

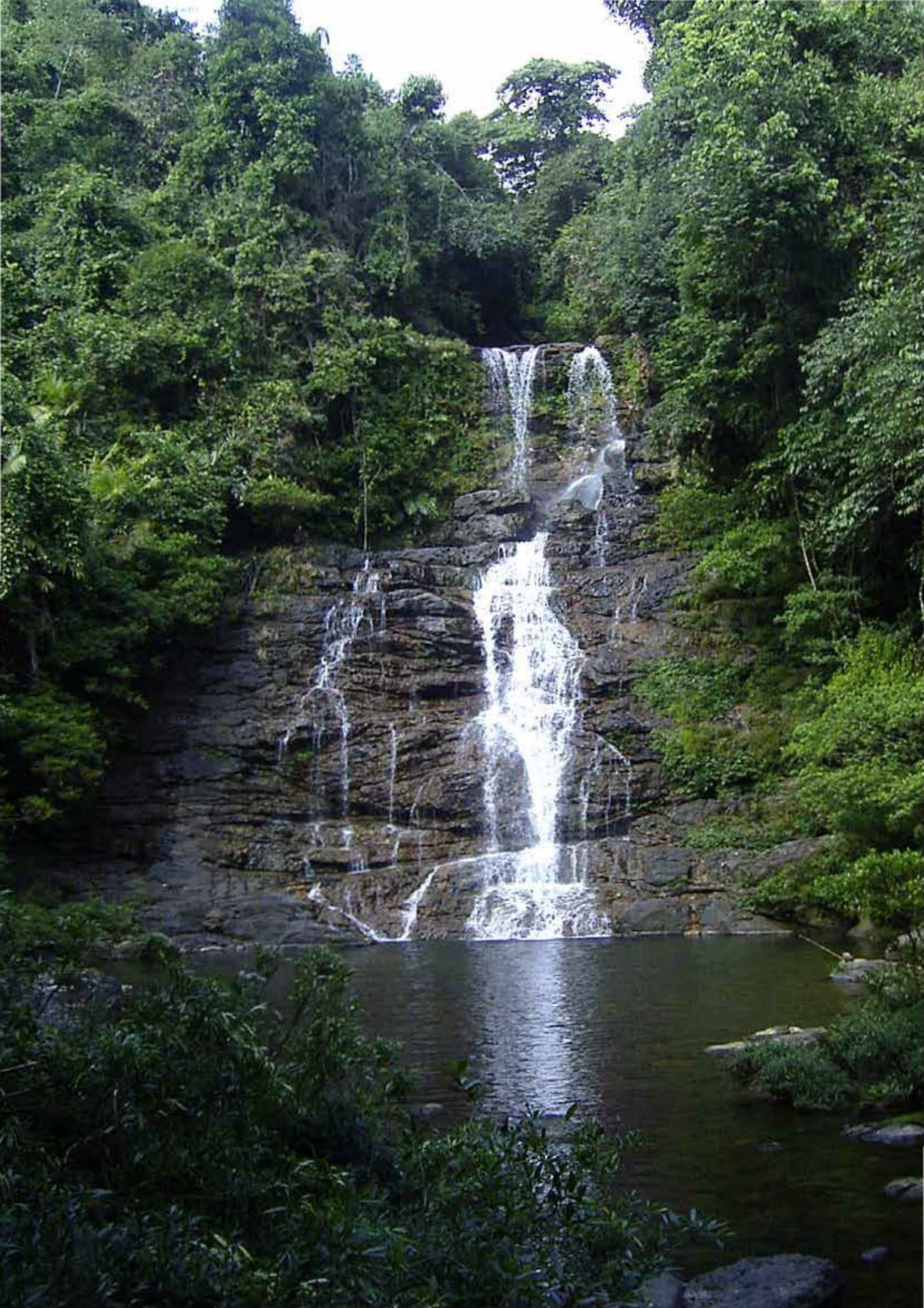


# In Conversation with People of Meghalaya

Aquaculture Mission









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## *The Programme*



# Meghalaya State Aquaculture Mission (MSAM)

-Source: Fisheries Dept. Meghalaya

Meghalaya is predominantly a fish consuming State, but the present supply of local fish is inadequate to meet the demand in the State. The internal demand for fish far outweighs the supply, making the State import fish from Andhra Pradesh. The total consumption in the State is estimated at 19,000 MT and the gap between the demand and supply is approximately about 14,500 MT.

Meghalaya, with its vast inland fishery resources in the form of rivers, reservoirs, lakes and ponds and an average rainfall of 1200 mm, offers tremendous scope for developing the fisheries sector, but lags behind in harnessing the potential of these natural resources. The available land in most parts of Meghalaya is uneven in terrain which makes it somewhat difficult to develop fisheries on commercial lines. However, rain water can be impounded in small ponds for the production of fish and inland fisheries therefore, offering a potential that can be successfully exploited by the people of the state. Furthermore, creation of additional water area for fish culture will lead to a transformation in the rural economy and improve the livelihoods of the poor tremendously.

The Government of Meghalaya has identified fisheries as a key sector and decided to assist the people to develop fish ponds. It has launched the Meghalaya State Aquaculture Mission (MSAM) co-terminus with the Twelfth Five Year Plan period (2012-13 to 2016-17). The development of fishery sector is a priority area in the planning process of the State Government to exploit the full potential of the sector which would help in increasing the supply as well as ensuring the economic prosperity and livelihood security of the rural poor in the State.

Another scheme was announced by the Government of Meghalaya in 2005, named 'Thousand Pond Scheme' (TPS). This innovative scheme with very limited investments had brought in about 500 hectares of additional water area under fisheries and provided assistance to 2,336 fish farmers over a six year period. A credit of Rs. 17 crore had been advanced to the farmers through this scheme. A small beginning had been made, though the scheme did not provide for any forward and backward linkages. Even when the scheme could be termed as a success, the impact of the TPS had been limited basically because it was implemented in a schematic mode and therefore, the implementation process was very laborious and time-taking.

After studying the effects and results of TPS, the Fisheries Department, Government of Meghalaya, decided to revamp the scheme to make it more dynamic. A new scheme was formulated to address the challenges and gaps as observed in the TPS scheme and the footprint of the new scheme included mechanism to cater to the forward and backward linkages in the sector.

On 5th of March, 2012, Chief Minister of Meghalaya, Shri Mukul Sangma launched Meghalaya State Aquaculture mission. Scaling up the earlier TPS scheme several folds and having a mission mode approach, the MSAM aims to tackle the present imbalance in demand and supply in two ways – enhancement of the productivity of the existing water bodies, and construction of new ponds. The latter requires the initiative of small land holders whose land is suitable for construction of fish ponds. The present extent of land under fish ponds is estimated to be about 2500 hectares, and there is a massive need to expand it manifold.

*The MSAM has the following objectives:*

- Development of existing water bodies and creation of additional water area for large scale fish production.
- Reclamation/rehabilitation of marshy and swampy lands and Beels and other water area and developing them into modern fish production system.
- Creation of mass awareness, capacity building, exposure training and skill development of all the stakeholders, for long term sustainability of fishery sector.
- Conservation of native, endangered and traditional species (Mahseer and Chocolate Mahseer) of Meghalaya and developing breeding farms of commercially potential species on a large scale.
- Introduce and promote ornamental fisheries as also diversify the current range, so as to capture several emerging opportunities in the aquaculture sector viz., fresh water scampi culture, etc.
- Enhancement of water storage capacity through development of small water areas and microclimate to sustain agricultural production
- Extend all technical support at the door step of the stakeholders.

Given the wide canvass of the Aquaculture Mission, some mini-missions and components have been formulated to narrow down and focus on the particular aspects of the Mission. Mini Mission-I is “Area and Productivity Expansion”, which will be achieved through four sub components.

Component I is “Individual Pond Construction”, and is crucial because it has implications not only on production enhancement but also for poverty alleviation, employment generation and provision of nutritional security. All the persons who are interested to take up fishing and have land of at least 0.1 hectare or 1000 square meters are being provided financial support in terms of assistance and loan for the construction of pond and maintenance in the first year.

Component II is the “Community Pond Construction”. This component emphasises on collective action and technology adoption. Economies of scale in fish production can be realised in this component because each community pond has at least a size of two hectares. The citizens of Meghalaya have strong community bonds and participate in cooperative management of community resources and the State has a large number of community fish ponds on common lands, moreover there are a large number of water bodies on common lands which can be further utilised for community fish farming. Development

of these water bodies can enhance fish production. The minimum area for a community pond has to be 0.5 ha. Secondly, financial support for these ponds is being provided at a lower rate as the community is expected to provide a few services on its own.

Component III is the development of marshy areas, swampy areas and Beels. This is important because it helps in utilising the existing unutilised land and water resources in the form of low lying areas. Capital as well as input requirement is low and return is high in the development of these areas. It also improves the ground water potential at a low cost.

Component IV is “Reservoir Fishery Development”. This Component is very efficient because it does not require any capital investment. The implementation of this Component requires convergence with other schemes especially of Water Resources and Soil and Water Conservation Departments.

Though a lot of fishing activity is presently active in the State, the economic model is one of low inputs and low output. Further, in the absence of development of proper market for the inputs, farmers have to depend upon other States for seed which is resulting in heavy mortality. The poor quality of seed combined with less feed results in low growth of fish. The average weight of a fish is only 0.3 to 0.4 kg in the State as against 1 to 2 kg in other states.



Mini-Mission II is “Critical Infrastructure Development” and precisely addresses the issues highlighted above. It has seven Components. “Fish Seed Production” component deals with the development of hatcheries and fish seed production as per the requirement of the farmers. Hatcheries will be developed under public sector and/or public and private partnership (PPP). “Fish Feed Production” component deals with setting up of feed mills and/or procuring quality feed at a low price from other areas. “Disease Management” component analyses the diseases pattern and mortality of the seed supplied and suggests remedial measures. “Soil and Water Testing” component focuses on the variation in the growth of fish and its relationship with the quality of water, soil and climate. This component also has the agenda of suggesting the fish seed varieties suitable for the climate and experiences of progressive fish farmers. “Post-harvest Management” component examines the marketing needs of the fish farmers and provision of suitable infrastructure. The value chain management and processing activities is also being examined under this component. Strengthening of fishery cooperatives is the focus of a separate component known as “Fisheries Cooperatives”.

Establishment of sanctuaries for conservation of indigenous and endemic species is the focus of Mini-Mission III. The conditions of existing sanctuaries are being studied and based on the result, the improvement of the existing ones and development of the new ones

is being targeted under this Mini Mission.

The most important aspect for the success of MSAM is capacity building of farmers as well as officials, multi-service providers, co-operators etc. Mass mobilisation campaigns are needed to build awareness among the people about the opportunities available for them. Mini-Mission IV, known as “Capacity Building”, is intended for this purpose.

Two other aspects are equally critical for the success – awareness building among the masses and documentation of the success stories. These two require continuous effort in terms of media campaigns and publicity through posters, pamphlets, wall writings and cultural programmes. All these activities come under the purview of Mini Mission-V, known as “Mass Media Campaigns, Documentation and Outreach”.

Mini Mission-VI, “Emerging Opportunities in the Fisheries Sector” focuses on new opportunities that can be availed by the sector. Several opportunities like development of ornamental/aquarium fish, trout farming and fresh water prawn/scampi culture are emerging in this sector. Building up entrepreneurship in these areas is the focus of this component. The mission is also looking into development of aqua tourism and aqua parks in convergence with Tourism Department. Fish mela is another activity that the mini mission seeks to organise to create awareness among the fish farmers about the emerging opportunities.









# Area and Productivity Expansion

-Source: Fisheries Dept. Meghalaya

Expansion of fish production in the State to fill the wide and growing gap between demand and supply is the central focus of the Meghalaya State Aquaculture Mission. Demand projections indicate that the demand for fish will grow at an annual rate of 9.0 to 10.0 percent in the Twelfth and Thirteenth Plan periods. Area and Productivity Expansion Mini-Mission (MM-I) seeks to address this issue. It has two components – one is construction of new ponds, known as Area Expansion, and the other is availing the existing water resources for fish culture, known as Production Intensification.

Construction of new ponds will be taken up mostly on the individual lands. But some ponds will also be constructed on community lands if the community comes forward with land and also makes some contribution in the construction of pond by way of labour. Meghalaya has a large body of community lands and the recent

experience shows that fish ponds constructed on the village common lands are successful in achieving socio-economic development of the village, as also in harmonising the village communities.

The State has several water bodies in the form of marshy, swampy lands and beels which are under the control of the community. Fish production can be taken up in these lands if the community contributes their share in renovation and is also willing to maintain it afterwards. The State also has several water bodies in the form of reservoirs and lakes, though the water is primarily used for agriculture, which can also be used for the production of fish. These two production activities will intensify production on existing water bodies and hence, improve the productivity of the water bodies. The Mini Mission-I will utilise all these possibilities of production expansion.

*The activities of the MM-I can be divided into four sub-components:*

1. Construction of individual ponds
2. Construction of community ponds
3. Reclamation of swampy lands, marshy lands and beels
4. Development of Fisheries on reservoirs and lakes

Individual and community ponds are two activities that are oriented towards improving livelihood and poverty alleviation. While the component of community ponds also has the same impact as that of the individual ponds, it differs in terms of the scale as well as financial support extended by the State. Development of fisheries in marshy, swampy lands and beels and development of fisheries in reservoirs and lakes

are two activities that will expand fish production in the existing water area. In other words, expansion of production is achieved through productivity improvement. A developmental cost of all four components under this mini mission will be shared by the Government of Meghalaya in the form of assistance, through commercial banks in the form of loan and through community/individual contribution.

### Construction of Individual Fish Ponds

The main purpose of this activity is to utilise idle land, water and labour resources to provide supplementary income and employment to the rural poor along with nutritional security, and production enhancement. The Mission intends to expand the area under fish ponds by 10,000 hectares in five years on the lands of one lakh farmers.

Earth work is the major element in the construction of a pond and it is estimated that 600 man days are needed to dig a pond of 0.1 hectare area to a depth of 1.5 m. The recurring costs consist of seed, feed, health care, human labour for harvesting, besides lime, dung, chemical fertiliser and fishing equipment. In addition to the recurring cost for the first year, the cost of feeding in the second and third years is also included in the project cost to help the farmers in stabilising their income for three years as they have to repay the loan. There are some other costs like processing fee, insurance, transporting inputs and sign board to be incurred by the farmer. These costs will also be included in the project cost so that the burden on the farmers is reduced. The scheme envisages a back-ended assistance of 60 percent and a loan of 25 percent of the total cost. The remaining 15 percent is being contributed by the farmer.

### Construction of Community Fish Ponds

The people of the State exhibit strong community bonds and culture of community management of village resources. This is evident from the earlier experience of the Department of Fisheries. The Department has created some community ponds in the past and their maintenance is rated as good even now. Mawpdang Community Pond, Jaud Community Pond, Lynciong Community, Khulia Community pond, Bonbudai Community Pond, Mawtneng Community Pond are few examples of such successful ponds. For instance, the Mawtneng Community Pond in Ri-Bhoi District is so efficiently managed that the revenue earned from the sale of fish is used for community needs like salary of teachers in the village schools. The total target for the community ponds is 500 hectares. Fishery Co-operative Societies and Multi Purpose Co-operative Societies are also being considered for engagement in the construction of community ponds. The same norms as prescribed for the community ponds are also applicable for the co-operative sector.

### Reclamation of Marshy, Swampy Areas and Beels

Marshy, swampy areas and Beels are natural and permanently water logged low lying areas with overgrowth of vegetation and abundant organic matter. These water bodies are being developed for fish production at a nominal input cost. But the capital cost is as high as in the case of individual and community ponds. These lands, managed by the communities, village authorities, Nokmas and Sirdars are being reclaimed and made suitable for fish production. After renovation of these water bodies, fingerlings have to be stocked. Fish grows in these water bodies without any provision of supplementary feed as a variety of biological feed is available. The Mission will renovate these water bodies and stock the fingerlings if the community is willing to take up the activity of stocking the fingerlings from the second year onwards and also protect the water body from deterioration.



## Stocking of Fingerlings in Reservoirs, Lakes and other smaller Water Bodies

The State has three important reservoirs namely Umiam, Kyrdekulai and Nongmahir. The Umiam reservoir is the largest of the three with an area of 500 hectares. The remaining two reservoirs together have an area of 160 hectares. The area under reservoirs comes to 650 hectares. Besides these three reservoirs, there are several lakes. The Department of Fisheries has identified 24 such lakes so far with a total area of 50 hectares spread over six districts. The total area under reservoirs and identified lakes comes to 700 hectares.

Fish production in the State can be enhanced merely by stocking fingerlings in these water bodies. It would be feasible to stock 2000 fingerlings per hectare as these water bodies are mainly meant for irrigation. Fingerlings stocked in these water bodies have to subsist on natural feeds. As this is the activity of the department and there is not much role for the community, this stocking will be continued in all the five years of the Mission. Assuming 40 percent mortality and average weight of 0.15 kg per fish, output per hectare will be 180 kg ( $0.6 \times 0.15 \times 2000$ ). The total output comes to 126.00 MT per year and 630 MT for five years

## Impact of Mini-Mission I: Area and Productivity Expansion (Upto – September 2014)

<i>Programmes/ activities</i>	<i>Nos. completed</i>	<i>Water area covered (in ha)</i>	<i>Remarks</i>
Construction of individual ponds of 0.1 ha size each	6920	692	Remaining projects in progress. The achievement is through the scheme SPA Value Chain, RKVY corpus fund 2010-11 & 2011-12
Construction of community ponds	39	26.5	Another 70 projects (approx.) will be covered during 2014-15. Field spot verification in progress



# Critical Infrastructure Development

-Source: Fisheries Dept. Meghalaya

Productivity per hectare of water area depends mainly on seed, feed and health care. The Mini-Mission II focuses on the provision of infrastructure needed for the development of new water area, besides bridging the existing gap. The infrastructure required can be classified into pre and post-harvest infrastructure. Seed, feed and health care are the items in pre-harvest infrastructure, and storage, transport and marketing are considered as post-harvest infrastructure. However, at the present stage of development, there is a need to create only some of the items of post-harvest infrastructure.

Expansion of seed production can be achieved in three ways viz., by up-grading the existing departmental hatcheries and establishment of private hatcheries with the support of the government. In recent times, portable hatcheries have been developed at CIFA, Bhubaneswar. These hatcheries will also be introduced in the State to encourage decentralised production of fingerlings.

At present, farmers are feeding rice bran and oil cake at low quantities. Other nutrients required for the fast growth of fish are missing in the feed. In order to cultivate the habit of feeding concentrates, a few small scale feed mills are being established in the private sector with the financial support of the government.

Lack of health care facilities is another constraint in improving the productivity in the fisheries sector. To cater to the need of providing health care two laboratories are being established in the State.

There are about 50 fishermen cooperatives in the State and most of them are in a dormant state. The Mission will strengthen and make them active. Besides this, the Mission also attempts to strengthen the Fish Farmers' Development Agency, the implementing agency of the activities of the Mission.







## Fish Seed Production

The expansion of area under 'The Thousand Pond Scheme' has increased the demand for fish seed in the state but seed production was not taken up under the Scheme. Therefore, farmers are compelled to get fingerlings from far off places and face the adverse consequences of high mortality.

As per departmental estimates the total demand for fingerling by the end of the Mission is expected

to reach 1,397.35 in a progressive manner over the 2012-2017 plan period. The major part of the demand (80 percent) would come from individual ponds, which are owned by the poor. Therefore, there is an urgent need to arrange the timely supply of seed, in the absence of which farmers may leave the activity. To achieve this, the existing supply channels have to be made active and new channels have to be created.

*Table: Estimated Year-wise Total Demand for Fingerlings (Lakhs)*

Year	Additional Demand	Total Demand
Base Year	-	190.35
2012-13	192.4	382.75
2013-14	222.4	605.15
2014-15	247.4	852.55
2015-16	267.4	1119.95
2016-17	277.4	1397.35

## Seed Production in Private Hatcheries

The Mission is supporting private entrepreneurs to take up fish seed production by establishing modern hatcheries and FRP portable hatcheries. For this, both financial and technical support is being provided. The topography of the land and economic conditions of the people do not permit establishment of large hatcheries. Hence, the project supports private hatcheries of only two hectares and the

entrepreneur has to bear the cost for any additional area. The project is supporting establishment of 15 hatcheries, each with a production capacity of 1 crore spawn. The estimated cost of each hatchery is Rs. 16 lakhs. Government is providing an assistance of 60 percent of the total cost and also arranging 25 percent as bank loan. The balance 15 per cent is to be invested by the entrepreneur as margin money.

## Establishment of Portable FRP Hatcheries in the Private Sector

The CIFA of Bhubaneswar has developed Fabricated Reinforcement Plastic (FRP) technology for Carp seed production in 2004 and has supplied 126 hatcheries to different states so far. Being smaller in size, it is easily transported. This technology is being introduced in Meghalaya through the Aquaculture Mission. Progressive fish farmers having a minimum water area of one hectare or SHGs or

Fishery Cooperative Societies are being encouraged to take up the scheme. Each hatchery has a production capacity of 30 lakh spawn, which gives 12 lakh fry and finally, 10 lakh fingerlings. The scheme aims to cover 77 beneficiaries. The scheme will provide 60 per cent government assistance and 25 per cent as bank loan. The balance amounting to 15 per cent has to be provided by the beneficiary as own contribution.







## *Fish Feed Production*

The Mission seeks to introduce concentrate feed in the State. Presently, feed is managed with the locally available rice bran and oil cake coming from Assam directly in the ratio of 1:1 and concentrate feed is not used. When the Mission is expanding the area four times the present area, there will certainly be pressure on feed supply. The Mission is continuously monitoring the feed situation in the State and making necessary interventions. The feed requirement by the end of the fifth year amounts to about 15000 MT or 50 MT per day.

With this objective in mind, a quick study of feed mills is carried out by the department in Andhra Pradesh and Kerala, the two States where

aquaculture is in a highly advanced stage. After the study, the department decided that unit with huge capacity is not needed at this juncture and establishment of at least 5-6 feed mills in each district with 0.3 MT – 0.5 MT would suffice for the plan period. Provisions are being made to add one more feed mill every year in each district.

Since the feed mills are small (0.3 MT – 0.5 MT) therefore, management of the feed mills by women, SHGs or Fishery co-operatives as well as enterprising progressive farmers and individuals is being encouraged. Units are being encouraged to be established in villages where the fishing activity is high so that the demands are met internally.

## *Fish disease management: Establishment of Laboratories*

One of the major risks faced by a fish farmer is the occurrence of fish disease in ponds and tanks. Fry, fingerlings and even adult fish which get injured during transportation or even by rough handling are liable to fungal attack. With the large scale expansion of water area under the Mission it is possible that both parasitic and non-parasitic diseases will occur and the department should be ready to deal with them. Beside common diseases, large scale mortality

often occurs in rivers and streams. In the absence of testing laboratories, the actual cause of such mortality cannot be determined. Establishment of a well equipped laboratory is essential to deal with all such diseases. Two laboratories, one in Khasi Hills and one in Garo Hills, are being established. The centre is responsible for only providing the diagnostic services and the cost of medicines has to be borne by the farmers utilising the services.

## *Pre and Post Harvesting Infrastructure*

One of the goals of Aquaculture Mission is to increase productivity of pond culture by reducing post harvest losses. To achieve this, four types of interventions are needed.

1. Provision of proper tools and equipment.
2. Development of fish markets.
3. Introduction of processing technology.
4. Introduction of technologies developed by the research institutes.

### Tools, Kits, Nets and other Equipment

Due attention has to be given to the study of water of fish ponds as well as the study of bottom soil which plays an important role in the productivity of fish ponds. There are important physical and chemical properties of water influencing aquatic productivity such as temperature, pH, dissolved oxygen, turbidity, CO<sub>2</sub>, dissolved nutrients like nitrogen, phosphorus, potassium, calcium, magnesium, etc which have to be considered. So far, study of water and soil of the fish ponds by the fish farmers as well as by the Department of Fisheries are not properly pursued due to lack of necessary equipments like water-soil analyser kits.

The State Aquaculture Mission is addressing this problem by providing support for the purchase of necessary equipment and servicing of Multiple Service Providers (MSPs), who will visit the fish ponds under the Mission to test the water and soil conditions and take necessary steps for rectification. The MSPs will also be provided

with dragnets, which will be utilised for the trial netting to ensure proper growth of the fish. They are also used for bottom-raking, which not only promotes faster growth, but also prevents building up of any poisonous gas at the bottom.

For intensive fish farming and pellet feeding, there is a need for the use of pond aerators as an alternative to oxygenation of the pond. Aerators provide oxygen and also cause movement of water which allows fresh oxygen to enter and at the same time, toxic gases generated from decomposition of organic matter in the pond to escape. There are two types of aerators - fountain providing type and diffused type. As part of demonstration, both types of aerators are being procured for the progressive fish farmers as well as the departmental farms. The Mission is also strengthening the departmental farms by providing modern equipment like water-soil analyzer kits, dragnets, happas, hand nets, aerators, etc.



## Development of fish markets

### *Construction/Up-gradation of Markets at District Level*

There is a need to upgrade and modernise the existing fish markets and also construct new fish markets at each district headquarters of the state. Though domestic markets hold huge potential, they are highly unorganised and unregulated. Since shelf life of fish is limited and it is a highly perishable commodity, the key marketing intervention lies in hygienic handling and preservation of its quality and freshness from the stage of catch to the stage of marketing.

A hygienic fish market must have a compound and gate, sufficient parking space, internal roads with drainage, fish unloading platform, fish auction hall

with auction platforms, fish trading and cutting platforms with adequate water supply, drainage, wide walking space for consumers, washable floor and side walls, sufficient light, fans, exhaust fans, insect incinerator, ice and chilled storage facility, water and electricity supply, solid waste disposal system, effluent treatment system, etc. Contamination of fish with dirt, microbes and chemicals is also to be avoided. An effective and efficient cold supply chain management of fisheries product with a proper inter-linkage with value chain management to facilitate seamless movement of fisheries products would also be required.

### *Sale of fish in the rural markets*

The Aquaculture Mission intends to facilitate the sale of fresh fish in weekly markets 'haats' through Mobile Refrigerated Vans, which would procure the harvested fish from aquaculture units in and around the market in the early hours of the market day and ensure their sale to the villagers in hygienic condition.

One van will be supplied to each district in the third year of the Mission. The Refrigerated Vans, suitably designed for transportation of fish, will prevent spoilage of fish and the un-sold fish can be preserved overnight for sale the next day. Availability of fresh fish can help reduce import of fish from other states.

### *Establishing sale outlets in the selected centres of the districts*

It is observed that fish festivals, occasionally conducted in the State and District headquarters, draw huge crowds vying for fresh fish. In view of this high demand for fresh fish, the Aquaculture Mission proposes to set up 20 sale outlets in any of the feasible centres spread across all districts of the state, so that the fish harvested

from the ponds of the fish farmers can be sold at these outlets. The sale outlets will be constructed in the departmental campuses in both the district and sub-division, and one deep freezer will be installed in each outlet. A strategy will be worked out to ensure daily supply of fish from the fish farmers to these outlets.



## Introduction of processing technology

Fish processing technology plays an important role in post-harvest management, as spoilage of fish begins right from the moment it is caught and netted out of the water. Fish kept under

refrigeration will be fresh till it reaches the consumers. There are also other preservation technologies like freezing, sun-drying, salting, canning and fermentation which can be employed.

### *Establishment of MEGFISH units*

A variety of fish products such as fish cutlet, fish pakora, fish momo, fish chow and fish samosa can be prepared and marketed to increase consumption. Since urban consumers are conscious of brand names, the production can take place under the brand name “MEGFISH”. The Department of Fisheries, West Bengal has successfully created the brand “BENFISH”,

which has become popular among the consumers. It is proposed to establish four units of MEGFISH stalls in different parts of the State, particularly, in the urban areas. Entrepreneurs/ unemployed youth who are interested in taking up marketing will be assisted for selling these products, both through shops and mobile modes.

### *Establishing smoked fish small scale units*

Smoked fish is one of the delicacies of the people of the State, particularly in the Jaintia Hills and Garo Hills districts. There are two such units in the Jaintia Hills district at the level of cottage industry. Fresh fish are brought from the local markets to these processing units for preparation of products like “Kharang” and “Khyrwong”. These products are sold not only in the nearby local markets, but also in other distant markets in the State. There is a need for construction/ up-gradation of the smoking places, which would

include construction of proper and hygienic smoking sheds, improved furnaces, overhead water tanks and other facilities. It is proposed to establish 18 such small scale units spread across the state, in addition to upgrading the existing two units at Jaintia Hills. The smoking unit consists of two components – construction of smoking shed including furnace, smoking grills, over-head water tank and drain canal and construction of 0.05 hectare pond for rearing of catfish.

### *Dry fish fermentation*

In Meghalaya, traditional foods like “Tungtap” in Khasi Hills and “NA.kam” in Garo Hills are famous and fetch a high price. Fermentation has the added advantages of enhancing flavour, increasing digestibility and

improving nutritional value. At present, there are six dry fish fermentation centres in Khasi Hills. It is proposed to establish 20 more centres in the state by extending financial assistance to the small entrepreneurs.

## Technology Induction

Several technologies developed by research institutes across India are yet to be adopted in the field. These new technologies will be tested in the production systems of the farmers for technical feasibility, environmental, social and economic benefits. Demonstrations of these technologies will be conducted in the farmers' ponds. Technology related workshops are being organised for farmers and officers. One National Workshop

will be organised every year for deliberating on the possibilities and potential for inducing emerging technologies in the state. Technology transfer packages, including manuals, videos and model promotional campaigns, will be produced. Technology incubation centres for popularisation and commercialisation of technologies will be also examined in due course of time.



*Some of the major technologies to be tested and inducted are:*

- Diversification in aquaculture by bringing in more potential fish species and varied cultural systems in freshwater fish farming.
- Breeding and culture of high value fish species
- Ornamental fish breeding and farming
- Breeding and culture technologies for potential coldwater fish species
- Organic aqua farming
- Pen and cage culture technology in reservoirs and wetlands
- Technology for live feed organisms
- Fish health management
- Eco-friendly fishing technologies for harnessing sustainable fishery from the reservoirs
- Fishing equipments for harvest and post harvest operations

A few technology applications from the above list will be implemented in a phased manner.

## *Impact of Mini Mission II: Critical Infrastructure Development (Upto September 2014)*

To meet the fish seeds requirement through the additional coverage of water area under individual ponds, community ponds etc., Eco- Hatcheries, Fibre Re-enforced Plastic (FRP) are being set up across the state. Further, to meet the fish feed requirement in the state 7 (seven) “Fish Feed Mills” are being set- up – one in every District. Presently, 3 (three) Fish Feed Mills are being set-up. Detail as follows.

<i>Programmes / activities</i>	<i>Nos. completed / to be completed</i>	<i>Annual Target for fish seed production (Fingerlings)</i>	<i>Remarks</i>
Establishment of Eco-hatcheries in private sectors	12 nos. completed	24 lakh fingerlings from each hatcheries	Commercial fish seed production will commence from the next breeding season i.e. February – march 2015 onwards. All entrepreneurs have been trained at CIFA Bhubaneshwar and CIFRI Kolkatta
Fibre Re-inforced Plastic (FRP) hatcheries	14 nos. to be established - work in progress and targeted date of completion October 2014	10 lakh fingerlings from each hatcheries	Commercial fish seed production will commence from the next breeding season i.e. February – march 2015 onwards. All entrepreneurs have been trained at MSFR&TI, Mawpun and Digrichirring Fish Farm, Tura in Meghalaya
Establishment of fish feed mills in the private sector	3 nos. to be set up - work in progress and targeted date of completion October 2014	500 kg/day	Entrepreneurs have been trained at CIFA Bhubhaneshwar. Production will comprise of both grounded and pelleted feed to commence from Nov - Dec. 2014





# Establishing sanctuaries for conserving indigenous and endemic species

-Source: Fisheries Dept. Meghalaya

‘Chocolate mahaseer’ (*Neolissocheilus hexagonolepis*) followed by ‘Golden mahaseer’ (*Tor putitora*) are the two predominant indigenous species of Meghalaya. Of late, a significant decline has been observed in most of their natural habitats. Mass killing of brood fish and juveniles by the use of dynamite, bleaching powder, pesticides, local herbs, electric current and other destructive methods has been one of the major reasons for the

reduction of mahaseer population. The fish migrate upstream for spawning, feeding, and descend back after spawning. During both the phases of migration, the gravid and spent fish are killed due to adoption of illegal fishing methods. Their breeding ground comprising of stones, gravel, etc. have been replaced by large boulders, debris, silt, river pollution, resulting in destruction of spawning grounds of this group of fishes.

To save the species from further decline, it is the need of the hour to adopt strict conservation measures and this will be one of the major tasks of the “State Aquaculture Mission”. Conservation is important at least for four reasons viz.,

- The species indigenous to the state are the wealth of the state and they require to be preserved for posterity
- They are also highly valuable food fish
- They form a source of livelihood for many fishers
- They offer a great potential as sport fish for promotion of Aqua-tourism.

## Surveys for identifying the endangered species

For evolving a sound rehabilitation policy, surveys for identifying the endangered species, comprehensive information on fish resources, stock structure, production trends, natural habitat and exploitation pattern is being collected. The services of Programme Managers, in collaboration with the respective DEOs of the Department,

are being utilised for this purpose. Awareness programmes with the village authorities to brief them of the purpose of the survey are being conducted and the service of local guides utilised. The local people will also be approached to provide the necessary information about the available stock of the indigenous species.

## Media campaigns specific to conservation

People are being made aware of the importance of biodiversity in general and conservation of indigenous and endemic species in particular. Through the Aquaculture Mission, various components of mass media campaign are being intensively used to sensitise the people about its objectives. Throughout the state, public meetings, poster campaign, slogans, distribution of

pamphlet/leaflets, advertisement/press releases published in Khasi, Garo and English newspapers, press conference, press conducted tours, radio broadcasting, television telecast, outreach programme for mass mobilisation, competitions for school children, onstage/live campaign, newsletter, etc are also being conducted to create awareness on conservation.

## Orientation workshops for the villages with potential

Communities are the guardians of the rivers, streams, etc. of the state and it is only through their active participation and involvement that this programme will succeed. But a majority of people in the rural areas are yet to realise the importance of conservation. The knowledge on the need of conserving the biodiversity in general and aquatic life in particular can be disseminated to the village folk through orientation workshops. These workshops are being organised in the villages where

potential areas exist for taking up conservation activities. Experts from within the institution of state and from other reputed institutions viz. Directorate of Cold Water Fisheries Research, Bhimtal, CIFA, NFDB, ICAR, CIFRI, CIFT, etc. are being invited to participate and contribute. This is intended to enrich the knowledge, understanding of the rural folks on the importance of taking up conservation activities in rivers, streams, etc. within their respective villages.

## Development of the sanctuaries

Sanctuaries to be created under the Mission are for conservation of mahseer and other indigenous and endemic species of the state. The objective of such sanctuaries will be for enhancing and preserving aquatic biodiversity, provide breeding and feeding grounds, protect the species from genetic pollution, increasing the abundance of threatened fish species, restoration of the diminishing stock and meeting the expectation of the people of the state. Sanctuaries are also known to attract tourists which will eventually benefit the rural people and improve their livelihood conditions.

Creation of fish sanctuaries are being done in the deepest parts of the river having pockets of water pools, less probability of siltation, free from human interference, poaching, etc. Experts are being utilised for site selection and adequate

measures, such as marking the selected site with distinguishable symbols, are being taken up. Wherever necessary, small artificial dams, mini barrages are being constructed to raise the water level.

For protection, the River Guards of the state Department of Fisheries are being deployed to protect these sanctuaries. Villagers are also being encouraged to protect and provide for the upkeep and maintenance of these sanctuaries. In addition, local youths are being trained to act as watch and ward at strategically important sites, breeding pockets and confluences during the breeding or migration season of the fish. It is important to put a halt to the large scale killing during the migratory journey of the species, failing which all efforts to conserve the species would be in vain.





## Case Studies of Fish Sanctuary in Meghalaya

### *Amlayee Mahaseer Fish Sanctuary, Nongbareh (West Jaintia Hills District)*

It has been a practice of the indigenous tribals to go into the hills for group hunting, or descend to the Rivers and Streams for Community Fishing, using tuberous roots, barks and fruits of certain trees to poison the fish, once the harvesting of the major crop is over in December/January. In fact, this hobby is still practiced in some remote corners of the State, popularly known as “Shoh-Kha-ru” - and sometimes disputes arise between two neighbouring Villages over the ownership of the River.

Amlayee river was no exception. Nongbareh-rim and Nongbareh-lyntiar are two hamlets on either side of the river that disputed over the rights of community fishing. Even insecticides and pesticides were often used to kill the entire fauna of the river. But the Lyngdoh (traditional religious head) was a very far-sighted man. He saw the dangers of such over exploitation of natural resources. He, therefore, convinced both the communities of the importance to conserve the precious fish of the river, and decreed that nobody would be allowed to catch fish from the river and that the violators would be heavily fined. Resultantly the Mahaseers of Amlayee flourished. Amlayee Mahaseer Fish sanctuary came into

existence. It happened about 40 years ago when the concept of conservation of fish was not even heard.

The Amlayee Mahaseer Fish sanctuary is a classic example of micro-management and is located at Nongbareh Village under Amlarem Sub-Division, about 21 Km from the Sub-Divisional Headquarter Amlarem and can be reached by road. About 1.5 Km of this stream is being protected by the Village Durbar where Chocolate Mahaseer (*Neolissocheilus hexagonalepis*) has extensively populated, and swims along with the children. A small check dam was constructed across a part of the river. “The Amlayee River” originates from Khonglah village, covers a distance of 5 km from Khonglah Village to Nongbareh and meets the Umngot river. Brooders from this sanctuary are also taken for experimental research in breeding techniques by the ICAR and St. Anthony’s College Shillong. The best season to visit is during the month of October- November. In fact this is just one of the river Umngot sub-basins where more fascinating Mahaseer fish sanctuaries can be created with active participation of the people, for sport fishing in line with the concept of “Catch and release”.



### *Songkal Wari, Rombagre (West Garo Hills District)*

It is a fish sanctuary created in the river Simsang under West Garo Hills District. Its area is about 0.1 ha and a depth of about 4.5 m. It is densely populated by Chocolate Mahseer and other species of Mahseer. Initially, it was initiated by IFAD by forming a Natural Resource Management Group (NaRMG) to look after the eco-diversity of Rombagre Village and its surrounding areas in the year 2003-04. The Department of Fisheries, only helps them technically, and later on assisted them financially by way of giving incentives under the scheme “conservation & legislation of fish and fisheries”. The main objective of creating sanctuary is

to protect the decreasing population of indigenous species in the river and to create awareness among the community. Now, the Songkal Wari commonly known as Rombagre Fish sanctuary has achieved that. It has become the breeding place and fish has multiplied into thousands moreover it has also helped in increasing the fish population throughout the entire stretch of Simsang River. Songkal Wari has become the Tourist Spot and also it has set an example to other communities to follow a similar example in different locations and rivers. It is just because of Songkal Wari that many fish sanctuaries have come up in Garo Hills.

### *Wachi Wari (West Garo Hills District)*

It is also a fish sanctuary newly created in the Simsang River very near to Songkal Wari. Its area is about 0.1 ha and a depth of 2.5 m. The population of fish is almost as equal as Songkal

Wari. It is a picnic spot and the community is collecting fees whoever goes there for a picnic. People enjoy swimming along with the fishes and feeding them.

### *Asim Bibra Fish Sanctuary (East Garo Hills District)*

Chibok is the tributary of river Simsang and hence the hot spots for various aquatic fauna. The community through participatory mode has made resolution to conserve the aquatic hotspots and also took initiatives for catchment area development including strategic way of livelihood improvement. Various ‘wari’ - a sanctuary in local dialect do exist right from the origin of the river Chibok and an elder man from the village, Mr Jackariash R Marak, narrated that there are around 11 (eleven) such Community Conserved Areas namely Chiphot bibra, Rabdikwari, Miteramabata, Maktrakigol, Degasia, mandrang wari, Ringpleng wari, Kalbong, Dinran wari, Rongguang and Jakpigok.

For the prospect of sustaining livelihood, the community through a participatory mode on 3rd February 2007, under the umbrella of Village

Committee comprising of the Nokma, Sordar, Secretary, Accountant, Treasurer and 11 executive members, passed a resolution for sustainably conserving the Asim Bibra fish sanctuary. They have also restricted illegal method of fishing, and have taken steps in conserving the catchment areas. One tea stall has also been erected by the community for providing refreshment to the tourists and passerby.

There is also a procedure for proper management of yearly community fishing schedule. The area has about 146 household and every household usually contributes Rs. 20 per year to the Village Community pool which is further used during the community fishing event to meet the expenses of refreshment or other miscellaneous activities. The annual community fishing event is held in the month of March or April.



### *Deku Dobagre Fish Sanctuary (South Garo Hills District)*

To maintain the aquatic eco-system of the river water in precise terms and to preserve the biodiversity of the whole surrounding natural environment this fish preservation practice that has been brought forward by the community of Deku Dobagre village. Bugai River is one of the most famous rivers under the district of South Garo Hills which falls under the Chokpot Block. Deku Dobagre is a village in the Chokpot block with a population of approximately 260 inhabitants. Since 2008, with the help of the Nokma of the Deku Dobagre village, the Dokua Male SHG has taken the initiative to preserve fish in the Bugai river.

Conserving fish in this river also attracted the new SHGs, formed under the MRDS project, to join hands with the Dokua male SHG in conservation efforts. Singga Kucholsan SHG, Ritimkari Kucholsan SHG, Mikasal Kucholsan SHGs and Dokua Kucholsan SHG are bringing in new rules and regulations for protection. They have also managed to improve and extend the area of reserve in a more sustainable and feasible manner. Also, a Fish Sanctuary Management Committee has been formed to manage the fish reserve more efficiently. Thus, it is an attempt of the community to retain a healthy natural environment and to conserve their rich natural resources heritage. [Source MRDS]

### *Impact of MINI MISSION – III: Establishment of fish sanctuaries*

In order to conserve the indigenous and endemic species of the state, about 200 sanctuaries will be set up within 5 (five) years period. Presently, implementation of 54 fish sanctuaries is under progress

<i>Programmes /activities</i>	<i>Target for 5 years 2012-17</i>	<i>Progress of implementation till date</i>	<i>Remarks</i>
Establishment of fish sanctuaries	200	54 nos.	Targeted date for completion 31 Nov, 2014



# Capacity Building and Human Resource Development

-Source: Fisheries Dept. Meghalaya

The successful execution of the various components of the Aquaculture Mission calls for systematic building of the competencies of various stakeholders to the required degree. The Mission intends to enhance the capacities of human resources for aquaculture practices, viz., efficient management of hatcheries, fish seed production, ornamental fishery, fish production in ponds and tanks, disease management, fish feed production,

processing and marketing of fish, etc.

There are two main components of this Mini Mission - building the capacities of the stakeholders and creating/strengthening the training infrastructure. Apart from these two, it is also necessary to reward the achievements of both entrepreneurs as well as officials so as to motivate others.

## *Building the capacities of the stakeholders*

### Training and exposure visits for Officers

The Officers are being provided technical training on thematic topics:

- Hatchery management – CIFA, Bhubaneswar/ CIFRI, Barrackpore
- Feed technology – CIFA, Bhubaneswar
- Fish processing technology- CIFT, Cochin
- Ornamental fisheries- CIFA, Bhubaneswar
- Specialised training in cold water fisheries- NRC on Cold Water Fisheries at Bhimtal
- Fish Disease Management

Exposure visits outside the state are being organised for the officers and they are being exposed to the following technologies, so that they get an opportunity to see and learn.

- Aquaculture farms of progressive farmers and institutions in Andhra Pradesh
- Ornamental fish farms in West Bengal and Kerala
- Private hatcheries run by entrepreneurs in Andhra Pradesh and Kerala
- Fish feed mills in the private sector in Andhra Pradesh
- Organised and well managed Fish markets in Andhra Pradesh and West Bengal
- Visit to scientific institutions connected to ornamental fisheries

### Training and exposure visits for fish farmers

The farmers are being provided intensive training on the following:

- Intensive Aquaculture in ponds and tanks- CIFA, Bhubaneswar
- Hatchery management – CIFRI, Barrackpore and such other institutions



The farmers are also taken for an All India exposure trip covering institutions such as NRC for Cold water fisheries at Bhimtal, CIFRI, Barrackpur, CIFA, Bhubaneswar, CIFT, Cochin and also aquaculture farms, feed mills and hatcheries in Andhra Pradesh, West Bengal and Kerala.

### Training and exposure visit for Programme Managers

The Programme Managers under the Mission are also being provided with intensive short duration trainings, both within and outside the state on the technologies to be implemented through the Mission. The Programme Managers have to acquire the following skill sets for performing their functions under the Mission.

- Technical skills – relating to the technologies in the fisheries sector
- Training skills- in organizing trainings, training methods, evaluation of training
- Communication skills- interpersonal communication and communication in groups
- Documentation & Reporting skills- report preparation, writing success stories, preparing news reports and press releases
- Facilitation skills- organising farmer groups, participating civil society organisations and other stakeholders, participatory planning and management
- Project Management skills- related to planning, implementation and reporting of projects

### Training for Multi Service Providers

There is also scope for employing skilled workforce in the fisheries sector for providing various services to the fish farmers, which is referred to as Multiple Service Providers (MSPs). They are given hands-on training to attain the following skill sets:

- Testing the soil and water of the fish ponds using water-soil analyser kits, interpreting the results and providing guidance to the farmers.
- Trial netting, to record the growth of fish and data capture.
- Use of fishing equipments like happas, hand nets, aerators, etc.
- Monitoring of the Pre-stocking management of ponds, including pond treatment, liming, manuring, stocking of fish seeds, etc.
- Post stocking management including schedule of liming and manuring, raking, assessment of growth.
- Diagnosis of fish diseases and treatment, harvesting techniques
- Organising fishermen groups and developing fishery clusters
- Collecting data and generating beneficiary level reports as per the needs of the Aquaculture Mission

### Capacity building of Fishery Co-operators

As part of strengthening of Fishery Co-operative Societies, the members of Fishery Co-operative Societies are also being imparted training on Intensive Aquaculture, Ornamental Culture and

Installation of FRP hatcheries at CIFA, Bhubaneswar. They are also taken for All India exposure visits to expose them to the recent developments and the technologies related to the fisheries sector.

## Entrepreneurship development in the fisheries sector (Fishpreneurship development)

Progressive fish farmers and interested youth are being provided skill training for starting enterprises in the fisheries sector. Entrepreneurs in the following areas are being developed by the Mission.

### *Private economically viable fingerling producers-*

- Techniques of producing quality fish seeds (fingerlings)
- Operation and management of FRP hatcheries- fish breeding in field conditions, management and spawn production
- Management of nursery ponds, rearing ponds, stocking tanks, brood stock tanks, etc
- Practical tips on marketing, running small enterprise, availing credit and cash management

### *Private aquarium entrepreneurs –*

- Culture and breeding of ornamental fish
- Setting of aquarium tanks
- Practical tips on running small enterprise, credit and cash management, marketing.

### *Private feed producers –*

- Importance of quality feeds
- Components of fish feed- Feed compounders
- Formulation of good quality feeds
- Pelleted feeds- Floating pellets and sinking pellets
- Feeding method
- Feed storage
- Feed manufacturing equipments

## *Creating and strengthening training infrastructure*

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It is proposed to establish training centres with adequate facilities at all district headquarters. These training centres are to be equipped with one training hall – cum - dormitory for imparting training to the entrepreneurs, potential fish farmers of a particular district. So far, training hall at Nongpoh, Ri Bhoi District at a total cost of Rs 40 lakh is completed. Construction of training hall at Tura, West Garo hills is under progress and preliminary work for construction of 1 (one) training hall each at Nongstoin, West Khasi Hills and Jowai, West Jaintia Hills is under process.

## *Awards to fish farmers and incentives to departmental officers*

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The Government of Meghalaya has decided to institute “Awards for excellence in Fisheries Sector” to acknowledge, recognise and reward the extraordinary and innovative work done by the fish farmers and fisheries organisation in the state of Meghalaya. Maximum 11 (eleven) awards are to be given under the individual category @ one per district, and 3 awards will be given in the category of groups/organizations across the state. Steps for implementation of the scheme are under process.



## *Impact of Mini Mission IV: Capacity Building and Human Resource Development*

### *Meghalaya State Fisheries Research & Training Institute (MSFR&TI), Mawpun*

Capacity building and skill development of the stakeholders and provision of technical support for long term sustainability of fishery sector are some of the priorities of the Meghalaya State Aquaculture Mission (MSAM).

To achieve this objective, the state has established an exclusive Farmer's Training Institute, known as Meghalaya State Fisheries Research and Training Institute (MSFR&TI) at Mawpun, in Ri Bhoi District. The Institute was inaugurated on 2nd May, 2013 and 31 batches of farmers have been trained so far, covering more than 1000 farmers already.

Besides, other training programmes have also been conducted in this institution as follows:-

- Training of Ri Bhoi unemployed youth sponsored by Agriculture Dept.
- Training of entrepreneurs under FRP
- Trainees sponsored by Water Resources Dept.
- Trainees sponsored by Soil Conservation Dept.



# Mass Media Campaign, Documentation and Outreach

-Source: Fisheries Dept. Meghalaya

## Mass Mobilisation Campaigns

The Aquaculture Mission aims to mobilise the public perception through the medium of mass campaign in order to successfully publicise the goals, objectives, technical and financial support and their likely impact on socio-economic welfare of the rural people, to the target section of the Mission. In order to create public awareness, the mass media campaign would be used intensively by the Aquaculture Mission to sensitise people toward the fisheries sector.

## Scientific Workshops and Seminars

Workshops and Seminars are considered to be an important tool in helping the communication of technical components of the Mission. Organisation of several such workshops is being undertaken. Likewise, periodical review workshops with the experts from the various fields of fisheries, consisting of state officials and other functionaries of Aquaculture Mission are also being organised periodically to facilitate the up-gradation and dissemination of the fish production technologies, and to review the progress of the planned programmes.

## Interaction Meets

Interaction meets between the officials of the fisheries department and fish farmers is one of the ways of mobilising the public perception. These are being organised under Aquaculture Mission periodically at various locations in the state to provide an opportunity to the people to express their views on the various components of the Mission.

## Public Meetings

Public meetings are also being organised to make the people aware and deliberate in detail about the problems and come out with strategies to motivate the people at large for their active involvement in the conservation of biodiversity and ecosystem of the state.

## Mass Awareness and mobilisation

The outreach programmes for mass mobilisation include competitions for school children, fish Melas/ Exhibitions, Poster campaigns, Onstage/ Live campaign (dramas, street plays, songs and slogans) are also being organised throughout the state.



## Publicity through Mass Media Campaigns

Aquaculture Mission also intends to use both print and electronic media intensively for mass mobilisation of people about the state Aquaculture Mission, its goals and various activities through:

- Advertisements in News Papers
- Press conferences
- Press Conducted Tour
- Radio Broadcasting
- Television Telecast
- New Media Campaigns
- Website Development

## Documentation of Mission's Activities

Documentation of the proceedings of workshops/ seminars, goals and activities, technical components of the programmes, success stories of the Mission, media coverage, content notes, convergence notes and annual reports are the other important components of the mass mobilisation.

## *Impact of Mini Mission V: Mass Media Campaign, Documentation and Outreach*

### *Outreach Programme/ Fish Festival.*

State Aqua-Fest were organised during the month of November, 2013 at Shillong and Tura respectively followed by a Mini Fish Festival at Shillong during December, 2013.

During the Aqua-Fest 5.9 MT of table size fish were sold at Shillong and 5 MT at Tura followed by the sale of smoked fish, fish pickles, ornamental fishes etc.



### *Workshops, Departmental meetings etc.*

Till date 11 (eleven) Departmental meetings/workshops to review the progress on the implementation of MSAM schemes were held. These workshops also update the Department on the actual progress made in the field through spot verifications conducted by the Programme Managers in all districts of the state. Similarly, other issues concerning fishery development in the state, target for completion of schemes, future plan of action etc. in conformity with the objectives of the mission were discussed and decisions taken accordingly.

### *Inauguration of 1st pond constructed under MSAM*

Symbolic inauguration of the 1st pond constructed under MSAM are being organised in all the 11 (eleven) districts of the state. So far, such inaugurations have been held in all the 11 (eleven) Districts Hqts. of the state



Inauguration of the 1st pond constructed under MSAM at Mawtap Sohiong East Khasi Hills District

### MSAM Theme song

A theme song of the Meghalaya State Aquaculture Mission titled “Mission with a vision” composed by the office of the FFDA Shillong and sung by the Programme Managers FFDA was released by the Chief Secretary of Meghalaya Shri W.M.S Pariat on the 8th June, 2013. Apart from an appeal for conserving aquatic- biodiversity of the state, the message of the song is to capture public’s participation in achieving the objective of the MSAM i.e., “Dependence to self sufficiency”

Lyrics of the Theme song are reproduced below:

#### “MISSION WITH A VISION”

Lyrics: Shri. A.F.Syiem, Deputy CEO, FFDA, Shillong.

Sung by: Programme Managers of Fish Farmer Development Agency (FFDA) notified to implement the MSAM

1. A land of milk and honey,  
A land blessed with plenty,  
It doesn't make any sense,  
On others, still we depend.
2. The Fish that we eat,  
To reach us! It takes weeks,  
In spite of having a choice,  
Not willing to raise our voice.

#### Bridge

Poisoning and random killing,  
Mother earth is weeping,  
What a pity! A tragedy,  
Leaving behind a dead legacy.



#### Chorus:

It's time to stop!  
It's time to wake up!  
Move forward with a vision,  
Let's start with the Aqua Mission.

#### Spoken

Be not just a consumer!  
Be a producer!  
Dependence to self- sufficiency  
Turn this dream into reality.

3. Uplifting economy,  
It's Mission priority,  
Development a goal,  
Aqua Mission will play its role

#### Repeat Chorus

End

Fig: Theme song of the Aqua- mission “Mission with a Vision” sung by the Programme Managers FFDA.

### Registry of Potential Fish Farmers

A total of 37121 nos. of Potential Fish Farmers all over the State have registered through these various outreach campaigns with the Department. The details are as follows:-

Sl. No.	DISTRICT	No. of farmers Registered
1	East Khasi Hills	5901
2	Jaintia Hills	2662
3	West Khasi Hills	2254
4	Ri-Bhoi	5398
5	East Garo Hills	6906
6	West Garo Hills	11007
7	South Garo Hills	2993
TOTAL		37121



## *Aquafest - 2014*

-Source: MBDA Media Team

A day for “fish lovers, fish sellers and fish watchers” is how Shri K N Kumar, Principal Secretary (Fisheries) described the 2nd Meghalaya State Aqua Fest, 2014 organised at the premises of State Central Library on 22nd October, 2014 by the Department of Fisheries, Government of Meghalaya. The main aim of Aquafest - 2014 was to encourage the production and consumption of local fish produced by local fish farmers. Aquaculture is the best performing mission of all the missions undertaken under IBDLP programme so far. Till now about Rs. 75 crore have been invested for several activities relating to fisheries. Under the mission 7500 fish ponds have been supported and 10 fish ponds are created per day.

The idea behind organising the Aquafest is to promote and create awareness amongst the local population about the variety of local species, conserving the local population of fishes, showcasing new technology for fish breeding and feeding, connecting producers to sellers and exposure of local population to emerging opportunities in aquaculture sector.

The Chief Guest on the occasion was Shri A. L. Hek, Honourable Minister, Health & Family Welfare and Information Technology. In his inaugural address, Shri Hek said that “instead of buying fish from outside the state, which not only takes weeks to arrive but also hikes up the rate due to transportation, middle men and wholesalers before reaching the consumers, the local fish farmers should take the opportunity of harvesting their own fish. The Department of Fisheries along with the Aquaculture Mission is there to help fish farmers of the state”. Further elaborating about the need for Aquaculture Sector in the state Shri A. L. Hek mentioned that “the problem of unemployment can be solved if people, especially those in the rural areas, take up fish farming as one of their occupation.”

The Guest of Honour, Shri PBO Warjri, Chief Secretary, Government of Meghalaya, stressed on the need to look at emerging opportunities in the fisheries sector as a major area for future expansion and financial growth because “that is where the money lies”, he said. Shri RM Mishra, Principal Secretary, Planning Department and CEO, MBDA in his address, called the Aquaculture Mission, a Star Mission of IBDLP because it is under this mission that most of the success stories are created. “It is a well integrated program which includes financial inclusion and it is a platform that brings at par the urban and the rural people in such an event”, he said.

Awards were also presented to the successful entrepreneurs from all over the state under the Department of Fisheries. Students who won the drawing competitions from different schools including differently-abled students were also presented with certificates and cash prizes. A Catch and Release Angling Competition was earlier held on October 20, 2014 at Ward’s Lake as part of the activities for the Aquafest.

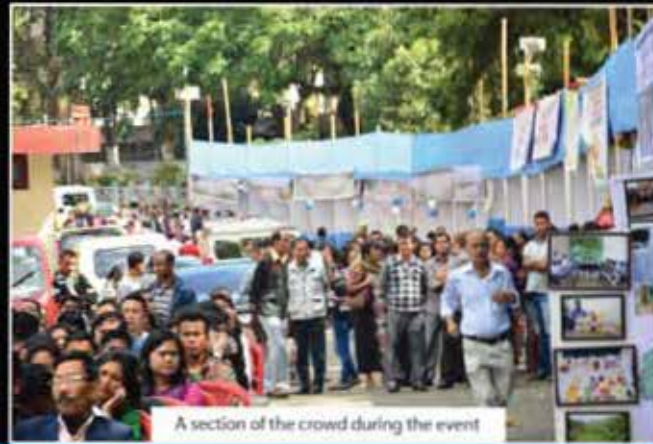
Overall the Aquafest was a huge success and a huge number of people gathered for the event. A lot of events and activities were organised as a part of the event which added colours to the entire fest. A lot of people to people interaction along with the dissemination of appropriate message was managed during the fest. After witnessing the huge turnout at the first and second edition of the Aquafest the Fisheries department is planning to organise more such fests at different locations across the state.





## Aquaculture Mission

From L to R: Shri K N Kumar (IAS) Principal Secretary (Fisheries); The Chief Guest Mr A L Hek, Minister of Health and Family Affairs & IT; Shri PBO Warji (IAS), Chief Secretary to the Govt of Meghalaya; Shri R M Mishra (IAS), CEO MBDA



A section of the crowd during the event

# MEGHALAYA'S



Shri K N Kumar (IAS) Principal Secretary (Fisheries Dept) giving a speech during the Aquafest 2014



The Theme Song of Fisheries Dept sung by the students of ST. Anthony's College



The CEO of MBDA and the Principal Secretary (Planning Dept) Shri R M Mishra (IAS) addressing the gathering

## 2<sup>nd</sup> State AquaFest 2014



Shri PBO Warji (IAS) Chief Secretary to the Govt of Meghalaya and the Guest of Honour making a speech during the Aquafest 2014



The Chief Guest and the Guest of Honour facilitating progressive farmers and School Students who won awards during the event



The Chief Guest of the Event Shri A L Hek Minister of Health and Family Welfare & IT making speech



## *Collaboration of Department of Fishery Science, St. Anthony's College with State Aqua-mission, Govt. of Meghalaya.*

-Source: St. Anthony's College, Shillong

The Department of Fishery Science has contributed immensely in development of fisheries sector of Meghalaya. The department has been functioning since 1984 and contributing towards human resource development in fisheries sector in the state. The main objective of the department is to develop human resources in the fisheries sector. The students are also encouraged for self-employment in the fisheries sector, as there is enough scope in the state. A good number of students of the department from across the region have already started fish farming in a scientific and professional way as their vocation. However, beside the self-employment, the students of the Department are eligible to study Master Degree in many of the recognised Universities in India and abroad. The department also provides farm advisory service to local fish farmers by way of advice regarding construction of farms, project formulation. The department also conducts training and extension programmes in different parts of Meghalaya.





Department of Fishery science has been actively participating in different programmes since the launch of the 'AquacultureMission' (2012-17)'by State Fisheries Department, Meghalaya. Department has been contributing to 'Aquaculture Mission' in the following ways:

- i. Graduates (BSc in Fishery Science) from the department are working as Programme managers under this mission.
- ii. Graduates (BSc in Fishery Science) from the department are working as Programme manager in The Meghalaya Co-operative Apex Bank under the mission.
- iii. Faculty members of Department of Fishery Science impart training as a resource person to the fish farmers organised by the state fisheries department in different districts of Meghalaya for development of fisheries in the stateunder aquaculture mission.
- iv. Faculty actively participates in different programmes organised by state fisheries department.
- v. Students take part actively in exhibitions, cultural activities etc. organised under 'Aquaculture Mission'.
- vi. The State fisheries department has given financial Assistance for the infrastructure development of Department of Fishery Science.
- vii. The Department of Fishery Science in collaboration with Department of Biotechnology of the college is working in a project entitled "Assessment of population structure and genetic diversity of Chocolate Mahseer (*Neolissochilus hexagonolepis*) in selected water bodies of Meghalaya" sanctioned by the state Fisheries Department.



# Emerging opportunities in the Fisheries Sector

-Source: Fisheries Dept. Meghalaya

There is an exclusive visionary component envisaged under the Mission for tapping the emerging opportunities in the fisheries sector and addressing them with scientific backing for further exploration. The potential for breeding and rearing of ornamental fish, trout farming, freshwater prawn culture, etc has to be fully exploited. Under the Mission, appropriate sites and structures of water bodies are being identified for promoting aqua tourism.

## Ornamental/aquarium fisheries

In aquaculture sector, the ornamental fish breeding and trade provides excellent opportunities as a non-food fishery activity for employment and income generation. It is totally environment-friendly, socially acceptable and involves low investment with short gestation period. It could be adapted as a small-scale backyard enterprise either full-time or part-time and ensures high profit.

In a bid to create employment opportunities for the local youth, it is felt that ornamental fisheries should be introduced under the State Aquaculture Mission.

### *Breeders & Rearers:*

This category comprises of entrepreneurs who culture, breed and rear various ornamental fish, both indigenous and exotic. On successful breeding, the fry are reared for 2 – 3 months and till they grow to a marketable size. They will then be sold to the retail shop or hobby centres.

### *Hobby/Retail Centres-cum-Aquarium manufacturing/Fabrication unit:*

Aquarium manufacturing is one of the important components of the trade, through which employment opportunities can be generated. Some youth, in a limited scale, can start manufacturing of aquarium and supply them through the hobby centres or directly to the hobbyist. Under the Mission, hobby centres-cum-aquarium manufacturing/ fabrication unit will be combined into one component and financial assistance will be extended to the entrepreneurs to improve this potential area. Apart from financial assistance, the breeders/rearers hobby/retail centres-cum-Aquarium manufacturers will also be sent for training at C.I.F.A, Bhubaneswar. They will be trained about the care and maintenance of aquarium, care of diseased fish, quarantine, etc. so that they can help the consumers in need.

### *Ornamental Fishery Park:*

The Meghalaya Government will also negotiate with MPEDA, to establish an ornamental fish park in the state of Meghalaya by making available the required land and other facilities.

### Trout Farming

The agro-climatic conditions of Meghalaya are very congenial for cold water aquaculture. It is reported that trout can be cultivated at lower elevations even up to 1000 MSL provided the optimum water quality is ensured. Trout farming in Meghalaya, even though is a challenging task, is one of the components covered under the Aquaculture Mission which is being taken up on experimental basis. The project is a joint venture between the Department of Fisheries, Meghalaya and Directorate of Coldwater Fisheries, Bhimtal, Uttarakhand. It is targeted that 9 projects will be covered in which financial assistance of 60% subsidy, 25% bank loan and 15% own contribution will be provided to the interested fish farmers having the requisite criteria for establishing such farms.

### Introduction of freshwater prawn culture

*Macrobrachium rosenbergii* also known as ‘Scampi’ is the largest of the Family Palaemonidae. It is found in most inland freshwater areas including lakes, rivers, swamps, irrigation ditches, canals and ponds as well as in estuarine areas. The species is suitable for cultivation in tropical and subtropical climates. Culture of scampi can be monoculture or mixed culture with carps. Being hardy in nature, it has better resistance against diseases compared to marine prawn. In view of its high market value, scampi culture is more preferred than culture of other fishes.

Under the Mission, polyculture of prawn with carps (replacing bottom feeders with fresh water prawns) will be taken up as an experiment in private sectors ranging from 0.1 ha (min.) to 0.3 ha (max.) who are interested in taking up the programme. 20 (twenty) projects are targeted to be taken up within 5 years (2012 – 2017). Assistance will be provided at 60% subsidy, 25% bank loan and 15% own contribution.

### Introduction of new Table species

As the position stands today, the traditional aquaculture in the state mainly relates to the culture and production of carps as the main crop. Diversification of the culture system with the non-conventional species (Freshwater prawn, *Tilapia mossambica*, *Notopterus chitala*, *Labeo gonius*, *Puntius sarana* and cat fishes) will be adopted. Diversification of fish species, activity and production will be an important contribution to ensure the sustainable development of aquaculture. It is also a tool for expansion of the sector responding to an ever changing nature of consumer demand. The State Aquaculture Mission will explore on experimental basis the following programmes for the introduction of new table species.

- Polyculture of Chital with *Tilapia*
- Polyculture of *Puntius sarana* with Carp
- Polyculture of *Labeo gonius* with Carp

### Culture of Magur (*C. batrachus*)

*Clarius batrachus* usually known as Magur is an air breathing fish well adapted to adverse ecological conditions. High production of the species through mono and polyculture operation can be obtained. *Clarius batrachus* is available in all parts of the state and can be cultured in small cemented ponds/backyard ponds and may be stocked at 50,000 – 70,000 nos. in one ha. water area. The fish attain a marketable size of 100 – 150 gms during



one year culture period and will be profitable to the farmers. The minimum water area eligible will be of 0.02 ha. to a maximum of 0.10 ha. It is being targeted that 100 ha. water area with 5000 units of 0.02 ha. each will be covered. Assistance of 60% subsidy, 25% bank loan and 15% own contribution will be provided to the interested entrepreneurs.

### Aqua Tourism/Aqua Park

The possibility of establishing two aqua parks, one in Khasi Hills and another in Garo Hills is being explored. The Nongkhnum island, located about 14 KM from Nongstoin in West Khasi Hills could be one location where aqua park can be established. It is considered as the biggest river island in Meghalaya, covering 20-25 sq.km. area. Langshiang falls, which is the third highest waterfalls in India is located about 10 KM from this island. The Naphak Lake could be a location in Garo Hills to establish the aqua park. Further survey of this particular lake and other existing lakes/locations in Garo Hills suitable for this purpose will be carried out by the Department in consultation with experts in this field.

### Sport Fisheries

In Meghalaya, angling is one of the main hobbies of the people. Presence of numerous rivers/streams offer an opportunity to all angling enthusiasts including men, women, young and old to travel to far off places in search of angling adventures. Development of sport fisheries will boost the economy of the state in which hotels, restaurants, lodges, sport fishing equipments shops, etc. will be established near these angling hotspots which will cater to the local anglers as well as tourists, thereby generating employment to the local youth directly or indirectly. Promoting of sport fisheries can be taken up jointly with Tourism Department.

There are numerous angling spots in Meghalaya one of which is Ranikor, a small town on the border of India and Bangladesh. It is one of the wild fishing spots in the state and located about 140 kms away from Shillong. The place, with its immense natural beauty and innumerable fresh water fish, offers a great opportunity to be converted into one of the angling paradises of the state. Other rivers like Simsang in Garo Hills, river Rilang, Khri, Umngot of Khasi and Jaintia Hills are some of the known sporting sites in Meghalaya where sporting events are organised from time to time.

## *Impact of Mini Mission VI: Emerging opportunities in the Fisheries Sector*

Aqua Tourism/ Aqua Parks: Through the Mission investments were made to develop about 20 aqua – parks / aqua- tourism in the state. Presently, 4 (four) are being taken up as follows. Implementation is under progress and some are targeted to be completed within 31 Dec. 2014.

		Rs. in lakhs
1	Development of Aqua Parks/ Tourism at Jaud East Khasi Hills	12.00
2	Development of aqua Parks/ Tourism at Phot-ja-ud, Mawkyrwat	25.00
3	Development of Aqua Parks/ Tourism at the Project of Kiew Irat, Ri-Bhoi District	25.00
4	Development of Aqua Parks/ Tourism at Chengga Benga , Betasing Block, South West Garo Hills	25.00

### *Mahaseer Eco-Park*

An initiative to set up a Mahaseer Eco Park with the support of the Directorate of Cold Water Fisheries and Research, Bhimtal is underway. As a 1st step, Mahaseer fingerlings in collaboration with Department of Cold Water Fisheries and Research Bhimtal have been released at Nongmahir Reservoir



# Convergence under the Aquaculture Mission

-Source: Fisheries Dept. Meghalaya

Convergence refers to the successful delivery of integrated services to the people, which either did not happen, or was separately provided, by different agencies of the government. It is expected that convergence of other programmes with State Aquaculture

Mission will enable better planning and effective investment in the fisheries sector. Convergence also brings synergy between different government programmes and/or schemes in terms of their planning, process and implementation.

## Scope for Convergence with Aquaculture Mission

Majority of the works relating to water catchments, water conservation and water management are handled by the Department of Water Resources (DoWR) and Department of Land Resources (DoLR) under the Ministry of Rural Development. As more than 50 per cent of MGNREGS works are related to water conservation, the possibility of convergence between MGNREGS and water conservation and watershed development programmes of DoWR and DoLR will certainly optimise the durability of the assets created under the programme. The ponds, tanks and other water bodies can be developed for several purposeful activities like irrigation and fisheries, to recharge the ground water table as also to provide livelihood options through Fisheries.

Water has been at the core of various developmental schemes initiated by the different ministries of the Government of India. Consequently, there

have been a number of schemes initiated by different line departments, which have their critical component, water conservation and water management. Watershed development projects are being implemented in different parts of the country under the programme, Integrated Wasteland Development Project (IWDP). A watershed project in a village is considered as an immensely suitable focal point for the various developmental activities to get converged.

Since sustainable aquaculture production revolves around water resource, water would be at the heart of the whole Mission, which has to be taken advantage of. The Mission will strive for creating sustainable water based livelihoods and for providing nutritional security for the people. The Mission will work with different line departments for a synergistic and sustainable use of water resource in the state of Meghalaya.

## Convergence of funds

Funds for similar works under different schemes will be converged to the extent possible. For instance, construction of water bodies under IWMP of Soil and Water Conservation Department and construction of water bodies by the Department of Water Resources. Programmes that allocate funds under the same head may be identified and such

programmes will be converged. For instance, six programmes of the Government of India have a budget for "Capacity development"- Watershed programme, MGNREGS, BRGF, NFSM, RKVY and NHM. A common training programme can be designed for these schemes and thus, the funds could be converged. An attempt of convergence in this direction is being done.



Provisions under certain schemes for gap filling will be utilised. For instance, BRGF will be used to bridge vital gaps in local infrastructure and other developmental requirements that are not being adequately met through existing funds. Similarly, VGF (viability gap funding) will be used for filling the gaps in funding. Infrastructure Gap Filling Fund could be created for local infrastructure development in similar lines as done by the Government of Tamil Nadu under RD & PR Department. It is proposed to create a corpus fund of Rs. 50 crores to fund convergence initiatives from other departments. Guidelines

for utilisation of the convergence will be issued by the Aquaculture Mission.

Convergence of funds for facilitation of ecological synergies under various schemes under NRM, NICRA (National Initiative on Climate Resilient Agriculture), Water Mission, etc will also be planned.

Convergence of funds from public sources and private agencies will be tapped for schemes related to tourism and construction of feed mills (for projects under PPP mode).

### Cases of convergence in vogue

There are cases of convergence taking place in the field, some by default and others by design. Some of the instances of convergence taking place are:

In Nongbareh village in Jaintia hills, where a small check dam was constructed across one part of the Amlaye river has been declared as a Fish Sanctuary by the people of that village. The endangered chocolate mahseer species is also being conserved and has now populated the entire stretch of the river.

One NGO (Rombagre Natural Management Resource group) has been striving in conserving the indigenous aquatic resources of the Simsang river (Garo hills) located on the Tura-Williamnagar road. It has become a popular tourist spot as the visitors passing through this place are fascinated with the fishes

being conserved. In the Rombagre Fish sanctuary, the view point platform and approach footpath were constructed by the Tourism department, and the revenue generated by way of entry fee is utilised for the maintenance of the reservoir. This is a good case of convergence of Tourism department with the Fisheries department in achieving the objective of mahseer conservation.

The Aquaculture Mission will jointly work with Department of Tourism and Department of Water Resources for conservation of fish species as well as establishing sanctuaries in the state. The Mission will also work in close collaboration with the DRDA and other development agencies related to convergence of activities, for which an amount of Rs. 50.00 crore is earmarked as Convergence Funds.



# Implementation Process

-Source: Fisheries Dept. Meghalaya

Institutions play an important role in the economic development of a state. The Aquaculture Mission needs support from two institutions namely, Fish Farmer Development Agency (FFDA) and Fishery Co-operative Societies (FCS). The former is the executing

agency and the latter is the people's institution for galvanising the farmers in marketing of inputs and output. Apart from the institutional support of these two, the mission requires all the support that it can garner from the civil society organisations.

## Fish Farmers' Development Agency (FFDA)

The Fish Farmers' Development Agency is an autonomous body created for the implementation of the Mission. The Minister in charge of Fisheries is the Chairman of the Agency. It has a two-tier system of organisational structure, one at the State level and other at the district level. The Director, Fisheries is the Chief Executive Officer (CEO) at the State level and the CEO is assisted by a Deputy Chief Executive Officer (DyCEO) in all technical as well as administrative matters.

At the District level, the Superintendent of Fisheries functions as the District Executive Officers (DEO) of the FFDA, is responsible for the implementation of the programmes under the Mission. From the stage of the Mobilisation till the completion of the projects, the role to be played by the DEOs and Sub-divisional EOs entails enrolment, liaising with the MCAB for credit transfers, execution, supervision, and record keeping as well as financial transfers, as

per the legal and financial frameworks. They are fully responsible for organising the prompt MIS data transfer as also the subsequent facilitation of the field monitoring and evaluation by the internal and external teams.

Two levels of contractual employees assist the DEO in addition to the Fishery Department's officers viz., the Sub-divisional Fishery Officers, Fishery Demonstrators, etc. The Programme Managers (PM), recruited on a contract basis from B.F.Sc/B.Sc. (Pisciculture) graduates assist the DEOs in implementing and monitoring the State Aquaculture Mission. The second cadre is the Multiple Service Providers (MSP). They will be selected from candidates with Class XII qualification. They will be used for reaching out to the farmers. There will be six MSPs per district and they have been imparted with the necessary training by the FFDA. Their appointments are purely contractual and co terminus with the Mission.

## Fishery Co-Operative Societies

The major focus of the mission is on the poor who cannot procure the necessary inputs and sell the output on their own. If the farmers get together and form a society, they can conduct the business enterprise more efficiently. Many

of the interventions of the Mission can be implemented through the co-operatives. There are a large number of fishery co-operatives which are in a dormant stage due to lack of activities. Since the Mission is introducing

area expansion on a large scale along with infrastructure development, technology induction and capacity building of the fish farmers, some of these activities can be entrusted to the co-operative sector and it becomes viable and vibrant. For availing assistance for pond construction, the

society must have a minimum lease period of ten years. For cooperatives with good track record, assistance would be provided for (a) creation of cooperative fish ponds (b) supply of portable FRP hatcheries (c) fish processing (d) technology induction (e) capacity building.

## Role of Civil Society

The approach of the Mission to engage the civil society players would have to be appropriate both in terms of the selection of the like-minded organisations as well as in the identification of the activities that are likely to facilitate maximum participation of the people and the community. The bridge that would be laid by the civil society with the broader community would have the net effect of enhancing the awareness levels, improving the quality of the delivery, eventually to lead to a better, more knowledgeable, and more sensitive society that will further the objectives espoused by the Aquaculture mission better. The process of adoption of technologies does not always get initiated spontaneously, and the services of a facilitator may

be required to catalyse the process. Civil society can take the role of facilitating the public to become active partners of the Mission.

Several meaningful interventions have been envisaged for the civil society in terms of the specific activities that would be broadly under the umbrella of mass awareness, mass mobilisation, specific campaigns for the conservation of the native and endemic species of the state and social audit of the implementation of the Mission. Working out the best intervention for the best organisation would be a very sophisticated exercise, to be done with great diligence and care, so as to ensure the best fit for the specific tasks envisaged.





## *The People*



## A short Question & Answer Session with Shri K.N. Kumar, Principal Secretary (Fisheries)

-Source: MBDA Media Team

*Question: What is the situation of Aquaculture Sector in the State? Has it improved after the implementation of Aquaculture Mission?*

As on 31.8.2014, 6818 fish farmers have become pond owners with the assistance provided under the Mission. Other 13,000 fish ponds are at various stages of completion. The fish from the completed ponds will be harvested by September, 2014. As of now, we are still dependent upon imports from other states. This demand-supply mismatch will continue for a few more years. By 2018 we will know what actually was the incremental increase in production, based on the number of ponds that would be completed by 2017. Even as a part of the current demand would be met through this production, we will still have to cover a lot of ground before the impact of the Mission is fully felt. While the demand is satiated to an extent, the supply will have to go up much more.

*Question: Since the state imports a majority of its fish from outside for consumption, what steps are being taken to make Meghalaya self reliant in fish production for domestic consumption?*

The Mission targets to create one lakh fish ponds of 0.1 ha. size. In other words, it will mean that 10,000 hectares of water area would be brought into fisheries. Even at a conservative estimate of 2 tons/hectare, it should mean a production of about 20,000 MTs by 2018. When that happens, we can get close to becoming self-sufficient. But there are some unknowns. Due to life style changes, changing consumer preferences and improved standards of living, the per capita demand for fresh fish too will increase with time, so we will have to factor for such demand increases as well. Self-sufficiency is something that we will certainly achieve, but it will be difficult precisely to pin-point a year.

*Question: What role is being played by the IBDLP programme in supporting the activities of the fisheries department?*

The IBDLP has given us the financial support for Mini Mission-I (Area Expansion) in 2013-14. Apart from that there is an overall mood improvement and entrepreneurial orientation in the state due to the activities of institutions like Meghalaya Institute of Entrepreneurship (MIE) and Meghalaya Institute of Governance(MIG) which have helped in creating a positive environment for promoting fisheries.

*Question: Any successful Government Scheme has to be people centric in its approach. What are the foreseeable benefits that the people of the state would gain from the success of Aquaculture Mission?*

The whole Mission is oriented toward financially empowering the people of the state. Apart from the additional incomes they will generate through the sale of fish, there are several intangibles too. An improvement in the status and self-esteem of the people, as also a feeling of general well-being, are the consequences of owning a fish pond. The health and education needs of the family members would now be better met. We cannot put value to a child continuing her education, or a sick mother receiving better health care, due to better financial situation of the family. We have uploaded several success stories on our website [www.msam.nic.in](http://www.msam.nic.in). They speak for themselves. The other significant benefit is in the improvement in the nutritional standards of the people. Fish provide high quality protein that is easily digestible. The negative health consequences of consuming high quantities of red meat would have been minimised to an extent.

*Question: Developing Infrastructure and creating market access is a key component of Aquaculture Mission, What has been done so far?*

We have addressed the infrastructural needs of the sector from the perspective of providing better 'seed' and better 'feed'. The hatcheries and the feed mills will reduce the dependency on the supplies from other states. We have planned 12 eco-hatcheries and 54 FRP hatcheries. As of now 5 eco-hatcheries have started producing fingerlings. Once the whole process is complete and all the hatcheries start producing, the impact would be immense. Same is the case with the Feed Mills. Three Feed Mills have been sanctioned and work is going on. Markets will develop both organically as well as through the state intervention. We will begin the work of creating markets in the 3rd year of the Mission once the production peaks and the need for physical infrastructure is felt.

*Question: Meghalaya is rich in local fish variety, what is the aquaculture mission doing in terms of protecting and conserving local fish variety?*

We have sanctioned 37 fish sanctuaries in the state. They are all under various stages of construction.

*Question: What new technologies are being brought in to the state to develop the aquaculture sector in the state?*

The Fibre Reinforced Plastic Technology (FRP) has been inducted, for setting up low cost hatcheries in the state. The FRP Technology was sourced from CIFA (Central Institute for Fresh Water Aquaculture), Bhubaneswar. 54 such FRPs are being set up in the whole state. Each FRP will produce about 10 lakh fingerlings.



*Question: Convergence with other missions and schemes is a key aspect of IBDLP programme, kindly explain how Aquaculture Mission is converging with other missions to create synergy between resources and finances?*

As of now, we have yet to begin the process of convergence with other Missions of the IBDLP. We see a potential for convergence with Water Mission and SMRs (Small Multipurpose Reservoirs) of the Water Resources department. We have already worked out convergence with MGNREGS for setting up community ponds and Water Resources Department for supply of inputs and capacity building of farmers, under the Water Plus programme.

*Question: What about the capacity building of the farmers?*

We have inaugurated the MSFRTI (Meghalaya State Fisheries Research & Training Institute) on 2.5.2013 and started the capacity building of farmers. So far 36 batches of 40 farmers each have been trained by the faculty of the MSFRTI. We have also trained FRP entrepreneurs, and the farmers sponsored by the Water Resources Department and SIRD & Water Conservation Department. Capacity building of the farmers is critical to the success of the Mission.

*Question: “Dependence to Self-Sufficiency” is the slogan of MSAM, in what time scale do you think Meghalaya will become Self Sufficient in fulfilling its domestic needs and would it be possible in the near future that state has enough surplus to start exporting fishes to other states?*

That is the dream. If all the resources become available, I visualize Meghalaya becoming self sufficient in fresh water fish production may be by 2020. The exports can begin even earlier, depending upon the market conditions and the entrepreneurship of the farmers. We have lot of work ahead of us, but we are not daunted by the magnitude of the challenge. The Department of Fisheries will achieve its target.



Shri K N Kumar with Hon'ble Chief Minister of Meghalaya Shri Mukul Sangma at the inauguration of the first Fish Pond under Meghalaya State Aquaculture Mission

## Interview of Partners

-Source: MBDA Media Team



Sengborlang Women Self Help Group –  
Smoked Fish Industry,

The Sengborlang Women SHG is involved to promote Smoked Fish Industry to improve livelihood and to generate employment. Smoked Fish falls under the value addition, fetching a good price and is a profitable business under the Small Scale Industry.

**Q. When did you start your group?**

We are a group of 10 members which started in 2004. We got a loan from State Bank of India, Amlarem Block of about Rs. 2,50,000/-

**Q. Where do you get the fish from?**

We buy the fish from the market for Rs. 150 per kg.

**Q. What are the hurdles you are facing?**

One of the hurdles is getting fresh fish. Sometimes there is no good fish in the market, so we have no income. We are struggling sometimes and can't survive only with this. We would like Fisheries department to help us get fresh fish from local farmers in our area maybe.

**Q. How much do you make per day?**

About Rs. 400 on a good day, per person. We are a group, so our profits are shared.



Skhemborlang Kurkalang

**Q. How did you start this occupation?**

We had a fish pond since I was a little boy. My grandparents took care of the fish pond. About 8 – 9 years ago, I took over. I came to know about the Aqauculture Development – 1000 ponds scheme from my friends and went to the fisheries department to get help. I wanted to expand my pond. I got a loan of about 70, 000 from the bank to do that.

**Q. How big is your pond?**

My pond is now more than 0.2 Ha big and has about 4000 – 5000 fingerlings.

**Q. What is your annual turnover and profit?**

My annual production is about 800 kg and earning 40,000 – 50,000 rupees per year.

**Q. Where do you sell your fish?**

I sell it in the Myllem market for the local people only. However, i also conduct wild breeding of common carp and sell the fish seeds to other farmers.

**Q. What are the hurdles you are facing?**

Right now, i have only one fish pond. I would like to set up more ponds with the help of Fisheries Department.



Smti Bonphila Korsha  
Nongnger

***Q. When did you start fish farming?***

I started in the year 2010. I had just completed my 12th standard. I got a loan from the bank under the Aquaculture Development – 1000 Ponds scheme.

***Q. How big is your pond and what is the turnover?***

My fish pond is located in Mokbakol village and it is about 0.2 Ha. In a week, we get 4 -5 kgs of fish which we sell in the local market called Photkroh. My annual profit is about 50,000 – 60000 and the annual production is about 500 kg.

***Q. What are the hurdles you are facing?***

One of the problems we are facing is the heat which makes the water hot and kills the fish.

***Q. Where do you get your fingerlings from?***

It depends. Sometimes, I get it from fisheries department but i also buy from other places as well.

***Q. How has this occupation/venture helped you and your family?***

My father is retired now and my mother is a housewife. I have six siblings. So the profit I get from this fish farming has helped my family a lot. I have been able to help with the education of my younger brothers and sisters.



Weibly Jesper Marbianiang

***Q. When did you start fish farming and what were the hurdles you faced then?***

My interest in fish farming started when I was young. Having been born in a farming family, my parents had a small fish pond which can accommodate up to 200 fishes and it was enough for self consumption. However, we cannot sell them and earn some profit.

***Q. What assistance did you receive from the govt?***

I went to the district fisheries department on the advice of a friend to avail the scheme provided by the govt for the fish farmer. I got assistance in the year 2006-07 under the “Aquaculture Development-1000 ponds” scheme. Today I have 8 fish ponds and one of them is as large as a football field (approx.1acre).

***Q. Where do you buy your seeds from?***

From the District fisheries department at Rs 350 per 1000 seeds

***Q. Where do you sell them?***

After a year, I sell them back to the fisheries department but this time we measure in kg.

***Q. How has aquaculture mission helped you?***

By giving me assistance in my fish rearing activities, the fisheries department has helped me provide a better life for my family and myself. Furthermore by recognising my work in this field and by awarding this cash prize and memento, the Fisheries’ department encourages farmers like me to work and strive harder.

***Q. What are the current problems you’re facing?***

The water in langtor village is cold and it affects the growth of the fish. Hence, I can sell them only once a year.

***Q. How much profit do you make in a year?***

On a good harvest I make about Rs. 20000 - 30000 a year.





Mr Sanjiv R Marak

***Q. How long have you been engaged in the fishing industry?***

Mr Sanjiv R Marak , from Gambegre block , Amanda Rongsagre, Tura, West Garo Hills Meghalaya, inaugurated hatchery in 2013 and by the end of the June 2014, he started the business on the full time basis.

***Q. What were the hurdles?***

The most difficult part to make this happen was money, transportation, labour and not having an adequate experience of teaching fishery. Though he went for a training to Kolkata, it was little difficult to bring it on action as the training was only about theory.

In fact, ponds are difficult to build because of the geographical barriers like heavy rain falls, floods etc as it is likely to get damaged.

***Q. How the aqua mission helped you?***

Aqua Mission was helpful in providing scheme, subsidiary. Loan from the bank was Rs 4 lakhs, 9.60 subsidiary and 2.40 continuations. However, it wasn't sufficient enough to maintain that. Hence, only 50 percent of the business was successful this year.

***Q. How has your life changed since then?***

The life was difficult and pressurised since he was a Leader for Achik Youth , but now having hatchery as a professional , the life is much more easier than before. Lot of people wanted to know about the hatchery and I love to let them know the importance and that it is one of the methods of livelihoods.

***Q. Where do you sell it? Who buys it?***

Currently, I am selling the fish in and around West Garo Hills. The farmers from the fishery department, Self Help Group (SHG) as well as the individuals who are interested in keeping the fish as their pets are the one who buys from me.



Namarson Ch Marak

***Q. How long have you been engaged in the fishing industry?***

Namarson Ch Marak from damal akonggre, South West Garo Hills, started hatchery in June 2012 and by December 2013, his business was fully functional.

***Q. What were the hurdles?***

Money was the first thought and secondly, how to move forward with less skills on maintenance. With that feeding and buying fish product was little too difficult as well as looking after was a challenging task.

***Q. How the aqua mission helped you?***

Fishery department helped with Rs 54,000, bank loan was Rs 22,000 and Rs 80,000 spent from my pocket. Training was conducted for a day in SWGH, bethasing Block however, that was only for maintaining the fish which was not sufficient.

***Q. How has your life changed since then?***

Life has changed in various ways despite of challenges that I face every single day. I like this job!

***Q. Where do you sell it? Who buys it?***

Tura is the only place to sell. And people from that region order in bulk or if not traders would sell my fish from house to house.







## Voices of Partners

-Source: MBDA Media Team

### Bah Nehru Lapang ( Pahambir under Umling C & RD Block in Ri Bhoi District)

Since the days are becoming hard for earning livelihood, owing to the rising prices in every sector, whether it is fertilisers and pesticides, it is becoming increasingly difficult to maintain the farm as well as a family of 12 members. I saw the ray of hope when I received assistance under the State Aquaculture Mission. The Fishery Department guided me in understanding the benefits that can be availed by me and my family after production. The mission not only motivated me, but also the farmers. I am now confident that the output from the activity will uplift my socio-economic condition. At the same time, my dream of sending my children to school will also be fulfilled. The Department has contributed 60% as subsidy and also provided assistance from the Bank with 25% as loan and 15% of my own.



My average income is 1 to 1.10 lakhs per year which I earn by selling the agricultural products of my farms like pineapples, rice, chilies and pepper in the nearest market in Nongpoh. I believe once the production of fishes starts from the pond with a water area of 0.1 Ha, I will be able to reap more benefits. The species that will be harvested are the Grass carp, Indian Major Carp (IMC) and Exotic Carp.

### Kong Neliora Nongmalieh (Pahamlapong under Umling C & RD Block in Ri Bhoi District):-

Smt. Neliora Nongmalieh a partner under the Special Plan Scheme (SPA) of the Fishery Department while expressing her gratitude towards the department said, "such initiative of the department and the Government of the Meghalaya has started changing the lives of the rural people and it is delightful for me that I am one of those fortunate people. This pond has given me and my family a hope that it will help in fulfilling my day to day needs at home and it will also help in generating a stable income in the near future. At present, I earn 72000 to 74000 per year from the grocery shop and small agricultural practices like selling





betel nut and ginger. I have a small farm where I have pigs and some chickens. I sell 2 pigs for 15 or 16 thousand. The Department has helped me in understanding the whole process on how to maintain the pond; it's time to time requirements and other essential details. The department provided me with 1000 finger lings for the pond, after observing the production from it they will further provide me with seeds or the fingerlings.”

### Bah Respelly Kurbah (Mawmaram under Mawphlang C&RD Block, EKH District)

Bah Respelly Kurbah, set up his fish pond in Mawmaram under Mawphlang C&RD Block, about thirty six kilometres away from Shillong the capital of Meghalaya under the East Khasi Hills district. He is also engaged in farming, he states that,” the pond has provided us with lots of benefits. Since its inception, 25000 fingerlings have been produced in the pond. I find it easy to take care of the pond as I have to feed the fishes once a day either morning or later in the evening, this helps me in saving a lot of time and I can concentrate on other works. I also got a job of master roll in the PWD Sohiong on a daily payment of Rs.100. The gross income from selling fishes and farming products is around 1 to 1.10 lakhs which helps me in fulfilling my duty towards my family and at the same time, I am able to send my children to the school. The fishes produced from the pond include the Grass, silver and common carp. I sell the big common carp for a price of Rs 250 and the small ones for Rs 200 per kg. People all the way from shillong come to buy the fishes from me. The intervention has completely changed my life; the production has given me a stable source of income and also provided me with an opportunity in practising an alternative activity for source of livelihood.



### Kong Rikynti Thabah (Mawpat,Sohiong under Mawphlang C& RD Block)

The Livelihood Mission under the Meghalaya State Aquaculture Mission has already begun the dream run of benefitting the rural people across the state. Smt Rikyanti Thabah a 25 year young lady supporting the livelihood activity of the family expresses the change brought in the standard of living by the mission. Apart from fish farming business she and her family is also engaged in agricultural practices like selling of rice and potato grown in their field, maintaining the piggery farm which helps them earning a handsome amount from the activity. Their annual income from all the activities is 1 to 1.05 lakhs per year. The Fishery department has contributed with 60% of the total amount as subsidy, 25% bank loan and 15% own contribution. The total estimate is Rs 90,000. They will also provide with 1000 finger lings once the harvesting starts on basis of the production they will provide with more seeds and fish feeds.



“The intervention has helped me in looking after my family. The income from this has also helped me in renovating our house which was in a bad condition. We sell our fishes both in the local market and also in Shillong at the market rate” said Rikynti.

## Voices from the Field

-Source: MBDA Media Team

Bah B.Majaw (Fishery Demonstrator, Mawphlang)

The most popular fishes in the area are the common carp, silver carp and the grass carp and in accordance to the environmental and climatic factors they should have a survival rate of 80%. But the biggest difficulty here is that the farmers suffer with the low survival rate of seeds or fingerlings that they get from the Department or from the private vendors. Though these departmental fisheries and private vendors provide the farmers with the fingerlings or the seed of different varieties of species but only few of them survive leading to low harvest of the species. As a Fishery Demonstrator, I am directly in touch with the farmers and in my many years of experience in the field, I think, if only the seeds of the fish with high surviving rate according to the area are provided to the farmers then it will be a huge bonus for them and also for the state. Moreover, the problem with the farmers here is that they don't take rearing of fish ponds as serious as their piggery or poultry business; they take it for granted and as an additional source of income. They believe that the fishes will survive on its own so, sometimes they skip giving lime or fertiliser to the pond which in return hamper the production from the pond.

I have also spoken to hundreds of farmers in the area and found out that the farmers have very less information on the good practices and so I believe that the department should do more in building the capacity of the farmers.





### Bah A. Lyngdoh (Fishery Demonstrator, Nongpoh)

The State Aquaculture Mission Scheme has helped a lot of farmers all over the state. It has become an additional activity and source of income for the farmers where before they were solely depended on agriculture and activities like piggy and poultry. The Schemes like Value Chain Management (VCM), Special Plan scheme (SPA), has lots of advantages and in-fact benefited and still providing a huge assistance for the farmers of the state.



### Bah C. Lapang (Fishery Supervisor, Nongpoh)

We collect our data during our field visits in different villages and see which pond is feasible for the production of fishes, then we quote it to the Government. After their recommendation we call for an interview with the farmers, followed by training and assisting them with financial help which includes the subsidy of 60% of the total amount along with 25% Bank Loan and 15% own contribution of the farmers. We always monitor and at the same time follow up on what are the needs of the farmers and how can we assist them in sorting out the difficulties faced by them.





# Success Stories Under Aquaculture

-Source: Fisheries Dept. Meghalaya

## Seng-bor-lang Women SHG - Smoked Fish Industry

Smoked fish in Jaintia Hills is an old age practise and was done so in the traditional method. It is a well known fact that smoking of fish is one of the oldest methods of preserving fish from spoilage. Smoking methods may vary but all are based on a few common principles. Smoked fish is a delicacy in Jaintia Hills and is the key ingredient to many local dishes.

A group of women at Umladkur village under Amlarem Block has been practising smoking of fish since 1992 and saw that it was very beneficial economically. They thus decided to form a Self Help Group dedicated entirely for this purpose. This group was established in 1995 as the Seng-bor-lang Women Self Help Group and subsequently registered in the office of the Block Development Officer, Amlarem C & RD Block. This cottage industry is run by 10 (ten) members with Smti. Alma Mulat as the Secretary. The main aim of the Self Help Group is to promote Smoked Fish Industry for improving their livelihood and also generate employment.



The raw materials used in the industry include fresh fish, fire wood and bamboos. To reduce the cost price, the fish is bought in bulk from the market. “Kharang” (local name) and “Khyrwong/ Kha Pyndong” are the two products this industry produces and the difference between the two has a twist. Kharang is simply a single fish smoked in the furnace. Meanwhile, Khyrwong requires two fishes and are attached to one another end to end. Both the fishes are bent to form a semi-circle and are then tied to one another forming a circle. In the case of Kharang, after the fishes are washed, a small bamboo is inserted through the mouth and is then degutted. The bamboo acts as a stand for the fish during smoking so as to keep the dirt off the fish. For Khyrwong, the bamboo is pierced through the eyes of one fish and through to the next fish forming a support structure for the circle created. The fishes are smoked in the furnace for about 5 to 6 hours.

During smoking, the fish dries up and also absorbs the aromatic substances from the smoke. It is worth mentioning that the quality of raw fish has a significant influence on the quality of the smoked product. The group often gets a chance of buying fresh fish from the farmers in the nearby villages for smoking. This product is superior both in taste and aroma as compared to the raw fish brought from the market. The group has a good work allotment schedule where all the members participate right from obtaining the fish from the market to selling the fish. Each member would get a

chance of carrying the different specific works needed to be done and are not confined to one specific duty.

This Value Added Product fetches a very good price in the market and is not only sold in the local market but also in the other distant markets. As far as the market value is concerned, this operation is more profitable during winter. The fishes are sold at the rate of ` 170-180 per piece. The net annual income of the group is about ` 60,000-70,000. As the group purchase their fresh fish in bulk, the amount spent for said purchase is effectively reduced. Even on obtaining the fish from the farmers, the group still manages to squeeze a number that would benefit them. This low cost on purchase of raw materials and a subsequent increase in the selling price has proved to be very beneficial trade. Although it is considered a small scale industry, but from the Department's point of view, this plays a very important role as far as indigenous traditional knowledge on fish processing is concerned.

### Pond of Shri Rom Khonglah, Umkiang, East Jaintia Hills District

Shri Rom Khonglah is a progressive fish farmer from Umkiang village, East Jaintia Hills District. His Project is located at Lumcherra, Umkiang about 65 Kms from Khliehriat on the Khliehriat-Silchar Road. During 1995-96, with much financial hardship and difficulties he managed to construct 2 stocking ponds covering a water area of 0.2 hectare with the required depth of 1.5 m. He has constructed his project on the low lying area surrounded on all sides by beautiful arecanut hillocks where the ponds had been excavated on the abandoned paddy field adjacent to his house. The water supply is from natural spring. Fingerlings of 6 different cultureable fish species like Rohu, Catla, Mrigal, Grass Carp, Silver carp and Common Carp have been released. Owing to favourable climatic condition, it has been observed that the fish growth rate is remarkable in the area where fish attained about 500-600 gms weight in one year.



Pond management and maintenance is being conducted regularly before releasing the fresh stock into the pond. Based on the growth and size of the fishes, Shri Rom Khonglah also used to conduct interval netting in which bigger fishes are being disposed off whereas the smaller ones are released back and given a chance to grow to the required size. Total harvesting as per the time frame is being done by complete drying of the ponds where fish are being handpicked and sold. Fish produced are being sold locally in the nearby Umkiang market. The total fish production from his project is about 250-300 Kgs per year and the annual turnover comes to about Rs. 40,000 - Rs. 50,000/-. This has contributed tremendously to the annual family income of the farmer and proved to be economically viable. With so much contribution, this itself has created an awareness amongst the villagers regarding the importance of fish culture and its impact on the rural economy.

With all these trials and achievements, Shri Rom Khonglah has now stretched to another plot of land for his new fishery project covering a total area of 0.4 hectare, under the on-going Meghalaya State Aquaculture Mission(MSAM).

## Pond of Shri Washing Marak, Bansam - East Garo Hills District

Shri Washing Marak is in his mid 50's and an asthma patient. He lives on a hill top in a small village called Bansam awe under East Garo Hills District, along with his wife, and a daughter who is already married. The project is located about 30 kms away from Williamnagar town.

Today in his village he is an icon and a proud owner of a fishery pond measuring approximately 1 bigha (1333.33 m.sq) which he constructed after receiving support from the Fisheries Department during the year 2009-10 under the scheme "Aquaculture Development for 1000 ponds".



At that time when I was constructing my fishery pond no one was interested in fish farming. But today everybody envies me because of a good income I earn from marketing my fishes. And today I proudly tell my neighbours that "Fish Farming is a good venture and it's never too late to start", he said.

Mr. Washing Marak is a very interesting person because of his very nature of work. When we had gone to investigate his Fishery pond it came to our knowledge that his pond was actually constructed on a hill top and was about 2 kms away from his house. As we started climbing up towards his project site, it was very steep and we were very much exhausted and we thought to ourselves as to how he could have constructed his pond. But when we reached there and to our amazement it was a beautifully constructed pond. He feeds his fishes thrice daily with locally available raw materials like tapioca leaves, banana leaves, and remains of house hold items like rice, vegetables etc. He also feeds his fish with larvae and eggs of termites. He is now constructing his house next to his Fish Pond.

He is getting a fish production of about 500-600 kg/year.

"I love my fish very much and deeply connected with them. Whenever I catch a big fish and need to sell or give them away I feel very sad because I treat them just like my own", he said

"According to me this is the easiest and finest way of earning money and I urge everybody to take up such opportunities", he said

## Pond of Shri Eckarstar Momin, Dilma A'dap - North Garo Hills District

Shri Eckarstar Momin, a fish farmer set up his fish pond in a village called Dilma A'dap, about forty kilometres away from Mendipathar, under Kharkutta C and RD Block, in the newly created North Garo Hills district. He is also engaged in some local business to meet his day to day needs. His fish farming business consists of two components viz: Duck-cum-fish culture and Pig-cum-fish culture.



He is a beneficiary of the Scheme “Aquaculture Development for 1000 Ponds” for the year 2008-2009. He has constructed his first pond in an area of about 0.3 ha. He has also completed his construction work on his second fishery pond. He had an opportunity to attend the training Programmes organised by the Fishery Department to acquire skill, Knowledge, methods/ techniques related to fish farming which had helped him to develop the idea of making a decent livelihood out of it.



In the beginning of his first year of fish culture, he has released 3000 nos. of fingerlings. No supplementary feeding was required for his fishery pond as the waste from the livestock acted as feed for fish and manure as well. After one year from stocking he harvested 300 kgs of fish which he sold @ Rs. 150/kg generating an income of Rs. 45,000 which he used for his daughter's college admission.

He also mentioned that pond culture has a number of advantages. Pond water not only yields fish but also contributes to irrigation and drinking water for livestock in dry season.

He is also rearing 35 ducks in a duck house constructed over the pond water surface using some wooden or bamboo made poles. It is chiefly for the purpose for selling their meat and eggs. Droppings of ducks are also used to fertilize the pond. Ducks are fed with rice bran at the rate of 100gm/day/duck. Each duck lays about 50-60 eggs every year and can be sold at the rate of Rs. 10/pair. Approximately, he made a profit of Rs. 10,500/- by selling eggs per annum excluding the income from the meat.

Raising of pigs in a small scale is also a part of his business and a common source of income in many rural areas. He started to work on pig-cum-fish farming with about 4 nos. of pigs that are being raised in his pig sty for the purpose of selling them at reasonable prices. He learnt that livestock manure is used to feed the carps.

The farmer also has to spend less time and money in buying supplementary feed for the fish. For this reason, he started his venture of fish farming along with livestock with determination to get the desired results in near future.

On the other hand, integrated fish farming offers opportunity for taking up various farming activities with optimum utilization of land space for food production, thus increasing household income of small farmers. In spite of the remoteness of the location, he intends to continue the practice of farming in future and also urges other fellow farmers to adopt this farming system for increasing their income.

“FISH FARMING IS AN ENTERPRISE FOR BRINGING A GOOD SOURCE OF INCOME TO UPLIFT THE ECONOMIC CONDITION OF THE PEOPLE TO AN EXTENT,” he added.

## Notes

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