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Pituitary Gland (PG) Collection and Marketing: A new era in fish production

The PG acts as a stimulant for induced fish breeding across the world. Normally this PG is imported from India and China for fish breeding in Bangladesh. The widespread use of synthetic hormones to accelerate fish breeding results in low-quality fish seed production which ultimately impacts the overall fish production.

To address this very vital issue, Feed the Future Bangladesh Aquaculture and Nutrition Activity supported FishTech Hatchery- a private sector entity, to establish a high performing supply chain of PG collection and marketing from local sources. Through this supply chain, FishTech collects PG from fish markets, processes at their own lab and delivers the high quality PG to different fish hatcheries at a reasonable price. FishTech has trained 218 fish cutters and 49 PG collectors on PG extraction from fish heads, cleaning, collection, and preservation methods. This innovative idea created employment opportunities for fish cutters or PG collectors in the aquaculture value chain, especially for the local youth and women. FishTech promoted the benefits of using natural PG to 64 fish hatchery operators and encouraged change in the current practice of applying synthetic hormone for induced breeding. It has established 7 PG collection centers and 2 PG processing plants to ensure a steady supply of PG to the local hatcheries in 7 districts of Zone of Influence (ZOI).

Nasrin Bagum, a fish cutter from fish market of Jashore Sadar, *"I have been cutting fish in Chuadnaga fish market for 20 years, though I never heard of PG, extracting or its market value. Utilizing FishTech*

training, I have already extracted and sold 1,000 pieces of raw PG to FishTech and earned BDT 5,000 (USD 60). This additional income is helping me to satisfy my children's basic needs and education."

As a result of these initiatives, within 6 months, FishTech Hatchery collected 2.3 kg PG, and paid BDT 9.2 million (USD 109,500) to the fish cutters and PG collectors. FishTech, with the support from Bangladesh Aquaculture Activity created sustainable employment opportunities in the fish value chain for Bangladeshi farmers.

Fish feed quality is a key factor in impacting aquaculture productivity: evidence from hilly region of Bangladesh

Lower productivity and less or no profit from fish farming due to scarcity of quality fish feed is one of the important constraints for commercial fish farming in the hilly region of Bandarban. In such a situation, despite huge potential, farmers are reluctant to engage in commercial fish farming as a means of their livelihoods.

To address the problem, Feed the Future Bangladesh Aquaculture and Nutrition Activity made a partnership with Satata Poultry of Bandarban with a view to increasing access to quality fish feed and advisory services to the farmers.

Ms. Bhaggya Debi Tanchangya, a fish farmer of the village Paglachara in Rowangchari Upazila under Bandarban District says, “I am cheerful observing larger-sized fishes in my pond as a result of the use of quality fish feed. I assume I will get double the production of fish than the past”.

The proprietor of Satata Poultry, Mr. Nur Mohammad Mintu says, “I am very delighted to expand my feed markets in the new hilly areas with the technical support of Aquaculture Activity. My fish feed business is growing rapidly with more profit”.

As a part of this initiative, Satata Poultry supplied 6,550 kg fish feed worth BDT 289,575 (USD 3,439) with free transportation cost to 250 fish farmers including 115 women farmers and 15 nursery farmers. GRAUS, another implementing partner of Aquaculture Activity extended technical support to these farmers. This initiative helped the farmers to understand the importance of using the quality feed to obtain faster growth and increased production of fish in their ponds and creek. This intervention helped motivate the fish farmers to increase fish production using quality feed regularly. This support helped establish the linkages between the feed seller and fish farmers to increase farmers’ access to quality feed, other aquaculture inputs, services to support commercial fish farming in the hilly region under the Zone of Resilience.

USAID funded Aquaculture Activity support growth of dry fish industry: story of a women entrepreneur

In Bangladesh, tremendous business opportunity exists for dry fish and dry fish based products. However, due to lack of knowledge and skills of dry fish entrepreneurs to produce quality products and make the business sustainable, the potential of dry fish industry has not yet been achieved expectedly.

Feed the Future Bangladesh Aquaculture and Nutrition Activity funded by USAID in partnership with CoxsBazarShop.com, a private sector business entity provides support to mitigate this problem. As part of the intervention, CoxsBazarShop.com conducted training on business development for 80 dry fish processors including 20 women. Ayesha Siddika, a 29 years old woman, was one of the participants. She lives in Baharchora, Cox's Bazar with her 3 years old son, husband, farther-in-law and mother-in-law. She started producing and selling homemade *Balachao*, a ready-to-eat dry fish product from 2021. Initially, Ayesha was struggling with this new business to make a profit as the quality and taste of her product was not up to the mark.

"I am really happy producing better and tasty Balachao products and making more profits after receiving training from CoxsBazarShop.com"- Ms. Ayesha Siddika

As a result of the training, the processors were able to improve their dry fish businesses. Ayesha, similar to trained processors, was able to improve the quality of her *Balachao* products and became a regular supplier of CoxsBazarShop.com. On average, she sells about 500-600 jars, each 100 g worth about BDT 60,000 equivalent to USD 713 per month with a net profit of BDT 10,000 -12,00 equivalent to USD 119-143, which is about 3 times higher than the profit margin she gained in the past. Her income has been very important contribute to her family expenses. She plans to expand her business with new product lines soon.

Shamima dreams: a role model for the fish farmers

Shamima Sultana had a very difficult life like many other poor women in the South-Western region of Bangladesh. Frequent natural calamities, namely cyclones, drought, tidal surge, thunder strikes, etc. caused the sufferings of the people in the region. In this harsh environment, Shamima had to earn a living through rearing of cow, goat and poultry and fish farming for her five-membered family. Her husband Karimul Sheikh was a fish farmer. They had a *gher*[1], of 52 decimals and a small homestead pond of 2.5 decimals. However, it was not possible for her to make a good profit from the pond due to a lack of required knowledge and skills in fish farming. Moreover, the pond was flooded almost every year which affected the income from the pond negatively.

Under this circumstances, Feed the Future Bangladesh Aquaculture and Nutrition Activity made the partnership with Shushilan, a national NGO, to help address this problem. Shushilan introduced a special microfinance loan package for the aquaculture farmers to introduce improved nutrition-sensitive aquaculture technology in the area.

'I am confident that I can make more profit through aquaculture. I would like to get a loan BDT 50,000 (USD 590) from Shuhsilan microfinance project to expand my fish cultivation. I am confident to make me a role model'. – says Shamima Sultana, an aquaculture farmer.

After receiving support from Aquaculture Activity, Shamina, like others, adopted improved fish farming and vegetable cultivation in the *gher* of 130 decimals of which 78 decimal *gher* was lease-in. She has already sold fish and vegetable worth around BDT 1,60,000 equivalent to USD 1,900 and also expects to sell the remaining fish worth around BDT 80,000 equivalent to USD 950. As a result of this intervention, Shamima is now confident to make a good profit and change her future through fish farming.

Increasing production and market demand for mola fish to tackle malnutrition

A variety of factors cause malnutrition in Bangladesh, the two most prominent being poverty and food insecurity. Increasing mola (*Amblypharyngodon mola*) production can help increase farmers' income, reduce poverty and enrich consumers' diet with adequate micronutrients.

Bhola Monosex Tilapia Hatchery (BMTH) in collaboration with Feed the Future Bangladesh Aquaculture and Nutrition Activity has established a business-oriented commercial supply chain of quality mola stock for the grow-out fish farmers. BMTH has sold mola brood to 10 hatcheries and strengthened their technical and business capacity. , BMTH has also trained 1,000 fish farmers including 447 women on improved fish production technologies and marketing strategies of mola fish from November to December 2021.

S.M. Mahabubur Rahman Mamun, the Owner of BMTH says, "We have seen slow but steady demand for quality mola seed and fingerlings from the fish farmers. To increase mola production and consumption, we are continuously providing advisory information on mola cultivation and marketing technique. We are expecting a greater demand for mola fish seed from mid of March 2022 as the cultivation season starts."

As a result of these initiatives, BMTH produced 40,000 mola fingerlings so far that worth BDT 12,000 equivalent to USD 145. Besides, BMTH receives numerous queries on mola seed and mola production every week from the farmers of various parts of the Barishal division. The intervention has generated significant demand for mola seed, which will help BMTH to sell 3 million mola seeds worth BDT 0.6 million (USD 7,300) and 0.2 million brood worth BDT 0.1 million (USD 1,200) from March to May 2022.

Expanding the market of aqua medicinal products by skilling up nursery owners

Most of the hatcheries, nursery owners and fish farmers are unaware of the usage of Aqua Medicinal Products (AMPs), which results in poor fish productivity and profitability.

KAAS Trade, an importer and distributor of quality AMPs, collaborates with Feed the Future Bangladesh Aquaculture and Nutrition Activity to promote appropriate usage of major aqua medicinal products. KAAS has applied various promotion and business development strategies to expand the market of AMPs in the Activity area. As part of its market expansion strategies, KAAS conducted training for 10 hatcheries and 100 nursery owners on appropriate usage of AMP products. The training enabled these hatchery and nursery owners to advise their client farmers regarding appropriate usage of aqua medicinal products to help improve farmers' fish production performance.

"The aqua medicines of KAAS Trade provided excellent performance. The products' price is also affordable for me and for other nursery owners. I am expecting better fry production and earnings from my nursery in the upcoming months." – says Yasin, a nursery owner who received training and bought KAAS AMP products.

As a result of the KAAS initiative, within a short period of time, they have sold AMP products worth BDT 52.5 million (USD 750,000) in the Feed the Future Zone of Influence.

Experiential learning program helping rural women entrepreneurs realize their leadership potentials

Women account for 30 percent of the aquaculture workforce in Bangladesh but are largely limited to gender-based activities like cleaning ponds and fish processing. One of the biggest obstacles women encounter is the lack of knowledge and ownership over resources to invest in aquaculture. Moreover, Covid-19 has added extra threats and damages to women owned businesses in the last two years.

Feed the Future Bangladesh Aquaculture and Nutrition Activity, partnering with ENLIVEN and ULAB university, designed a pilot initiative to help the women entrepreneurs, involved in the rural aquaculture business, pivot their business model to cope with the crisis. This joint venture created an interactive learning platform both for the female MBA students and the rural women participants. Ten selected female MBA students went through a two-week-long training of trainers and conducted an extensive training need assessment. After that they conducted a three-day-long residential training program for the 100 rural women entrepreneurs in Barguna and Patuakhali districts, and provided business development services. A pictorial business management handbook for the rural women entrepreneurs has also been co-developed in *Bangla* so that they could use it in the long run.

Bharati Biswas (43), woman entrepreneur and recipient of this training says, “My grocery cum aquaculture input selling shop is a well- known shop that was affected largely by the pandemic. This training is very helpful and it allows me to learn from others’ experiences and make friends with a few business graduates. Apart from the business discussion, it supports me to regain confidence and continue my business in a more strategic way.”

These rural women not only got mentorship but also learned about record keeping, business plan, business development and other important aspects of the aquaculture market system. This initiative also generates opportunities for female MBA students to understand the field reality, business models, and challenges in rural context. The stakeholders are expecting to replicate the program for 1,200 female students over the next few years.

“Maach Gari” an innovation to increase fish market efficiency

Transportation system in Aquaculture in Bangladesh has many challenges, such as poor vehicle condition, lac of required facilities in the vehicles, high charges, lack of ride sharing facility, absence of a tracking mechanism, etc. Under this situation, quality of fish during transportation degrades, mortality increases, cost of transportation increases, which ultimately result in poor income for the fish farmers.

MWorld with support from the Feed the Future Bangladesh Aquaculture and Nutrition Activity introduced a mobile application “Maach Gari” to improve transportation for strengthening supply chain efficiency in aquaculture. The App helps farmers, hatcheries and nursery owners to transport fish efficiently by using a digital transportation technology. The App also helps farmers maintain the quality of fish during transportation and minimize transportation costs.

“Previously, I struggled with fish transportation. I had to check and bargain with at least 7-10 pick-up drivers. Even after loading my produce into the pickup, I worried if the fish fingerlings are getting enough oxygen. Transporting through Maach Gari App have solved my problem. With the App, I can pick a transport with the best facilities including a tracking system and get ensured that my products have been rightly delivered.” – says Md. Shamsul Alam, a nursery owner, who delivered 220 kg G-3 Rohu fingerlings from Jashore to Natore using ‘Maach Gari’ App.

From November 2021 to February 2022, 95 vehicles and 175 fish farmers, hatcheries and nursery owners registered with Maach Gari App and utilized the digital fish transportation service. So far, the App generated 302 trips and delivered 172 metric ton fish worth USD 225,240 to desired destinations and markets by the registered transport service providers.

The Bookkeeper' App: means of improving efficiency in aquaculture economy

Financial literacy and access to finance are two key challenges hindering overall sectoral growth of Aquaculture sector in Bangladesh. An insignificant number of aquaculture farmers are capable of doing cost-benefit analysis. Due to a lack of simple financial literacy, many fish farmers are unable to do appropriate financial management and take right decisions for their aquaculture business.

In collaboration with the Feed the Future Bangladesh Aquaculture and Nutrition Activity, Kiu Bangladesh launched a mobile application 'The Bookkeeper' to increase access to easy loan packages in aquaculture through improving the financial literacy. The App provides required vital information, such as cash flow management, financial risk management and money management. The App captures daily transactions and generates a 'credit score' based on the transaction history. The scores are then sent to a financial institution who analyze and determines the limit of the credit that a fish farmer is eligible. Kiu delivered training course to 600 fish farmers on financial literacy and use of The Bookkeeper App for recording expenses, between October 2021 and January 2022.

Rebeka Begum from Baintola Union, Rampal, Bagerhat received USD 240 equivalent to BDT 20,000 as loan from KMSS. She says, "I am a fish farmer, I grow Rui, Pangas, Puti and some Shrimp in small-scale, for household consumptions and the rest for sales. The Bookkeeper App improved my

knowledge in loan management to improve my profitability from pond aquaculture. The loan helped me to buy inputs for my ponds on-time and increase my aquaculture production."

The training has enabled 300 fish farmers to use the App and improve financial management and recordkeeping system of their aquaculture business. The credit scores generated from the App further assisted 138 farmers receive an amount of USD 22,895 as loan from Khulna Mukti Seba Shangstha (KMSS), one of the partners of Kiu, from December 2021 to February 2022. The loan applications of the rest 162 farmers are under process for immediate disbursement.

Adoption of improved post-harvest management practices to attain premium price

Fish farmers and other market actors incur a considerable loss every year in Bangladesh due to improper post-harvest handling, transportation, landing, and processing. This ultimately causes a huge loss for the aquaculture sector of the country.

MarGEn Ltd., a private agribusiness company with support from the Feed the Future Bangladesh Aquaculture and Nutrition Activity addresses the post-harvest losses by improving the knowledge of the fish farmers on better post-harvest management practices in the southwestern part of the country. MarGEn trained about 2,000 fish farmers, including 100 women fish farmers on improved post-harvest management techniques from November 2021 to February 2022.

"Previously, I experienced high post-harvest fish loss. At times, I had lost about 8 kg fish per 100 kg due to poor handling and inappropriate packaging. Now that I learned about the techniques on better post-harvest management of fish, I can reduce the loss and sell my fish at a better price." – says Renuka Mondal, a female fish farmer from Monirampur, Jashore after attending MarGEn's training.

The training has enabled the fish farmers to improve their post-harvest handling of fish and sell at a better price. It is expected that the improved knowledge and market information flow could potentially contribute to reducing the post-harvest fish losses by at least 5-8 percent. MarGEn already has started the process to procure about 50 metric tons of cultured fish worth USD 71,000 from the trained fish farmers from March to September 2022.

An innovative approach to extend disease diagnostic services for fish farmers

In Bangladesh, many aquaculture farmers, hatcheries and nursery operators do not have wider access to disease diagnosis facilities. Only a few government departments and universities provide services on fish disease diagnosis. Absence of adequate disease diagnostic services in aquaculture results in an increased fish mortality rate due to diseases caused by pathogens and parasites. As a consequence, a significant productivity loss occurs that farmers cannot withstand.

Feed the Future Bangladesh Aquaculture and Nutrition Activity supported FishTech BD, an agribusiness company in establishing the country's private sector-led first specialized Real Time Polymerase Chain Reaction (RT-PCR) based fish disease diagnosis laboratory in Khulna. The Lab is set out to diagnose fish and shrimp diseases, facilitate aquaculture research and provide technical support to small-scale aquaculture farmers. The laboratory is equipped with RT-PCR-based molecular technology that can diagnose 11 types of harmful virus and bacterial diseases in fish and shrimp.

Miran Hossain is a fish farmer from Paikgacha upazilla of Khulna district. He said, "In the last season, I noticed that the fish growth in my pond was slowed down. I took the soil and water samples to FishTech Laboratory in Khulna to find what went wrong. The report showed that the water is affected with bacteria that needed some treatment. I immediately took consultation from FishTech's Disease Expert and applied prescribed aqua medicines in the pond to prevent disease. Thus, the lab helped me to avoid production loss."

Since its inception in February 2021, the lab has performed different bacteriological, viral and fungal diagnosis, provided soil, and water tests services to 2,700 fish farmers, 47 hatcheries and 10 research institutions. FishTech has already earned USD 23,413 as revenue from the services that the Lab provided on fish disease diagnosis and created sustainable footsteps as a privately owned disease diagnostic facility in aquaculture in Bangladesh. FishTech is in the process to expand its Lab services to the doorsteps of the fish farmers by establishing 13 Sample Collection Points in Jashore, Khulna, and Satkhira districts.

Reducing dependency on imported feed ingredients-a breakthrough in aquaculture sector

Despite breakthroughs recorded in the growth of aquaculture sector in Bangladesh, the industry heavily depends on imported feed and feed ingredients, which makes fish farming expensive as fish feed account for at least 60% of the total cost of production.

Agro Industrial Trust (AIT), a private Agro-input company, collaborated with the Feed the Future Bangladesh Aquaculture and Nutrition Activity to produce and market three types of newly formulated floating fish feed (starter, grower and finisher) using locally available ingredients. To strengthen the supply chain, AIT developed capacity of 25 dealers and sub-dealers, and 50 Local Service Providers (LSPs) to reach the farmers, especially smallholder farmers in remote locations. AIT reached about 6,604 fish farmers with information on the newly developed fish feed and their appropriate usage through more than 100 product promotion events and 200 tea stall campaigns.

"Earlier, I spent 1,300 Taka (USD 15.50) to buy 25 kg fish feed. Now I spent 1,150 Taka (USD 13.70) to buy the same amount of fish feed. I became overwhelmed when I found that AIT's newly formulated carp floating feed increased the growth rate of my fish and allowed me to get a better profit margin." – says Md. Ariful Islam, an AIT demo farmer, who cultivated carp in his 50 decimal pond in Chatian, Kushtia.

As a result of its improved supply chain and promotional activities, AIT sold 630 metric tons of the newly developed carp floating feeds worth USD 355,450 within a very short period, from August to November 2021. The initiative helped AIT to establish a robust supply chain and ensure the availability of improved quality feed to fish farmers with affordable price.

One-Stop Service Center – an innovative doorstep facility for fish farmers

The fish farmers in Bangladesh are often not capable of maintaining water and soil quality of their ponds which leads to low productivity and profitability. They are also not familiar with the use of modern small-scale aqua machinery, especially soil and water testing kits for diagnosis of the problems. in their pond's problems because these are not readily available in the market.

Feed the Future Bangladesh Aquaculture and Nutrition Activity supported IMEXpro (BD) Corporations, a private business company, to introduce small-scale aqua machinery and testing services. IMEXpro established 40 One-Stop Service Centers (OSSCs) in six districts of the Zone of Influence to make kits and testing services available to the fish farmers. These OSSCs offer pond soil and water quality testing facilities, sell aqua inputs and provide necessary aquaculture advisory services. Each center appointed a Local Service Provider (LSP) who extends the same service at the farmers' doorstep.

Biplob Kumar Mondal is an owner of M/S Krishi Seba Traders, an IMEXpro One-Stop Service Center established in Monirampur, Jashore. He said, "Farmers often come to us with various problems related to fish farming. Now, we have the right testing kits to quickly test the soil and water parameters and provide necessary advice. These help farmers to take corrective actions and avoid fish mortality or other problems causing productivity losses."

As a result of this intervention, IMEXpro provided services on testing pond water and soil quality to 563 fish farmers from these OSSCs during February to March 2022. The services help fish farmers to take correctives measures for their ponds to reduce the risks of productivity loss.

Children friendly Ready-to-Cook and Ready-to-Eat fish products; a nutrient-rich healthy food item for children

Fish consumption is relatively low among the schoolchildren due to fear of choking bones and absence of children-friendly fish recipes, Ready-to-Cook (RTC) and Ready-to-Eat (RTE) items. Consumption of fish can be popularized to increase protein intake of the children by making various children-friendly RTC and RTE fish items readily available in the market.

MarGEn Limited, a private agribusiness company in collaboration with the Feed the Future Bangladesh Aquaculture and Nutrition Activity conducted nutrition education events to increase level of fish consumption among school going children. MarGEn organized five cooking recipe events in five schools in Dhaka city. About 166 parents and 550 students participated in these cooking events where a guest chef demonstrated cooking of various processed RTC fish items, like fish ball, fish bun, and fish shashlik.

Ms. Tripti Rani Baroi, the guest chef for MarGEn's school cooking event said, "Parents now-a-days look for easy and convenient meal for their kid's tiffin. In our country, we have very limited options for fish-based recipes that are delicious and easy to prepare. MarGEn's ready-to-cook option surely is a better alternative as healthy school meal for the children."

Through the events, MarGEn demonstrated the value of RTC fish items as better alternative to meat-based meals. Parents expressed that the events were helpful to shift their children's food habit to an improved diet. Up to April 20, 2022, MarGEn processed and sold about 20 metric tons of white fish in form of RTC and RTE items worth USD 83,333 and contributed significantly to increase fish consumption of urban dwellers, especially children.

Market promotion events; a vehicle to rapidly influence the aquaculture sector

Lack of access to information on improved aquaculture technologies is one of the key challenges hampers the growth of aquaculture sector. Aquaculture productivity and income are often negatively linked with this key constraint.

Feed the Future Bangladesh Aquaculture and Nutrition Activity collaborated with KNB Agro Industries Ltd., a fish feed manufacturing and distribution company to improve farmers' knowledge of better aquaculture practices and create access to quality fish feed. KNB organized 695 business promotion events in five districts of the Zone of Influence and oriented 17,916 fish farmers on pond management, fish seed stocking management, supplementary feed formulation, fish disease management, dyke cropping, and nutrition. During these events, KNB distributed about 40,000 leaflets that provide essential information on aquaculture technology, feed application, of and safe usage of aqua medicinal products.

"Previously, I was unaware about appropriate stocking of fish in pond. I used to release more fingerlings in my pond and use excessive amount of feed. I thought it would help my fish grow faster. After attending the business promotion event of KNB, I learned about appropriate aquaculture practices. I am really looking forward to have a better production in my pond in this season." – says Niara Begum, a women fish farmer from Damosh, Belgachi of Alamdanga upazila, Kushtia.

KNB's business promotion events significantly increased market demand for better quality fish feed. As a result, KNB sold about 290 metric tons fish feeds worth USD 163,620 from October 2021 to March 2022.

Role of micro finance to boost up dry fish business

During the COVID-19 pandemic, dry fish processors in Cox's Bazar suffered from a shortage of capital as access to loans from formal financial institutions was shrunken drastically. At the same time, sales of their dry fish products were too low that many of them were on the edge of bankruptcy.

To address the issue, Feed the Future Bangladesh Aquaculture and Nutrition Activity in partnership with Mukti Cox's Bazar have taken well designed steps to improve access to microfinance service for dry fish business in Cox's Bazar.

As a part of this initiative, Mukti Cox's Bazar has provided BDT 38.69 million equivalent to USD 457,381 as loans to 730 dry fish producers. They have also delivered capacity building training on financial and business management, and safe dry fish production technology to these producers. Rasheda Begum lives in Putivilla Dashi Maji para village, Moheskhali, Cox's Bazar. is one of them who received such training and an amount of BDT 50,000 equivalent to USD 593 USD as loan and the training in June 2021.

“Loan from Mukti helped me a lot to restart and recovery my dry fish business. Current, I am earning a good profits from this business and maintaining better life with my family.”

With the money and business knowledge, Rasheda restarted her business and sold various dry fish to the customers in her neighboring community. Subsequently, she rented a stall in the village market to improve the sales volumes of dry fish. Gradually, her sales increased with the increase in demand. Her current monthly sales is around BDT 230,000 equivalent to 2,700 and net profit is around BDT 28,000 equivalent to USD 330 which is double the amount she earned in the preceding year. She has purchased a piece of land worth BDT 50,000 equivalent to USD 588 from the profit of her dry fish business. Her husband helps her in selling dry fish products in the village market. Now, she has been able to recover her dry fish business and live better life along with her children and husband.

A story of women led fish-harvesting group in Wagyoipara, Rowangchari of Bandarban

The lack of fish harvesting facilities and higher rental cost of fishing net appear as one of the major constraints for nutrition-sensitive aquaculture in Bandarban's remote hilly region. It inhibits the fish farmers to go for partial harvesting and selling of fish multiple times depending on the good market price and convenience to increase the profitability of their small-scale aquaculture practice. Consequently, the farmers are unable to maximize their productivity, as well as increase the consumption of fish, especially the small fish, like mola to improve family nutrition.

To address the issue, Feed the Future Bangladesh Aquaculture and Nutrition Activity, in partnership with Gram Unnayon Sangathon (GRAUS), a local NGO, took the initiative to establish fish harvesting groups in the remote hilly area of Bandarban District. As a part of the initiative, a women-led fish-harvesting group consisting of five women and one man was established in Wagyoipara under Bandarban. The Activity trained the fish-harvesting group on fish harvesting and post-harvest technologies and provided them with a fishing net as an extension material on a cost-sharing basis in March 2022.

Anjana Tanchangya said, "We are very happy to have our own net to provide services to the fish farmers. We are getting good income from this new profession and have developed ourselves as aquaculture service providers from a general day labor".

The women fish-harvesting group is now providing service at a reasonable cost to the fish farmers in harvesting and marketing fish at a better price. They provide fish harvesting services to the Activity beneficiaries as well as other farmers, which helps ensure a smooth supply of fish to the markets based on the demand. After getting the fishing net, by April 2022, the group harvested fish from 12 ponds and creeks and earned BDT 30,000 equivalent to USD 355. On average, they receive six harvesting orders per month. They have opened a Bank Account and deposited BDT 4,000 equivalent to USD 47 for the maintenance and buying new nets in the future.

Bottom Sludge Removal Technology opens new avenues for fish export

Continuous increase in population decreases the availability of cultivable land along with the water resources for aquaculture production in Bangladesh. To meet the demand of the increased population, and potential export market to help improve the socio-economic condition, the country needs to increase aquaculture production as much as possible from the available water resources by adopting improved aquaculture technologies.

Feed the Future Bangladesh Aquaculture and Nutrition Activity in partnership with Sardar Agro, introduced the "Bottom Sludge Removal Technology", in a 50 decimal pond to demonstrate an innovative way to increase fish production significantly from pond aquaculture to meet the increasing demand for fish. For wider dissemination and adoption of the technology, Sardar Agro organized capacity building training for the interested farmers. So far, Sardar Agro trained 211 farmers on various features and techniques for the bottom sludge removal from ponds for the expected increase in aquaculture production. Ten students of the universities from Khulna and Jashore started research at this site to study economic and water quality aspects as part of their Master's program. Besides, for effective forward market linkages with fish buyers, especially with exporters, Sardar Agro time to time organized exposure visits to their ponds.

Md. Almotaffifin Ahmed, Project Coordinator of Sardar Agro says, "The bottom sludge removal technology is an outstanding means to increase pond production and supply fish in a bulk quantity for export market. Already a few large and institutional fish buyers including some exporters started communicating with us to procure bulk quantity of fish from us. We hope that this would help us to penetrate into the export market and ultimately contribute significantly to national economy."

Thanks to the Activity support, from March 2021 to April 2022, Sardar Agro was able to increase production of pabda fish/butterfish along with carp to 66 metric ton/hectare, which is more than 5 times in comparison to the existing production, 12 metric ton/hectare. During the period, Sardar Agro exported 11.8 metric ton pabda, worth BDT 2,994,000 equivalent to USD 35,335, to India.

How digital technology could contribute to aquaculture sector through providing essential services

Lack of credible data makes it impossible for banks, financial services sector and insurance institutions to either assess the creditworthiness of aquaculture farmers or offer products to the neediest ones. As a result, the majority of aquaculture farmers lack access to formal credit that is needed as working capital to purchase key inputs at critical stages in the aquaculture production cycle.

With the goal to help mitigate this constraint, Feed the Future Bangladesh Aquaculture and Nutrition Activity, is supporting Kiu Bangladesh Ltd., a Fintech business, to develop and introduce a mobile business App named “The Bookkeeper” that has features on business record keeping, business management, and Lending-as-a-Service (LaaS). Kiu identified over 1,200 small fish farmers, traders, and

retailers from Khulna division as eligible clientele. They have delivered capacity building events to 600 fish farmers including 42% women on various features and usages of the Bookkeeper App. Kiu field staff are also continuing regular guidance to their clients.

“The Bookkeeper App has increased our ability to manage the financial part of our fish business efficiently. The App has changed our spending and savings behavior. By keeping the account accurate, I can now review the actual situation of my fish business anytime,” says Rebeka Begum, a woman fish farmer from Baintola union of Rampal upazila under Bagerhat district.

The fish farmers, traders, and retailers have started using the App with great enthusiasm. A total of 379 participants successfully availed of BDT 1.26 crore equivalent to USD 150,000 as loans through using Kiu’s Bookkeeper App. The Activity intervention nicely demonstrates how a digital App can help improving required services and capcity on aquaculture business in Bangladesh.

Ready to Eat food market: transforming the food industry landscape

The frozen food products have been flourishing in the local markets in Bangladesh for last couple of years, especially, the pandemic provided a boost to its popularity. Fish-based products in comparison to meat-based products are considered the better options of animal protein required for human health, however, fish-based Ready-To-Eat (RTE) product market is yet to explored and developed.

Feed the Future Bangladesh Aquaculture and Nutrition Activity supported Roja, a brand owned by Sea Resources Group, a sister concern of Rangs Group, to introduce fish-based RTE food items, educate consumers, develop a market and increase consumption of fish-based RTE products. To make the behavioral shift of the consumers, Roja took a formal branding approach placing 80 refrigerators in various super shops in Dhaka, Chattogram, and Sylhet districts.

"We have experienced a surprising impact in the sales from the outlets, where we have branded refrigerators. Our management will replicate this in other stores and we will continue expanding our branding activities beyond the project tenure." Says G.M. Iqbal Bappy, the Head of Sales of Roja brand.

As kick-off, Roja has already come up with 5 exciting value-added frozen RTE products based on cultured freshwater fish and was able to increase its sales of RTE frozen food from USD 2,687 to USD 9,920 in the period from August to December 2021.

How a One Stop Service Center can enhance aquaculture production in the remote hilly area

Lack of farmers' technical knowledge in improved fish farming, extension service, market actors, and access to the market are the important factors responsible for poor aquaculture production in Lama-Alikadam areas in Bangladesh. On top of that lack of easy and on-time access to quality fish feed and aqua inputs, for example, fish seed, fertilizer, aqua-medicinal products, etc. at reasonable prices are the most cognizable factor aggravating the situation further.

To improve the situation, Feed the Future Bangladesh Aquaculture and Nutrition Activity, in collaboration with Satata Poultry, a private enterprise, took initiative in November 2021, to establish a one stop service center (OSSC) to make easy access to quality feed and other aqua inputs along with technical training, soil-water testing and other advisory services for the fish farmers, nurseries and other market actors. The ultimate role of the OSSC is to help increase aquaculture production, establish linkages among market actors and create access to the market for all concerned in the locality.

Joynal Abedin, a fish farmer of Lama, says, "Earlier, I had no idea about water quality management, fish stocking density, fish feed management, disease control procedure, etc. Now our natives and I have learned it from Satata Poultry and applying in our ponds and getting good results. We are now getting quality fish feed and other necessary aquaculture inputs, harvesting facilities, technical services within the reach of our hands, and nowhere to go. We are very happy with the one stop service center".

Satata Poultry supplied 33.2 MT quality fish feed among 405 fish farmers including the beneficiary farmers of the Aquaculture Activity partner, GRAUS (Gram Unnayon Sangathon). For easy access to quality inputs, Satata Poultry established 3 Agents/Sub-dealer points at the remotest unions of Lama

and Alikadam Upazila. They also sold 3.7 MT lime to the aquaculture farmers. Till today, 16 farmers received fish harvesting facilities, 55 fish farmers received fish feed carrying facilities, and 145 fish farmers got technical support including water quality tests. Besides, Satata Poultry conducted training to educate 204 fish farmers on aquaculture and feed management and established linages among 45 backward and forward aquaculture market actors through creating a market linkage channel.

Better efficacy helps market expansion of natural Pituitary Gland (PG)

In Bangladesh, due to lack of availability of natural PG of local origin in the domestic market, imported synthetic hormone is used widely in the hatcheries for induced breeding. This is not encourageable from economic as well as safer fish seed production point of view.

Feed the Future Bangladesh Aquaculture and Nutrition Activity supported FishTech Hatchery to establish a high performing supply chain of natural Pituitary Gland (PG) of local sources. They have established 7 PG Collection Centers and 2 PG Processing Plants to ensure a steady supply of PG to the local hatcheries in 7 districts of Zone of Influence (ZOI). To further prove the efficacy of the natural PG and synthetic hormone, FishTech Hatchery conducted experiments and trials, and produced a scientific paper titled "*Comparative study on the effectiveness of natural sources hormone and synthetic hormone in the induced breeding of Cyprinus carpio*". According to the study, the synthetic hormone accounted for 92.20 percent fertilization compared to natural PG that accounts 90.80 percent. However, natural PG induced hatchlings have a substantially greater survival rate of 84.20 percent compared to synthetic hormone that provides a survival rate of 74.50 percent. Findings of the study was shared in the "9th Biennial Conference and Research Fair 2022" on May 29, 2022 organized by Bangladesh Fisheries Research Forum (BFRF). The findings have received overwhelming responses and appreciations from the participants of Bangladesh Agricultural University, Department of Fisheries, Bangladesh Fisheries

Research Institute, Patuakhali Science and Technology University (PSTU), Quality Feed Company Ltd., ACI Ltd. and other government agencies, universities and private businesses..

“Eight years ago, I conducted a study on PG and discovered that natural PG-induced fry had a greater survival rate than those generated by synthetic hormones. However, unavailability of domestic PG processing businesses in Bangladesh prevented hatcheries to access to natural PG. WorldFish-led Bangladesh Aquaculture Activity is helping the commercialization of natural dry PG in a sustainable way. This is a ground-breaking initiative for our country”. says Dr. Imranul Islam, a professor from Patuakhali Science and Technology University at the 9th Biennial Conference and Research Fair 2022.

To date, FishTech Hatchery collected 2.50 kg PG from the local fish markets of 6 ZOI districts and processed in their facilities. They have sold 2.38 kg dry PG to 26 hatcheries and generated USD 182,000 revenue. It is expected that the scientific findings on the efficacy of natural PG will influence the fish hatcheries in the country to replace the use of synthetic hormone by the use of natural dry PG of local origin and thus expand the market of natural dry PG nationwide.

Strengthening knowledge and market linkage for sustaining fish feed business

Small semi-auto feed millers in Bangladesh often fail to create demand of their feed products and generate expected revenue as they lack knowledge and skills in business development and marketing .

Feed the Future Bangladesh Aquaculture and Nutrition Activity supported Matrix Business Development Ltd., a private company to help improve feed millers' knowledge and skills in business development and fish feed marketing. Matrix built the capacity of 50 small feed millers on feed production, business and established institutional linkages with 120 sub-dealers , 80 local service providers and 100 feed machinery technicians. Besides, Matrix organized 100 product promotion events and helped improve the business of these 50 small feed millers in five districts of the Zone of Influence (ZOI). Matrix produced and distributed Information, Education, and Communication (IEC) materials, namely festoons, signboards, and booklets promote these small scale fish feed producing ventures.

"The training from Matrix made me realize that a proper business planning and communication with the customers are important for my feed business. I applied the knowledge from the training, improved my business and marketing strategies and experienced a positive revenue growth by 10 percent within a year". Says Shahin Mia, a small feed miller from Kotalipara of Gopalgonj District.

As a result of the above interventions 50 small feed millers were able to establish business linkage with about 3,517 fish farmers as new clients, which created an access to improved quality fish feed for the smallholder farmers, and increased feed millers' revenue by around 10 percent.

Acknowledging role of the Aquaculture Activity in ZoR through National Fish Week award 2022

The scarcity of quality fish spawn is one of the major constraints for fish nursery development and fish farming in the hilly region of Bangladesh. It results in poor production and less or no profit for the farmers and nursery owners. To address the issue, Feed the Future Bangladesh Aquaculture and Nutrition Activity supported the Maa Mothsha Hatchery and Nursery (MMHN) of Bandarban aiming to increase access to quality seed for the farmers.

With the support of the Aquaculture Activity, MMHN started producing quality fingerlings in 9 nursery ponds and selling in all Upazilas of Bandarban district and the nearest Upazilas of Cox's Bazar District. He also constructed a backyard fish hatchery and produced 35 kg spawn till July 2022. He was able to sell20 kg spawns worth BDT 92,000 equivalent to USD 1,000. He also sold 865 kg carp fingerlings worth 736,400 equivalent to USD 8,000 to 367 farmers. As recognition of the contribution to aquaculture in Bandarban and surrounding Districts by producing and supplying quality fish spawn and fingerlings, the Department of Fisheries awarded Md. Elius Khan, owner of MMHN, with the prize for the best fish seed producer in Bandarban district in the inaugural event of the National Fish Week 2022 celebration. Elius Khan received the award from Mr. Bir Bahadur Ushwe Shing, Member of Parliament and the Honorable Minister of Chittagong Hill Tracts Affairs, Bangladesh.

Md. Elius Khan says, "All credit goes to the Aquaculture Activity for creating the opportunity for me to receive the best seed producer award."

Increasing domestic supply of Pituitary Gland (PG) in Bangladesh to keep pace with growing demand

In Bangladesh, fish hatcheries are highly dependent on imported synthetic hormones for the induced breeding of fish. This often results in increased dependency on external sources, and eventually poses a threat to the country's aquaculture sector.

Feed the Future Bangladesh Aquaculture and Nutrition Activity collaborates with FishTech Hatchery to establish the domestic supply chain of Pituitary Gland (PG) as the source of natural hormones. As part of the intervention, FishTech trained 218 fish cutters and 49 PG collectors on PG extraction from fish heads, cleaning, collection, and preservation methods. FishTech promoted the benefits of using natural PG to 64 fish hatchery operators and encouraged the change in the current practice of applying synthetic hormones for induced breeding. It has established 7 PG collection centers and 2 PG processing plants to ensure a steady supply of PG to the local hatcheries., FishTech continues to collect raw PG from fish markets, process it at their own lab, and deliver high quality dry PG to different fish hatcheries at a reasonable price through developing supply chain. FishTech has expanded the domestic PG market to 18 districts in the southwestern and northern part of Bangladesh.

B.M. Newaz Sharif, the Project Coordinator of FishTech Hatchery says, "Initially the market of domestic PG was very limited. After working with WorldFish-led Aquaculture Activity, we have motivated the hatcheries on the benefits of using natural PG collected from local sources. This helps us to expand our business of dry PG gradually and add about 100 new client hatcheries in our portfolio."

As a result of the initiation, from January to August 2022, FishTech Hatchery was able to collect 3.9 kg raw PG from different kitchen markets, largely from Jashore, and sell 2.9 kg dry PG at a price of BDT 14.5 million equivalent to USD 162,000 to about 200 hatcheries. The intervention has also created new income opportunities for the fish cutters and others, especially women and youth in the aquaculture value chain.

Youth women entrepreneur's initiative to expand dry fish market

Despite several significant challenges, namely lack of consumer trust, difficulty in selling products, high production cost, and low profit margin, huge potential exists in the dry fish value chain in Cox's Bazar. To expand the dry fish market and exploit the potential, it is one of the important steps to produce dry fish-based ready to cook (RTC) and ready to eat (RTE) products and market the products throughout the country.

Considering the need- Feed the Future Bangladesh Aquaculture and Nutrition Activity started collaborating with Palongki Konna (PK), a youth woman-led micro-enterprise of Cox's Bazar from April, 2022 to produce dry fish-based products. As a part of the initiative, PK trained 30 women on safe dry fish production as well as the production of safe dry fish powder. PK also purchased some machineries like grinding machine, foil machine, mincer machine and vacuum packing machine for producing safe dry fish powder, and smart packaging. It also has developed a website (www.palongkikonna.com) and advertised on social media to promote the business.

I have learned, how to expand my business through proper marketing, branding and promotion, which helped to increased my sales and revenue"- Nazma Akhter; Founder and Owner of Palongki Konna.

As a result of this initiative, PK was able to sell 241 kg safe dry fish powder worth BDT 206,957 equivalent to USD 2,229 and 212 kg safe dried fish worth BDT 231,550 equivalent to USD 2,503 from April to August 2022.