

Towards Increased Production of Milkfish Fry in the Philippines: SEAFDEC/AQD technology through the lens

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Although the Philippines has a long coastline and is surrounded by rich waters, its capture fisheries sub-sector is just second to aquaculture which is the main driver for growth in the fish production industry of the country. In 2019, aquaculture production accounted for 53.20 % of the total Philippine fisheries production and the top two aquaculture commodities that the country produced were seaweeds and milkfish. Even though milkfish is among the top two commodities, this does not mean that there are no problems with its production. One of the major aspects that hinder sustainability is the harrowing concern regarding milkfish seed supply which is highly unpredictable. The local production of milkfish fry could not adequately supply the national demand, leading to the import of fry from nearby countries. To reduce the reliance on imports, the Government of the Philippines through its Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) came up with the “National Bangus Fry Sufficiency Program” with the goal of building legislated multispecies hatcheries in strategic locations in the country. DA-BFAR then tapped the services of SEAFDEC Aquaculture Department (AQD) to provide training and technical assistance, especially in undertaking the feasibility studies of proposed sites where hatcheries are to be established. So far, eight out of the 16 sites have had their feasibility studies submitted to DA-BFAR and their respective local government units (LGUs). To date, there are three ongoing hatchery projects that are in various stages of construction. Out of the three, two are for marine and one is for freshwater aquaculture commodities. In the SEAFDEC/AQD compound, multispecies hatcheries have also been constructed to supply the Western Visayas region with high quality milkfish fry as well as other commodities. Apart from building hatcheries, SEAFDEC/AQD has also partnered with the regional office of DA-BFAR in Western Visayas to revive abandoned/unproductive hatcheries which would then serve as milkfish satellite hatcheries once rehabilitation is completed.

The Philippines is among the top fish-producing countries globally, with its aquaculture sub-sector dominating its fish production. For a developing country, aquaculture is seen as a way to produce food and provide livelihood to people in the marginalized sector. In the Philippine Fisheries Profile 2019 of the Bureau of Fisheries and Aquatic Resources under the Department of Agriculture (DA-BFAR, 2020), the total volume of fish production from aquaculture constituted about 53.20 % of the Philippine total fisheries production. The bulk of aquaculture production came from seaweeds (63.60 %), followed by milkfish (17.38 %), tilapia (11.85 %), and then shrimp/prawn (2.81 %). The remaining 4.36 % is the

combined production of other commodities such as oysters, mussels, and crabs.

Milkfish (*Chanos chanos*, Forsskal) or bangus in the Philippines, is unofficially dubbed as the “National Fish of the Philippines” due to its immense popularity in the country, as an economically important cultured fish (White, 2016). Its popularity stems from its ability to survive and adapt to many culture conditions leading to increased production, making it a staple food for millions of Filipinos. However, data shows that its aquaculture production has been fluctuating in recent years (Figure 1). In 2016, the Philippines produced 398 tonnes (t) of milkfish, followed by a 3.26 % increase to 411 t in 2017. Milkfish aquaculture production drastically went down by 26.27 % to 303 t and then staggeringly went up to 409 t the following year (DA-BFAR, 2017; DA-BFAR, 2018; DA-BFAR, 2019; DA-BFAR, 2020).

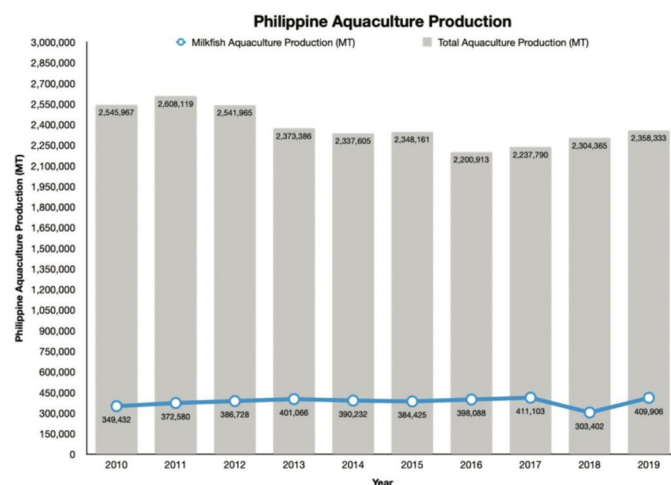


Figure 1. Milkfish aquaculture production in the Philippines over ten years (2010 - 2019) by quantity (t)
Source: DA-BFAR (2010 - 2020)

The erratic production figures can be attributed to the seasonal availability of seed stocks as the Philippine milkfish industry is still highly reliant on wild-caught seed stocks (Santos et al., 2018). According to the Memorandum on Bangus Fry Sufficiency Program of DA-BFAR by E. Gongona (personal communication, 2 May 2018), the current combined production of wild-caught fry and captive-bred fry is just 1.1 billion pcs, 1.4 billion pcs short from meeting the annual fry requirement of the country, which is 2.5 billion fry. Fish farmers therefore resorted to importation of fry from nearby countries, particularly Indonesia to make up for the insufficiency.

To address this problem, DA-BFAR came up with the “National Bangus Fry Sufficiency Program” which aims to locally produce an estimated 1.2 billion milkfish fry by putting up hatcheries in strategic locations all over the Philippines and to reduce the reliance of fish farmers on imported fry by as much as 85 %. About 48 hatcheries are needed to realize this program, and each hatchery would need to produce 25 million fry per annum. These proposed hatcheries would need about 3,750 milkfish breeders: 2,500 females and 1,250 males following the ratio of 2 females to 1 male. Apart from solving the scarce fry supply, the program would also try to break the stigma that captive-bred fry are inferior to wild-caught fry in terms of growth, morphology, and survival as DA-BFAR would ensure that the fry produced would be of the highest quality.

Legislated Hatcheries

The constructed hatcheries in the different regions of the Philippines are meant to culture multispecies aquaculture commodities (Figure 2). Hatcheries were designed based on the basic requirements of a milkfish hatchery, considering the location and capacity of the region where it will be constructed. Proposed hatcheries would contain broodstock tanks called ‘core hatchery,’ and if the broodstock tanks are absent, it will function as a ‘satellite hatchery.’ These proposed hatcheries are versatile enough to accommodate the culture of other economically important aquaculture species such as the black tiger shrimp (*Penaeus monodon*), mangrove crab (*Scylla serrata*), and other commodities that are quickly gaining in popularity, e.g. pompano (*Trachinotus blochii*). Doing this would give the receiving local government units (LGUs) the flexibility to choose what species to culture based on their preference and capacity (Figure 3). Once established, these hatcheries would then provide the seed requirements for grow-out of their respective regions. Aside from fry production, these hatcheries would also serve as training and demonstration facilities for interested private groups or individuals.



Figure 2. Perspective view of one of the proposed multi-species marine hatcheries

Main commodity:



Milkfish

Alternative commodities:



Pompano



Black Tiger Shrimp



Mud Crab

Figure 3. Species alternative to milkfish for culture in the hatcheries

The proposed establishment of the hatcheries was passed as legislation or Republic Act (R.A.) to ensure that it will push through. To enact this program, DA-BFAR has tapped SEAFDEC/AQD to provide training and technical assistance in conducting the feasibility studies for several of these legislated hatcheries. Out of 23 identified legislated hatcheries around the Philippines, SEAFDEC/AQD was tasked to study the feasibility of 16 hatcheries. Out of the 16, SEAFDEC/AQD has already finished conducting feasibility studies for eight sites and has submitted the necessary reports and other documents to DA-BFAR and the receiving LGUs.

To date, construction of three hatcheries in the CARAGA Administrative Region (Figure 4) which comprises five provinces in northeastern Mindanao: Agusan del Norte, Agusan del Sur, Dinagat Islands, Surigao del Norte, and Surigao del Sur, is already ongoing, and currently in various stages of completion. Two of these are multispecies marine

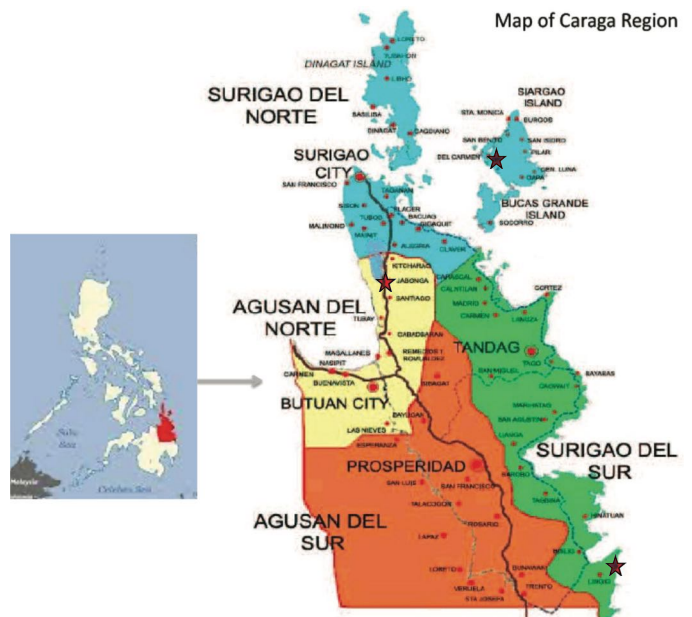


Figure 4. Map of Caraga Administrative Region, Philippines, showing the sites of the three hatcheries (★): Lingig (Surigao del Sur), Del Carmen (Surigao del Norte), and Jabonga (Agusan del Norte)

Lingig, Surigao del Sur



Del Carmen, Surigao del Norte



Jabonga, Agusan del Norte



Figure 5. Progress of the construction of the hatcheries in three sites: Lingig (Surigao del Sur), Del Carmen (Surigao del Norte), and Jabonga (Agusan del Norte)

hatcheries located in Lingig, Surigao del Sur and in Del Carmen, Surigao del Norte. The remaining hatchery is a multi-species freshwater hatchery in Jabonga, Agusan del Norte. Progress of the hatchery construction works in these three sites is shown in **Figure 5**.

Meanwhile, the feasibility studies of the sites in Perez, Quezon; Sultan Naga Dimaporo, Lanao del Norte; Surigao City, Surigao del Norte; Hinatuan, Surigao del Sur; and Jose Dalman, Zamboanga del Norte have already been turned over to their respective LGUs for the implementation.

Due to travel restrictions and health risks brought about by the COVID-19 pandemic, the conduct of feasibility studies of the remaining sites was passed on to the regional offices of DA-BFAR. The status of the feasibility studies undertaken by SEAFDEC/AQD for the legislated hatcheries is summarized in **Table 1**.

Table 1. Status of the feasibility studies (FS) of the legislated hatcheries assigned to SEAFDEC/AQD

R.A.	Location	Status
10787	Lingig, Surigao del Sur	FS Completed
10825	Del Carmen, Surigao del Norte	FS Completed
10825	Surigao City, Surigao del Norte	FS Completed
10813	Jabonga, Agusan del Norte	FS Completed
10945	Perez, Quezon	FS Completed
10859	Jose Dalman, Zamboanga del Norte	FS Completed
10860	Sultan Naga Dimaporo, Lanao del Norte	FS Completed
10944	Hinatuan, Surigao del Sur	FS Completed
10856	Bantayan, Cebu	FS to DA-BFAR 7
10858	Nasipit, Agusan del Norte	FS to DA-BFAR CARAGA
10939	Atimonan, Quezon	FS to DA-BFAR 4A
10948	Guinyangan, Quezon	FS to DA-BFAR 4A
10950	Ligao, Albay	FS to DA-BFAR 5
10938	Lopez, Quezon	FS to DA-BFAR 4A
10940	Gumaca, Quezon	FS to DA-BFAR 4A
10947	Plaridel, Quezon	FS to DA-BFAR 4A

Revival of Abandoned Hatcheries

Back in 2019, SEAFDEC/AQD assisted the DA-BFAR Regional Office 6 (DA-BFAR 6) in profiling the hatcheries in Western Visayas (**Figure 6**), which comprised the provinces of Aklan, Antique, Capiz, Guimaras, Iloilo, and Negros



Figure 6. Map of Western Visayas showing the location of Batan in Aklan, and NIPSC Concepcion Campus in Concepcion, Iloilo, where the abandoned hatcheries are planned to be revived and or rehabilitated into milkfish hatcheries

Occidental. The hatchery profiling was aimed at determining which hatcheries are operational or non-operational. Usually the hatcheries become abandoned or rendered non-operational due to the demise of hatchery owners or inadequacy of finances to continue the hatchery operations or bankruptcy. After profiling, DA-BFAR 6 selected two abandoned hatcheries that were considered candidates for revival or rehabilitation into milkfish satellite hatcheries.

The main criteria for selection include tank stability, accessibility of its location, and ownership rights. One of the selected abandoned hatcheries is located in Batan, Aklan, while the other is located inside the Northern Iloilo Polytechnic State College (NIPSC) Concepcion Campus in Concepcion, Iloilo (Figure 6). The ultimate goal of reviving these hatcheries would be to maximize the milkfish production potentials of the Western Visayas Region. The hatchery in Batan is privately-owned and was used to culture shrimp postlarvae. However, shrimp diseases were too much to handle in the past, leading to the termination of hatchery operations. The hatchery has almost all of the necessary amenities in rearing milkfish larvae to fry. However, a phycology laboratory that is essential to provide a continuous supply of natural food to the growing larvae during larval rearing operations shall be constructed.

The tanks and other facilities on-site were renovated, cracks were repaired, roofing installed, repainting carried out, and others (Figure 7). SEAFDEC/AQD has advised the construction of a phycology laboratory, and so far, the hatchery rehabilitation is almost complete, and SEAFDEC/AQD has already sent 1.1 million milkfish larvae and 30 L of rotifers to jumpstart the hatchery operations. Meanwhile, the non-operational hatchery in Concepcion, Iloilo, had not even operated from the start. However, some of the facilities were slightly used to culture tilapia (*Oreochromis* sp.) probably for experimental purposes.



Figure 7. Rehabilitated hatchery tanks in Batan, Aklan; and in Concepcion, Iloilo

The abandoned hatchery at NIPSC has two portions: outdoor and indoor. The tanks located outside were demolished as these were not fit for rearing milkfish larvae, and new concrete tanks were later built, making it more suitable for milkfish larval rearing operations. Inside, the hatchery houses several tanks and a reservoir. Some of these were rehabilitated, and a filter tank was constructed inside. Similar to the previous hatchery, a phycology laboratory needs to be constructed. To date, construction and repair of the necessary facilities were already done apart from the phycology laboratory construction (Figure 7). Once rehabilitation is completed, this would become a fully functional milkfish satellite hatchery that can accept eggs and larvae from nearby core hatcheries. It will be capable of rearing fry, which would hopefully translate to increased milkfish production in Western Visayas.

New Facilities at SEAFDEC/AQD

Aside from assisting the promotion of the “National Bangus Fry Sufficiency Program” of DA-BFAR, SEAFDEC/AQD is also keen on doing its part to produce the seed requirements and address several seed shortages of key commodities in the country. Recently, SEAFDEC/AQD has finished the construction of two multispecies hatcheries, one catered for marine species (Figure 8) and the other for freshwater species (Figure 9), at its Tigbauan Main Station (TMS) in Iloilo Province.

The newly built marine hatchery is expected to produce seeds of priority marine species such as milkfish, pompano, grouper (*Epinephelus* sp.), and others. At the same time, the newly built freshwater hatchery is set to produce the fry of catfish (*Clarias* spp.), giant freshwater prawn (*Macrobrachium rosenbergii*), and tilapia. Meanwhile, the newly constructed milkfish broodstock facility (Figure 10) would house the additional milkfish breeders acquired by SEAFDEC/AQD for the production of the much needed additional eggs to ramp up seed production at the other SEAFDEC/AQD facilities at its Tigbauan Main Station in Iloilo, Philippines.

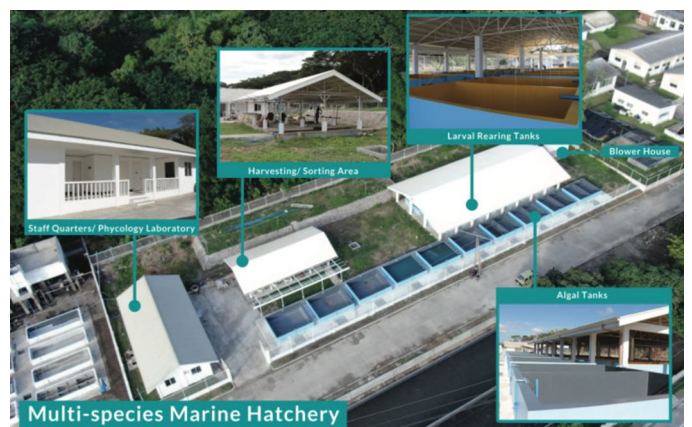


Figure 8. The newly constructed marine multispecies hatchery at SEAFDEC/AQD Tigbauan Main Station, Iloilo, Philippines



Figure 9. The newly constructed freshwater multispecies hatchery at SEAFDEC/AQD Tigbauan Main Station, Iloilo, Philippines



Figure 10. The newly completed hatchery systems at SEAFDEC/AQD Tigbauan Main Station, Iloilo, Philippines

Ultimately, this multimillion-pesos project (**Figure 10**) spearheaded by the current SEAFDEC/AQD Chief would serve as a model for the proposed multispecies hatcheries all over the Philippines. It will show what those hatcheries are capable of, how they should operate, and how much they can produce. These hatchery systems would help boost the efforts of the Philippine Government to ensure that there is available supply of seeds, *e.g.* fry, fingerlings of economically important aquaculture commodities to enhance the country's fish production from aquaculture.

Way Forward

In its bid to help address the aquaculture seed shortage of its host country the Philippines, SEAFDEC/AQD would continue to collaborate with DA-BFAR in implementing relevant projects in the future. SEAFDEC/AQD would also try to help produce high-quality fry using ripe technologies developed by its researchers and scientists. As simple as they may seem, innovations in culture technologies are also slowly being applied to increase production. Recently, SEAFDEC/AQD has installed water heaters in its milkfish broodstock tanks to enhance egg production during colder months of the year, and it has proved to be successful. However, production numbers do not match the output during warmer months. However, it

is a welcome development as SEAFDEC/AQD strives to aid its host country in achieving food security.

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