The SIS-Small Indigenous Species (Mola, Darkina, Puthi, Kanla, etc) which are considered as ‘fish of no importance to fisheries in many inland states’ have high demand and price in NE India, sometimes, their price is higher than most of our commercially important species of carps. By co-culture of IMCs and SIS, the overall fish productivity could be increased by 10-15%.
- iii. Presence of diverse aquatic resources ranges from warm water (25 to 30⁰C) to coldwater (15 to 20⁰C), tropical fish to temperate fish, food fish to dual purpose fish, and finfish to shellfishfor fisheries. As per the latest data, India’s16.91% of rivers and canals, 0.15% of small reservoirs, 0.69% of medium and large reservoirs, 1.63%

of ponds and tanks, 38.16% of wetlands and derelict water bodies and 55.09% of water bodies other than rivers and canals (forest water bodies, inundated lands, etc) are present in NE India. Further most of open water bodies are pristine with high soil nutrient status and plankton productivity for technological interventions and scientific exploration at full capacity.

- iv. Existence of huge open water bodies in the form of lake, reservoirs, rivers, streams, forest water bodies, etc for promotion of culture-based fisheries such as cage culture, pen culture, etc. The marginal and small farmers, landless farmers, peasants, etc can seek livelihood opportunities in these common property resources.
- v. Availability of manpower at low prices
- vi. Presence of training facilities from ICAR institutes like ICAR NEH, Fisheries colleges, State Govt. firms, NGOs, etc.
- vii. Better consumption of knowledge disseminated due to high literacy rate among the people (>72% in Arunachal Pradesh to >93% in Mizoram)
- viii. Strategic locations for international trade and commerce, presence of rich ancestral knowledge etc.

Table 1: Fishery resources of NE India (Source: Handbook of Fishery Statistics, 2020)

States	Rivers/ Canals (km)	Reservoirs (ha)	Ponds and Tanks (ha)	Wetlands (ha)	Any other than rivers and canal (ha)
Arunachal Pradesh	10957	136	29122	3227	56000
Assam	4820	1096	77250	154650	462382
Nagaland	1600	2258	3474.13	1110	0
Meghalaya	4200.87	717.53	3465.37	284.78	66.94
Manipur	14788	2142	11622.8	24433	0
Mizoram	1750	8010	5492.04	0	0
Tripura	2975.8	3049.34	18530.12	0	12161.01
Sikkim	1600	850	1466	0	0
Total NE	42691.67	18258.87	150422.5	183704.8	530610
All India	252431.48	4031801	9200327	481455.93	963189.2

Weaknesses

1. Lack of species and system diversification in fisheries and aquaculture (both in terms of species and systems). Though the NE India is considered as one of the global hotspots for aquatic biodiversity with >265 endemic fish species but the stark reality is in the effort of increasing fish production of the region, major R & D is focused on fast-growing only 10-12 species, less emphasis is upon bringing the multitudes of other locally available fishes in the form of Medium Carps, Minor Carps, Catfish, Notopterids, Murrels, etc. into the mainstream aquaculture and commercialization. Further, here aquaculture means culture of fish in pond or tank ecosystem, no emphasis over open water aquaculture.
2. Little emphasis over the development of capture fisheries and capture-based culture fisheries such as cage culture, pen culture, as a result, the average fish productivity of capture fisheries in NE India is <250 kg/ha/year whereas in inland and maritime states it is 500-100 kg/ha/year.
3. Lack of family approach in education with focus on women. Aquaculture is more women friendly and several of the activities like fertilization, feeding, marketing of fish, etc. are best done and managed by women. This is an area where major changes can be brought to farming by involving and empowering women on a massive scale.
4. Poor organizational and communication skills, lack of development of entrepreneurship or public-private-partnership (PPP), as a result, formation of fishery-based cooperatives or farmers' producers' organization (FPOs) is less in the region.
5. No proper marketing infrastructures, cold chains facilities for fish; in some states like Arunachal Pradesh, Nagaland, Meghalaya, not a single dedicated market exist for fish, they are disposed from same outlets of agriculture commodities. Further, there is no standard floor price and market intelligence for selling fish.
6. Limited awareness over sustainable and responsible fisheries, conservation aquaculture, resource mapping, etc. Most of the fishery ponds are seasonal and backyard in type with no proper inlet and outlet facility, contour and basin configuration, primary and secondary dikes, crests, berm, freeboards, side slopes, etc; further in most of the cases, tank resources are confused with pond resources.



7. Lack of location-specific R & D and promotion of need-based interventions; inappropriate allocation of scarce resources and improper technological innovations underestimate the fishery potential of the region.
8. No contingency plan and adaptive measures, secondary livelihood creation to cope with increased climate-induced perturbations.
9. Lack of quality fish seeds and quality fish feeds at affordable prices. Further there are high transportation costs in the far-flung areas due to poor accessibility and seed mortality due to transportation stress.
10. No proper seed policy is in existence.
11. Lack of skilled manpower and those who have earned skills, they migrate to inland States in search of better opportunities.
12. As more than 87% farmers are marginal and small in category, their purchasing capacity is low, they assume scientific farming is capital-intensive and energy expensive.
13. Lack of mechanization and modernization in resource utilization; use of traditional fishing gears and crafts underestimate the potential of fisheries production.
14. Practice of destructive fishing methods like stupefying the fish using dynamites, piscicides, electric shocks, etc. The effective population size (En), maximum sustainable yield (MSY), maximum economic yield (MEY), catch per unit effort (CPUE), catch per unit area (CPUA), etc are not known for many commercially important fishes in their natural habitats, thus the need of their stock enhancement or replenishment by ranching is poorly known. In absence of aquaculture enhancement, fishing pressure has been increased over the wild stocks to meet the increased market demand and it is depleting their stock day by day and endangering the livelihoods of the region associated with the capture fisheries.
15. Post harvest management and value additional sector is poorly development.
16. Most of the technology transfer wings of State departments, Central departments are running shortage of staff; each Fishery Officer or Subject Matter Specialist of KVO is overburdened with works with no staff, vehicle and other facilities, as a result, there is dereliction of duties. State Dept. put more emphasis over implementation of Govt. schemes rather assessing the actual needs in the local condition.

17. Increased dependency of farmers over Govt. schemes. In most of the cases, it is found that if Govt. supports, fish production increase, but once it is sacked, fish production dropdowns.
18. Increased occurrence of diseases, lack of proper facilities and infrastructure for disease diagnosis, water and soil analysis, etc
19. Absence of knowledge resource centers, custom hiring services, etc
20. High input cost and most importantly lack of availability of inputs at the appropriate times,
21. Poor lease policy

Opportunities

1. Fisheries have close association with the rural livelihoods and thus, direct impact over the socioeconomic development of the region.
2. Very high demand for fish in the region when compared to many inland States; fish fetches farm gate price as more than 95% of people consumes fish, out of top five fish consuming states in the country, three are from NE India (Tripura, Manipur and Assam). In this scenario, scientific fish farming could be potential source for income and employment in the region. Another interesting observation in the post-COVID era is that people are reluctant to consume fish comes from Andhra Pradesh, Tamil Nadu, Bangladesh etc, they demand more of fresh fish. It could be seen as a great opportunity for revamping regional fisheries production.
3. Presence of diverse aquatic resources, starting from coldwater to warm water, tropical fish to semi-tropical fish to temperate fish for diversification of aquaculture. Most of the water bodies sustain high productivity throughout the year, in some places of Tripura and Assam, the average fish productivity is >3 MT/ha/year even after low-input management, which indicates scopes for further improvement in the production of fish by intensifications. Further NE is a hub for 'high-value fish' such as Pabda, Tengra, Pengba, Chital, Mahseer, Scampi, etc. for development of ventures of commercial importance.
4. Community participation is more in fisheries, which could be viewed as a potential tool for promoting scientific fishery technologies such as composite fish culture (CFC) where fish production potential is estimated to be 4-5 MT/ha/year, integrated



fish farming (IFF) where fish production potential is estimated to be 3-5.5 MT/ha/year, pen culture where fish production potential is estimated to be 7-8 MT/ha/year and low-cost cage culture where fish production potential is estimated to be 10-15 kg/m³ in the region.

5. Fish farming could be made low-cost and affordable by development of networks and value chains with the allied sectors such as agriculture, livestock farming, etc. By utilization of locally produced agriculture-horticulture residues, spent mushroom substrates, aquatic weeds, detoxified rubber seeds, animal wastes, the feed and fertilizer cost which is accounted for 60-70% in the operational cost of fish farming could be minimized. For example, rice bran, mustard oil cake and meat meal are the three major ingredients of balanced fish feed. In Tripura, rice is cultivated in 2.57 lakh ha area over all the three seasons, and thus rice husk/bran is sufficiently available. In addition, more than 84000 ha area under single cropping could easily bring under mustard cultivation, which could produce almost 50400 MT of mustard oil cake. Furthermore, almost 34759 MT meats are annually consumed in Tripura which produces almost equal amount of bone meal and meat meal. By creating a network of regulated slaughter houses across the state, locally processing the by-products of rice husk, MOC and bone meal and meat meal to prepare fish feed can effectively address the issues related to feed cost. In addition, it will generate secondary employment in oil mills, slaughter houses and feed industry. Further by ancestral knowledge and ethno-botanical remedies, fish disease which is responsible for 20-30% of production penalty could be minimized by 30 to 50%. One important ITK to mention here is the use of concoction of kerosene, mustard oil cake and soil to control the infection of deadly transboundary fish disease Epizootic ulcerative syndrome (EUS) by almost 100% in Tripura. To correct soil acidity, as an alternative of lime, the ash of banana, mustard, paddy straw, fly ash from kilns etc can be used to minimize the cost of applying lime in aquaculture.
6. Ample opportunities to adapt with climate-induced perturbations by livestock cum fish farming, paddy cum fish farming, etc. Pig is considered as a cultural icon for NE India, through pig cum fish farming, huge socio-economic transformation is possible in the region particularly among the *adivasi* communities. Paddy cum fish farming is

the most underestimated resource in NE India; at present, the potential area for paddy-fish farming is >27000 ha with an average fish productivity is >250 kg/ha/year. By technological interventions, it could be increased to 1-1.5 MT/ha/year. Rice and fish are the two major ingredients in the daily diets of NE People; paddy-fish farming can immensely backstop the nutritional security of the region. Great opportunities for ornamental fish farming; in India's ornamental fish trade, the contribution from NE India is >85%; through development of infrastructures, identification and value addition in the market chains, scientific innovations, it is possible to make ornamental fish farming as a multimillion dollar business in the region for millions of unemployed youths, women and disadvantage sections of the society. Some high-value ornamental of international importance from NE India are- *Channa barca*, *Colisa fasciata.*, *Botia dario*, *Rasbora daniconius*, etc.

- Immense scopes for the development of value added products such as fermented fish, smoked fish, ready-to-eat fish products, etc; Shidal, a fermented fish product is a culinary identity for NE India and potential entrepreneurship and business modules could be developed on the basis of that.

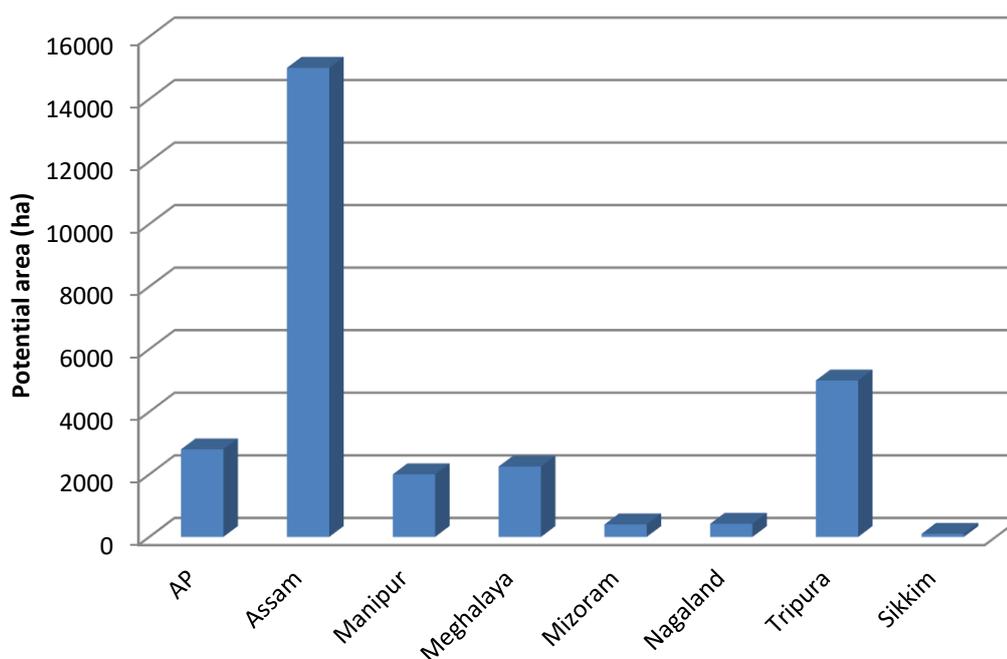


Figure: State-wise potential areas for paddy cum fish farming in NE India

Threats

1. The tendency of people to consume fish more than requirement poses a great challenge over this sector in NE India. As per the ICMR recommendation, a consumption of 12 kg fish/ capita/annum is sufficient for nutritional point of view, but in the state of Tripura, the per capita fish consumption is 30 kg/capita/annum, which is very difficult to address and overcome by technological interventions.
2. Heavy infestation of aquatic weeds in the water bodies, particularly the infestations of water hyacinth and water cabbage which leads to increased siltation and decreased effective areas for fish and fisheries. Sometimes these water bodies become dens for the breeding of mosquitoes, insects, worms, frogs, snakes, harmful pathogens of zoonotic importance etc which is not bad not for fish and fisheries but also for human lives.
3. No stringent regulations and measures over the discharge of industrial wastes, agricultural runoff, domestic wastes, idol emersions, water abstraction, mining etc, as a result, there is serious deterioration of water quality and sediment quality in the aquatic bodies. Enrichment of nutrients leads to emergence of serious issues like eutrophicaltion, hypoxia, and mass proliferation of aquatic weeds in the water bodies.
4. Non-existence of strict fisheries regulations such as following fishing ban during the monsoon season, control over three forms of overfishing such as growth overfishing, recruitment overfishing, and ecosystem overfishing, declaration of protected sites/ sanctuaries in the areas where fish breeding and spawning occurs naturally, proper mesh size during fishing (eumetric fishing), following quota system, stringent measures against illegal, unregulated and unreported (IUU) fishing, etc particularly in the open water fisheries. 'Tragedy of common' is in existence in many water fisheries.
5. No contingency plan and adaptive measures against climate-induced perturbations such as warming, floods, landslides, cyclones, earthquake, hailstorms, etc which adversely affect not only fisheries but also lives of people. The occurrence of floods or flood-like situations increased in NE India in the recent days, they are causing sheer destruction in fisheries by breaking the pond embankments and washing away the crop under farming. In the Economic Review of Tripura (2019-20), it was



reported that the State lost 5700 MT fish due to flood in 2018-19 which is a huge loss for farmers. Landslides cause road blockage and increase the transportation charges for inputs, manpower, services, etc. Improper allocation of scarce resources compromises the food and nutritional security of the region in this era of global warming and climate change.

6. Disease outbreak, particularly the outbreak of deadly Epizootic ulcerative syndrome (EUS) during the winter months. Tripura was the gateway for this disease when occurred first in the Indian subcontinent in September, 1988. Even after 35 years from its first occurrence, there is no effective measure against this disease; production penalty varies from 70 to 100%, farmers fear while investing fresh in aquaculture.
7. The potential of already established resources such as farms, hatcheries, laboratories, manpower, under different Govt. schemes has remained unexplored in many States till today. There are many places where resources created have become junk due to not keep it under operational and maintenance.
8. Problems of soil acidity and increased soil salinity have detrimental effect on the fish and other forms of aquatic life.
9. Poor communication gaps and transfer of technologies particularly in the tribal villages.
10. Improper fish marketing and delivering system and huge compromises in terms of setting the norms for health and hygiene of the wet markets, quality of water to be used, disposal of fish waste, health of fish handlers.
11. Reckless introduction of exotic fish/ hybrids/ improved strains in the name of aquaculture diversification or increased fish production pose threats to endemic gene pool of the region.
12. Lack of seed certification. As the quality of seed being the key element, it is important to ensure that seed available in the market is regulated through a mechanism that helps the farmers to get an assured supply of quality seed. Certification of hatcheries could be an option that can be considered to ensure that quality of the seed is regulated at the production stage. But lack of stringent seed policy is causing inbreeding depression, gene pool pollution genetic deformities and overall fish growth and survival.

13. Absence of insurance coverage to aquaculture crop. Two major fears of farmers are poaching and poisoning and flood which have been preventing many farmers to make investment in fish culture in NE India. Further, there is poor lease policy
14. Increased incidences of formalin adulteration in fish, translocation of transboundary pathogens, black marketing, etc due to fish import. A section of people particularly in Tripura and Manipur is slowly shifting their habit from eating fish and fish products due to increased incidences of adulteration and health complications. Fish import is draining out huge amount of state funds from the region.
15. Black marketing in ornamental fish trade
16. Introduction of technologies without assessing their viabilities/feasibilities in the local condition by OFTs or FLDs. Some marketing agents for minting money recklessly promoting and introducing technologies such as bio-floc technology, re-circulatory aquaculture, raceway farming, etc., which are highly energy expensive and less fit in the conditions of NE India where farmers are mostly marginal and small.
17. Less inclination among the people towards opting fisheries as a career as it is considered a low-profession in many urban societies. Further exodus of people from the area due to issues like unemployment and food insecurity affects the fisheries development of the region.
18. Many State authorities hardly treat fisheries at par with other sectors such as agriculture, horticulture, veterinary sciences; as a result, the sector attracts less financial support. Fish farmers are hardly treated as 'essential workers' despite, they play an important role in the nation building by supply fish, a health food for all.
19. The States of NE India are marching towards organic farming or organic package of practices; Sikkim and Meghalaya are already declared organic states. In some places, farming is organic by default, but in other places inclination towards organic farming and declaration of organic state poses threats to the production and productivity of fish in the region; it is difficult to make fish farming productive and lucrative in already heavily fish deficit NE India following organic practices.

Conclusion

The NE India as is a 'global hotspot' for aquatic biodiversity and resources. At present the potential of these resources are untapped and in underutilization in many places,

thus the fish production is far below the national average and local fish supply is below the requirement of the people. Currently, the annual fish deficit is estimated to be more than 43000 MT which could be reduced by location-specific technological interventions and creating awareness by training, demonstration and capacity building programmes. >95% of people are fish consumers in NE, thus huge potential is exist towards opting fisheries as a potential source of income, employment and entrepreneurship development opportunity. So, it is necessary to lay emphasis over the amalgamation of the sector with allied sectors like agriculture, horticulture, livestock farming, etc for the production of multiple food products and to uplift the standards of living and socio-economical security of the people associated with the sector. This SWOT analysis would be helpful to convert the weaknesses of the sector into the strengths and threats into opportunities for the sustainable development of fisheries of NE India.

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