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Aquaculture Development in Meghalaya: A Critical Evaluation of MSAM in West Khasi Hills

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With rich resources in terms of water and fish species, aquaculture is identified as a priority sector in the Indian state- Meghalaya. To fast track development and create self sufficiency, the state adopted a mission mode approach, launching Meghalaya State Aquaculture Mission (MSAM) in 2012. Owing to the progress achieved in terms of fish production, income generation and employment creation, MSAM 2.0 was introduced. The study aimed at assessing the performance of each of the 5 mini missions under MSAM2.0 in West Khasi Hills, the largest district of Meghalaya. Based on data, collected from various published and unpublished sources, and inputs from district officials and beneficiaries of various schemes, the overall status of aquaculture in the district was explored. It was observed that while the mission factored in measures for economic and environmental protection, MSAM 2.0 did not offer any mechanisms for social protection. Therefore, a re-evaluation of the strategies, to introduce human centric approach seems necessary to ensure an equitable development in the fisheries sector.

Keywords: Aquaculture, MSAM, West Khasi Hills, Fish Farmers, Meghalaya

Introduction

For sustained growth and development, especially of the rural economy, the development of the primary sector is widely accepted to be the main impetus. One of the main components under agriculture and farming systems is aquaculture, which directly contributes to income and employment generation, food security and farm sustainability (Halwart, Smith, & Moehl, 2009). In India, fisheries has been identified as a sunrise sector, emerging as a commercial activity, against its traditional role as a subsistence supplementary activity (Pillai & Katiha, 2004). This is evident from the increment in the GDP contribution of fisheries from 0.4 percent in 1950-51 to 1.03

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percent in 2017-18. Given that it is the fastest growing food production sub sector in many states, the role of aquaculture in doubling farmer's income cannot be overstated. Realising this potential, to develop, harness and manage fisheries in a sustainable manner, the National Fisheries Policy 2020 is proposed, to meet the targets set under Blue Revolution.[1] However, being a state subject, the development of fisheries is primarily dependent on the state's involvement in fisheries governance.

The north eastern state of Meghalaya, with its vast inland water resources like lakes, ponds, reservoirs and rivers, offer tremendous scope for the development of aquaculture. Despite being a predominantly fish consuming region, the current demand far outweighs the supply, indicating that the potential of the natural resources largely remains untapped. Further, based on the strengths and factor endowments of the state, to fast track development, fisheries was identified as a priority sector. Towards this, the Thousand Ponds Scheme (TPS)[2] was introduced in 2005, to expand the area under production. While it was successful in bringing over 500 hectares of additional area under fish framing (MBDA, 2014), it did not provide measures for forward and backward linkages. Therefore, with the learnings from TPS and to fill the gaps identified, the Meghalaya State Aquaculture Mission (MSAM) was launched in 2012, to transform the fisheries sector from a state of dependency to self sufficiency. Through a mission mode approach, MSAM aimed at tackling the 15,000 MT demand supply mismatch, by productivity intensification and area expansion (FFDA, 2012). The mission also envisioned rural transformation, by generating employment, especially with the growth of ancillary activities.

As MSAM significantly contributed to the growth of fisheries sector, creating ponds even in remote areas and directly benefiting over 20,000 fishers, the second phase MSAM 2.0 was introduced in 2018, which will be functional till 2023. The most demanded components were included under the new strategy document, to ensure that the projected targets of the first version are met. Overall, MSAM 2.0 takes a more holistic approach, undertaking demand driven projects and setting location specific targets (FFDA, 2018).

The centrally located West Khasi Hills has the most abundant water resources in the state, with two large rivers- Kynshi and Khri, and 10 other rivers and streams that stretch 710 km. With an average rainfall of 1200 mm to 3000 mm per annum, rain water can also be impounded in ponds and used for fish culturing (ICAR, 2015). Despite these available resources, the traditional system of fish production has failed to meet the local demand, resulting in excessive dependence on supply from other fish producing States, mainly Andhra Pradesh. Against this backdrop, through the strategies adopted under MSAM, the district administration is actively engaged in transforming the nascent fisheries sector to a self reliant, commercial sector.

The paper is based on a comprehensive study of the fisheries sector in West Khasi Hills, covering the available institutional mechanisms and status of aquaculture development within the district. Data, collected from published and unpublished sources, and inputs from district level officials and beneficiaries of various schemes, are used to assess the performance of each of the mini missions of MSAM 2.0. Through this, the study attempts to identify the potential impacts and functional challenges of

the mission, to suggest ways for improving the efficacy of existing legislations and support future interventions.

Institutional Structures for the Development of Fisheries

In India, the central planning for safeguarding the welfare of the fishermen, along with the development of fisheries and its allied activities is undertaken by the Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying. The schemes are formulated based on the assessment of fisheries resources by the Fishery Survey of India (FSI) and the inputs from various national fisheries institutes. For enhancing the productivity and production, the Blue Revolution mission[3] was launched through the National Fisheries Development Board (NFDB), merging all the existing schemes. To fill the gaps in the fisheries infrastructure, given limited budgetary allocation and poor credit availability, the Fisheries and Aquaculture Infrastructure Development Fund (FIDF) was also set up. Additionally, in mid May 2020, Pradhan Mantri Matsya Sampada Yojana (PMMSY) scheme was released, for achieving Blue Revolution in a sustainable manner. Although yet to be approved, the National Fisheries Policy is drafted as well, for integrated development and management of fisheries

Within the country, inland fisheries contributes to nearly 88 percent of all fish production (NFDB, 2020). Since the inland resources are diverse and dynamic, region specific governance is necessary for targeted development. Moreover, unlike coastal fisheries wherein the central government regulates as well,[4] in freshwater aquaculture, the central government only complements the state's efforts. As a landlocked state, inland fisheries makes up the entire aquaculture landscape of Meghalaya. With an existing consumer base and agro climatic conditions suitable for fisheries, the state on realising the potential of this sector, in 1972 created a separate Department for Fisheries. A two tier organisational structure, Fish Farmers Development Agency, one at the state develop and other at district level, was created for easy implementation of schemes in the sector. To ensure sustained growth in fisheries, the MSAM was launched in 2012. Through multi pronged strategies and focussed interventions, it aims at accelerated aquaculture development, for realising the full potential of the state. Under the mission, Meghalaya State Fisheries Research and Training Institute (MSFRTI) was established in 2013 to execute the activities that requires the skill building, capacity building and imparting technical knowledge.

The Superintendent of Fisheries (SF), who heads the district Fisheries Department acts as the executive officer for MSAM as well. In West Khasi Hills, in addition to MSAM, Blue Revolution, PMMSY, RKVY and IMDBLP are functional. However, from amongst the active components of these schemes, the utilised measures include only the construction of ponds, feed mills, hatcheries and retail outlets. These benefits all contribute towards the mini missions of MSAM 2.0.

MSAM 2.0 Components: Priorities and Performances

Over the years, despite the developmental prospects in aquaculture, the growth in the sector remained slow and the state remained reliant on other states for freshwater

fish. Identifying lack of public investments as one of the main reasons for the poor progress, MSAM was introduced for a systematic, scientific and holistic approach towards fisheries development (MSAM, 2012). With the impacts of MSAM, both in terms of tangible and intangible benefits,[5] noticeably high, MSAM 2.0 was launched in 2018. Convergence with other departments, existing fisheries schemes, and externally funded schemes like CLLMP, KFW, etc was stressed, for better financing and achieving the targets set under the mission.

Area and Productivity Expansion

The central focus of MSAM is to fill the gap between demand and supply of fish, for making the state self reliant. The first mini mission targeted this, through the expansion of area under aquaculture and production intensification of existing fish farms. Area expansion was undertaken by construction of individual and community ponds. As of August 2020, in West Khasi Hills, 96 percent of the beneficiaries of various schemes[6] received assistance for pond construction. Due to the hilly slopes and the topography, ponds required excavation as well as construction of concrete ponds. Therefore, to promote aquaculture, due to the high costs in setting up ponds, most schemes were intentionally employed in ponds construction. A few of these were created through convergence with departments like MGNREGS (C&RD), IWMP (Soil and Water Conservation), etc. However, within this, only 7 community ponds were set up. While individual ponds utilise idle land, water and provide supplementary income/ employment to rural poor, community ponds encourage use of common resources, harmonise the local communities and improve the socio-economic conditions of the villages. Therefore, the administration should encourage more groups to engage in community ponds.

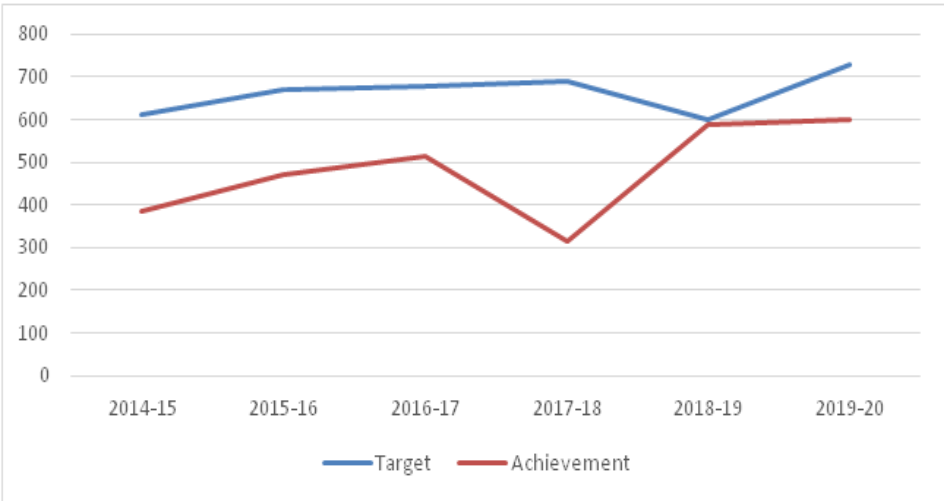
The table below also highlights that while 2541 ponds were constructed, only 40 ponds were renovated. Follow up studies revealed that nearly 30 percent of the ponds constructed remained non functional. As the district is prone to heavy rains and flash floods, there is a need to enhance maintenance and renovation activities, to fully capitalise on the areas created for fish farming.

Table 1: Beneficiaries and Availed Assistance under all Fisheries Schemes

Benefit	**Annual Beneficiaries**
Construction of Ponds	2541
Establishment of Fish Sanctuaries	8
Raising Fish Fry to Fingerlings	35
Construction of Feed Mill	2
Production of Fish Seeds	3
Renovation of Ponds	40
Construction of Retail Outlets	2
Total	**2631**

For enhancing the production and maximising the utilisation of available resources, integrated fish farming method is also a sub component. The fish cultivation in paddy fields will boost the soil fertility, improve production and act as pest control, in addition to it reducing the fish production costs and serving as a basis for supplementary income and nutrition. Despite rice cultivation practiced commonly across the district, only one pilot project has been undertaken in Nonglwai Village. Interestingly, it is being taken up by fish farmers who have been on exposure visits to other parts of the country, without the support of the administration.

Figure 1: Fish production in West Khasi Hills (in MT)



As can be observed in the figure, with the introduction of MSAM, the production levels initially rose with the increase in area under fish cultivation. However, due to the unavailability of fingerlings, quality brooders, hatcheries, and so on, the production fell by 2017. Following, the launch of MSAM 2.0, the set targets were slightly reduced and the district almost achieved the predetermined production goals. This may be because the beneficiaries of pond construction were offered assistance in recurring costs like fish seed, feed, etc for the first two years. Evidently, by 2020, the production level is stagnating, and the gap between the targeted and actual production levels is widening.

As of 2019-20, the fisheries sector has generated livelihoods to 2474 people approximately. The fish production in the district stood at 601.1 MT, against the local demand of 1320.5 MT. Given that the average production per ha is 1500 kg, to cater to the unmet demand, an additional 880.33 ha of water area has to be created. Therefore, activities under Area and Productivity Expansion component of MSAM have to be further promoted.

Critical Infrastructure Development

Mini mission 2 focusses on the creation of necessary infrastructure for developing fisheries, which can generally be classified as pre harvest and post harvest infrastruc-

ture. Considering the present stage of the sector, fish seed and feed have been assigned as critical components. The district is almost entirely dependent on Assam for fish fry and fingerlings. The Fisheries Department acts as the middleman, gathering the demand from the fishermen, to procure it from the Assam and distribute it locally. For eliminating this dependency, hatcheries are promoted under MSAM in two ways- upgrading the departmental farms and establishing private hatcheries. In West Khasi Hills, there are only 2 departmental hatcheries- in Mawshynrut and Nongstoin.[7] Post assessment of MSAM 1.0 revealed that FRP hatcheries are better suited to the hilly areas and had better acceptability.[8] For decentralising and improving seed production, individual farmers, cooperatives, SHGs and other private players with a minimum water area of 0.5 ha are encouraged under MSAM 2.0. By 2023, 10 FRP hatcheries are projected to be created, out of which only 1 has been approved as yet.

Figure 2: Fish Seed Production in West Khasi Hills (in MT)

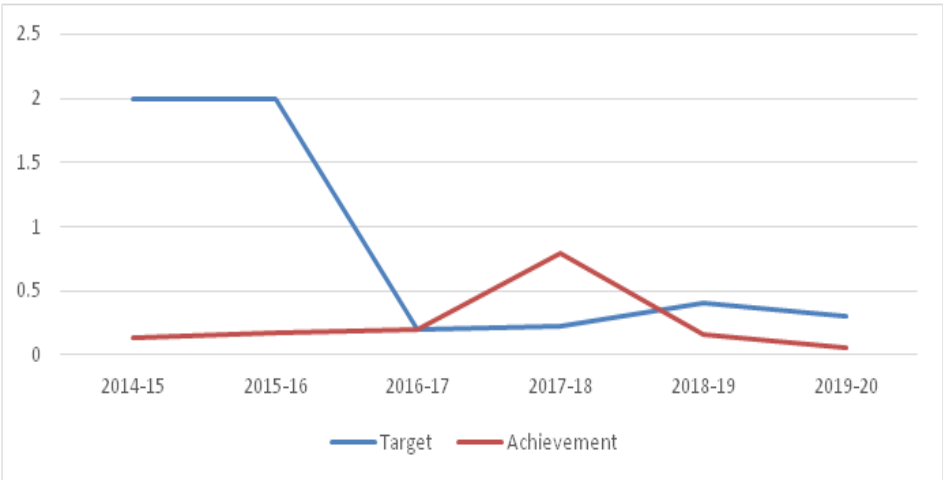


Figure 2 reveals that even with the measures introduced under MSAM, the seed production remains abysmally low. The target was dropped 10 times from 2016 to 2017, towards the end of MSAM 1.0. Although the seed production exceeded the set limit for a year, it has been steeply falling since, in spite of MSAM 2.0 being launched in 2018. With increasing fish production, the inputs requirement will rise as well. As timely supply of seeds are vital, fishers are often compelled to source fingerlings from outside, risking high mortality. In the absence of sourcing options, some farmers have left the activity as well. Hence, existing channels have to be strengthened and new supply mechanisms created.

The component also concentrates on establishing feed mills. Concentrated feed is necessary to improve the productivity. Currently, instead of this, rice bran and cake oil[9] in the ratio 1:1 is used (MBDA, 2014). The department also sources the district's requirements from the mills in nearby districts- Ri Bhoi, East Garo Hills, South West Garo Hills and East Khasi Hills (MBDA, 2014). Studies on advanced aquaculture states like Andhra Pradesh and Kerala highlighted that 5-6 feed mills in

each district of Meghalaya would be sufficient at the present stage, instead of setting up huge capacity units (MSAM, 2012). Despite this evaluation, the current target set in the district is only 2 feed mills, which are both under construction.[10] The small feed mills can be erected by progressive farmers or cooperatives in areas where fishing is widely practised, to meet the demand internally. Conversations with the farmers in various blocks of the district revealed that most do not engage in feeding, relying on natural food in the ponds like plankton, worms, leaves, etc. The administration should stress on the need to nourish the fishes by providing complete feed for intensification of aquaculture.

In addition to pre harvest needs, MSAM plans for setting up an aquatic laboratory for disease diagnosis and surveillance, water quality checks and so on. In the whole state, there are no labs for testing purposes, even though post harvest losses due to diseases are nearly 10-15 percent (FFDA, 2018). Under MSAM 2.0, a laboratory is proposed to be developed in MSFRTI and aquatic health centres in every district, for cost effective and standard quality certification system. In the absence of these measures, in West Khasi Hills, in case of diseases, the farmers are assisted in basic treatment including salt and potassium manganate baths. Provisions are made to equip Multiple Service Providers (MSPs) with tool kits to test the aquatic productivity[11] of the water, while visiting fish ponds of beneficiaries of various schemes.

Post harvest handling of fish, from catch to sale, is essential due to high perishability of the commodity. In MSAM 1.0, the need to construct/ upgrade a fish market in each district headquarters was recorded, to organise and regulate domestic markets. Till date, there are no cold storage facilities or ice plants in West Khasi Hills. Most fishers sell the catch from syntax tanks on the roadside or in the weekly markets (haats), where it is prone to insects, dirt, etc. Therefore, for hygienic handling and maintaining freshness, an effective cold supply chain interlinked with the value chain management is required. Since individual farmers cannot afford chilled storage units, the department could set up a facility and offer it to the farmers on service basis. Based on local requirements, under MSAM 2.0, the district department has proposed the construction of an ice plant (1 unit with a capacity of minimum 10 tonnes), offer assistance in setting up fish kiosks (in 2 areas based on feasibility studies) and promote the system of fish vending through motorcycles fitted with iceboxes (10 beneficiaries).[12] These propositions are aimed at preserving the unsold fish and preserving the quality, to ensure availability of fresh fish in the local markets and decrease imports from other states.

Conservation of Indigenous Fisheries Resources

Over the years, there has been a decline in the state's fish population, especially of indigenous mahseer, due to over fishing and exploitative fishing methods using dynamite, electric current, bleaching powder, etc (MBDA, 2014). Mini mission 3 was factored in to replenish the natural river systems and prevent further depletion of fishes, through strict conservation measures. District wide survey was conducted with the help of Fisheries Department in St Anthony's College, Shillong, for stock assessment, endangered species identification and selection of conservation sites. PRA tools, guidance from village authorities and local guides contributed to the initial

study. Sanctuaries are created in parts of rivers that have less probability of siltation and least human interference, to ensure natural breeding and feeding.

In West Khasi Hills, 4 fish sanctuaries were established during MSAM 1.0- Arsdad- Umnomlang River in Mawthadraishan block, Dorbar Shnong Nongwardo-Riangdo River in Mawshynrut block, Dorbar Shnong Umthied Bynther- Kynshi River in Mairang block and Dorbar Shnong Pormawlai- Riangdo River in Mawshynrut block. Further, 2 sites[13] under MSAM 2.0 and 3 sites[14] under Blue Revolution have been selected as potential sites for fish sanctuaries. Three of these locations will be developed as aqua tourism spots along with the Tourism, MBDA, PWD and Forestry departments. From within the local community, cooperative societies have been formed for preserving and maintaining the sanctuaries. For developing a revenue model, ticketing and eco friendly activities like camping, kayaking, etc have been permitted. Although, the number of volunteers for guarding is low and approach roads are not maintained in most spots. Further, to ensure active participation and involvement of the communities, various orientation workshops and public meetings are arranged for sensitising the masses and creating awareness regarding biodiversity conservation. These measures are coordinated by MBDA,[15] which also undertakes cleaning drives and media campaigns for stressing on the need for community participation.

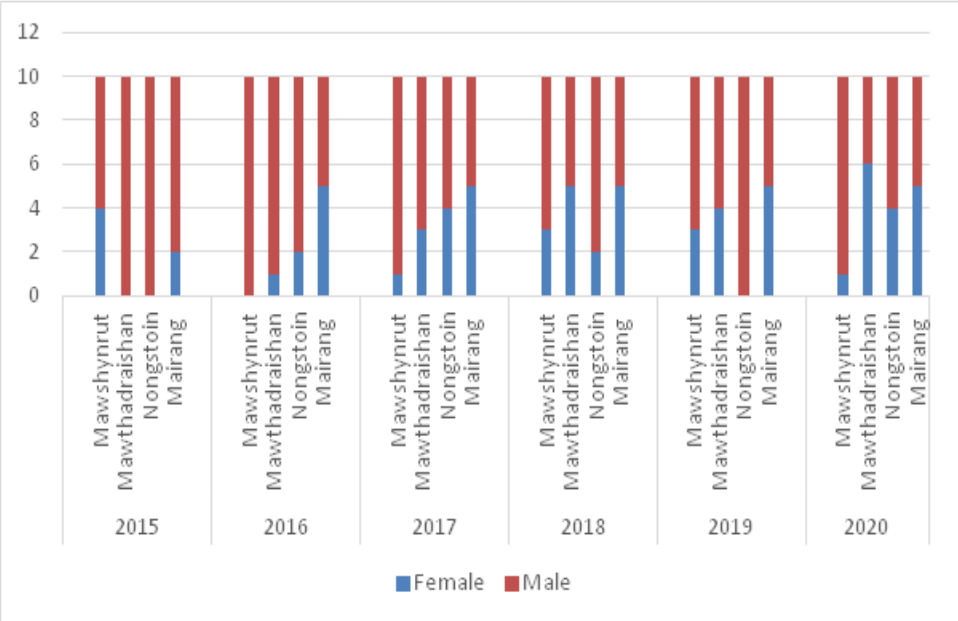
Ex situ conservation options are proposed under MSAM 2.0, for indigenous fish species which have both consumption and ornamental values (FFDA, 2018). Ten river ranching projects have been proposed,[16] wherein indigenous fish will be released into the rivers for increasing their population and replenishing other water bodies by releasing the fish seeds available from the site of river ranching. Overall, in addition to the investment of time and resources, there is a need to regularly collect information and develop a management regime to enforce regulations and monitor the efforts. In West Khasi Hills, the administration has rightly included the traditional power structures, than merely relying on formal management plans. However, all the existing measures are targeted at preventing fishing or destructive fishing practises. As the fishers are dependent on these resources, for eliminating future conflicts and striking a balance between conservation and livelihoods, a mechanism should be developed to identify the fishing capacity that is commensurate with sustainable resource usage. Regulative measures to prevent fishing during breeding season and extraction of juveniles could also be introduced.

Capacity Building and Human Resource Development

The mini mission aims at building the capabilities of various stakeholders and creating a sound training infrastructure for this purpose. For this purpose, MSFRTI was set up in Mawpun, Ri Bho, and batches of framers from each district is trained twice a year. The training material is developed with the help of national institutes, covering modules and practical sessions on fish culture, hatchery management, seed production, disease management and marketing of produce.

Every year, a batch of 40 fish farmers are selected, 10 from each block, to be trained from MSFRTI. The figure reveals that the number of female trainees are very low, occasionally zero from some blocks. Interesting, since 2016, equal number of men and women have been selected for attending the training from Mairang. As

Figure 3: Trainees from West Khasi Hills trained in MSFRTI



almost 80 percent of the beneficiaries of pond construction[18] schemes are women, there is a need to motivate more female fishers to undergo training. In most cases, women are discouraged from attending the training since it is conducted in a different district. This highlights the need for conducting the training locally, in areas where a number of farmers are engaged in aquaculture. Currently, block level training on intensive aquaculture is conducted by the departments in community halls. These platforms are also used to discuss the main issues and challenges faced by the fishers. Despite regular such events, the issues raised remain the same (and not solved)- training without practical sessions are not helpful, need to decrease minimum water area for availing schemes, fish seed and feed shortages, and so on. The staff from the department conducts demonstrations in the fields scientific aquaculture to increase production. However, the number of such training sessions are limited and reaches only a few. In essence, there is a need for offering courses at the village level, which would require an increase in the number of trainers and field staff. As of November 2020, there are only 2 MSPs[19] in each block. Catering to the specific requirements of the fish farmer, in terms of necessary information, skill development and such, is vital to bridge the gap between the fishers and the department, and promote aquaculture as a form a livelihood than just a means of alternate income. Towards the end of August, a training hall was inaugurated in Nongstoin, with hostel facilities, a small hatchery and demonstration ponds. Many stress that most of the people currently engaged in aquaculture are in Mawshynrut, which remains disconnected from Nongstoin due to poor road conditions. Given warmer climate, the fish cycles are faster towards the northern side of the district. Therefore, there is a need to set up a fish farm cum training centre in Mawyshynrut as well.

Fish farmers and potential fishers are taken occasional for training modules on ornamental fisheries, health management, feed formulation, composite fish culture, etc, conducted at the Directorate of Fisheries in Shillong. A few are also selected to attend similar sessions organised by Fisheries Institutes in nearby states. In addition to this, the state coordinates exposure visits for Officers, MSPs and fish farmers to premier institutes in Kochi, Bhubaneswar, Kolkata and Hyderabad.[20] The fishers who have been on these visits have reportedly been remarkably performing better and undertaking initiatives like composite fish culture, integrated farm cum fishing, etc. Appallingly, no female fishers have been on exposure visits from West Khasi Hills till date. Under the mission, entrepreneurs interested in setting up enterprises producing quality seed/ fingerlings, operating FRP hatcheries, breeding and culturing ornamental fishes in aquarium tanks, and producing seeds are provided necessary skill training (FFDA, 2018). From the district, only 1 for fingerling production and 2 for operating hatcheries have availed this feature so far. For improving the production, ancillary activities should be equally promoted. These viable opportunities could be advertised through village headmen, VEC secretaries and so on, to encourage more individuals to part take in these venues.

Emerging Opportunities in Fisheries Sector

Fisheries offer various means for income generation. Innovative and sustainable practices to tap into the potentials of aquaculture related activities are promoted under mini mission 5. In general, the mission looks at adding recreational value to fisheries, culturing new species, and developing emerging trends within the sector (MBDA, 2014). However, each district have evolved its own plan of action to diversify the approach towards livelihood opportunities and employment generation in the fisheries, specific to its geographic and agro-climatic conditions.

The three aqua parks erected under MSAM 1.0 (in other districts) have developed the localities into tourism hubs. West Khasi Hills has proposed the establishment of two aqua parks since 2015. While the parks are yet to be opened, it has been decided that maintenance and management will be through local cooperatives/ NGOs/ societies. Although a few trainees attended courses on ornamental fishery in all levels including production, breeding, marketing and conservation, there are no ornamental fish farms in the district. Overall, despite the immense entrepreneurial and export capabilities, the breeding and rearing of this fish category remains unexplored.

For introducing polyculture system in the district, the administration has proposed growing carnivorous Chital fish along with Tilapia in freshwater. As opposed to usual species that cost between Rs 100-300, Chital fetches Rs 600-800 per kg. The species has also recorded higher growth rate. With an estimated cost of Rs 11.1 lakhs, 4 projects have been planned and individual farmers/farmer groups invited for undertaking these. Although multiple applications have come in, beneficiaries have not been selected yet. Pilots on cultivation of freshwater prawn was suggested under MSAM 1.0. The species Scampi, found in inland freshwater, was selected as it has high resistance to diseases and is suitable for cultivation in tropical and sub tropical climates. The district has not initiated any measures towards this, even with 60 percent guaranteed subsidy assistance and high demand for prawns.[21]

Fish produce is highly perishable. Processing will enhance the shelf life, reduce wastage and add value to the products sold. Moreover, processed food items like canned and frozen fish are increasingly demanded due to changing lifestyle. Local market is accustomed to fermented fish, fish pickle, and other processed products as well. As fish processing has an existing market, interested individuals should be supported to set up processing units. In West Khasi Hills, a fish fermentation unit is being constructed in Mairang.[22] This will also create ample opportunities for subsidiary activities like transportation, packing, storage units, food and beverages, etc.

Angling is one of the main hobbies of the people in the district. With numerous rivers and streams, the district has the potential to attract angling enthusiasts and develop sport fishery. It will add to the local economy, boosting hotels, restaurants, lodges, fishery equipment shops, etc along the angling hotspots. Promotion of sport fisheries could be taken jointly with the tourism or sports departments. In spite of multiple angling competitions conducted around the year, the scope of enhancing this potential is not explored.

Conclusion

Fisheries have been recognised as a priority sector as it has the capacity to improve income of the people, generate employment, increase food and financial security, while also providing less labour oriented sources of income, especially for women, through ancillary activities like net making, fish pickling, fish drying, and so on. To develop the nascent sector, Meghalaya introduced the MSAM, tackling issues from area expansion and capacity building to inputs availability and building essential infrastructure. In West Khasi Hills, the mission has successfully managed to shift fishing to fish farming, attracting many individuals to take up aquaculture as the primary activity. Although the district is not yet capable of meeting its demand, the area under aquaculture has significantly improved. However, the fish yield is not stable and the seed production has been decreasing since 2017. Additionally, in most cases, fish farmers rely entirely on natural feed, due to which the input to output ratio remains low. While training has been imparted to improve the productivity and encourage innovative practices, the impact of these sessions has not penetrated throughout the district. To enhance the efficiency and capabilities of all, there is a need for village level training, at least in identified cluster regions. In the absence of departmental staff, farmer-to-farmer training should be introduced. Progressive farmers, especially those who have been on exposure trips, could engage with local communities for promoting intensified aquaculture.

MSAM rightly emphasises the domestic market. Even though fisheries and related activities have increasing export potential, the mission aims at meeting the demand of the local and not the external economy. Despite this, the district has not achieved self sufficiency, and is dependent on imports for meeting the demand. Reportedly, due to the lack of storage facilities, post harvest loss averages to 15 percent of the produce. Hence, creating necessary infrastructure to support the development of fisheries is imperative, to prevent spoilage and satisfy the unmet demand. To close the demand supply gap, MSAM strives towards increasing the area

under aquaculture, mainly through pond construction. To sustainably manage the resources and conserve the aquatic biodiversity, measures to preserve the species and ensure responsible fishing have also be enforced. Towards this, multiple sanctuaries have been set up in West Khasi Hills. These regions will be developed at tourist hubs, generating further employment. Innovative practices and emerging trends in fisheries like food processing, ornamental fish farming, etc are also promoted to stimulate local entrepreneurship.

Currently, small scale operations dominate aquaculture in West Khasi Hills. Individual's land size and resources often limit their opportunities, which to a large extent can be overcome by collectivisation. Through economies of scale and better marketability, forming associations will strengthen, empower and sustain the smaller fishers. However, MSAM neither promotes such formations nor does it create an enabling environment for the same. A strong legislative support/ organisation is necessary to achieve the goals of collaborative efforts since it requires regular interactions and negotiations with various stakeholders. In the absence of such fishing associations, the fish farmers lack bargaining power with input suppliers and produce consumers, have poor market linkages, etc (Hasan, Bueno, & Corner, 2020). As mentioned above, nost of those engaged in aquaculture within the district are small fish farmers. This highlights the importance and vulnerability of the sector. Despite this, MSAM does not introduce any mechanisms for protecting the rights and interests of the stakeholders. Insurance for rejected produce, credit supply and subsidised inputs to landless fishers, etc are some measures which needs to be considered. Overall, the strategies under MSAM 2.0 targeting accelerated development of aquaculture, seemingly follows a commodity centric and not a human centric approach. In other words, the design covers only economic and environmental aspects, failing to protect the fish farmers at the social level. Therefore, mission needs to re-evaluate its approach, to safeguard the welfare of the fishers.

Acknowledgements

This report is incomplete without acknowledging the contribution of many stakeholders - both inside and outside the Government. Foremost, the Deputy Commissioner, West Khasi Hills for proactively supporting the study. Secondly, Department of Fisheries and the field staff for providing the necessary inputs and data. Finally, the fishers and beneficiaries of various schemes, who gave their time and opinions in this labourious process.

Endnotes

[1] Blue Revolution is a centrally sponsored scheme under Ministry of Agriculture and Farmers Welfare, by converging all the ongoing schemes under National Fisheries Development Board, for integrated development and management of fisheries that ensures increased production, modernisation, food and nutritional safety, employment, export earnings and welfare of the fishers.

[2] TPS was a credit linked scheme, operational from2005 to 2011, to expand the area under fisheries. Under TPS, beneficiaries were offered 75 percent subsidy and 25

percent bank loan for the construction of ponds.

[3] Also known as the Neel Kranti mission, it was launched in 1985-90 (along with the 7th Five Year Plan) to develop, manage and promote aquaculture to double farmer's income. It was later restructured to combine all the existing activities of NFDB-coordinate central and state activities, improve production, processing, transport, storage and marketing, etc.

[4] In Marine fisheries, the responsibility is shared between the centre and coastal states, as regulation and management of the the sea beyond 12 nautical miles is with the centre.

[5] Tangible benefits- improved fish production, enhanced income, etc; Intangible benefits- impounding run off water, better nutrition, etc.

[6] All functional schemes include- SPA-I, VCM, RKVY Corpus Fund, SPA-II, IBDLP, RKVY, State Plan, MSAM, RKVY Mission Fingerlings and Blue revolution.

[7] Comparatively warmer, Mawshynrut is the most conducive block for fisheries. The hatchery was set up in this region as the connectivity to the block is limited due to poor road conditions. Nongstoin is the district headquarters and the hatchery was recently set up in the newly inaugurated training hall.

[8] Developed by CIFA, Fabricated Reinforced Plastic (FRP) hatcheries are portable, less expensive means for seed production. It requires less space for installation and is suitable for small scale breeding with capacity of upto 1 million spawn of carps in one operation.

[9] These items are brought in from Assam and is freely available locally.

[10] The feed mills are currently being set up in Mawshynrut and Nongstoin. Porsohat in Nongstoin, is being developed as a training centre with an attached farm for meeting seed and feed requirement.

[11] This includes the temperature, dissolved oxygen, nutrients, pH level, etc.

[12] Out of all these proposals, only one fish retail outlet has been approved as of November, 2020.

[13] Nongshram Area IVCS- Riangdo River in Mawshynrut block and Madan Bynthre Community- Kynshi River in Mairang block.

[14] Nongkhnum Area Integrated Village Cooperative Society Limited, Synjuk Sordar Shnong and Siminaguri Village Dorbar.

[15] Community Led Landscape Management Project (CLLMP) is a WB supported project under the state government, implemented by MBDA. It aims at capacity building of the rural communities and traditional institutions for community led management of the natural resources in a systematic manner.

[16] The projects targets individual beneficiaries and the per unit cost is estimated to be Rs 50,000, which will be completely assisted. None has been set up so far.

[17] Coincidentally, the fisheries is headed by a woman in Mairang.

[18] The Khasi tribe follows the matrilineal system where land is passed onto daughters. As ownership is with women, most of the beneficiaries are women.

[19] Multiple Service Providers are trained staff for providing various fishery related services to the fishers.

[20] NIFPHATT in Kochi offers training in post harvest management, marketing and

fish processing, ICAR-CIFA in Bhubaneswar conducts training in freshwater aquaculture, ICAR-CIFRI arranges sessions on fish production and conservation practices, while NFDB in Hyderabad organises field visits to progressive fish farms in Andhra.

[21] In the whole state, only one pilot for freshwater prawn cultivation, Scampi along with common carps, was undertaken in Ri Bhoi district.

[22] Fermentation is popularly practiced in Mairang but in small scale.

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