

Towards Reviving the Production of Philippine Native Aquatic Species

Frolan A. Aya

The overexploitation of native aquatic species mainly for household consumption, not to mention the habitat loss and introduction of invasive alien species in major inland water bodies of the Philippines, has resulted in the significant decline of their natural populations. Philippine Republic Act 9147 otherwise known as the Wildlife Resources Conservation and Protection Act of 2001 and the Fisheries Administrative Order 233-1 in 2010 issued by the Philippine Bureau of Fisheries and Aquatic Resources (BFAR) served as two legal frameworks for protecting and conserving aquatic wildlife including indigenous species of the Philippines. With the current declining state of the country's native aquatic species, relevant studies such as breeding and development of seed production techniques are necessary to revive the production of native aquatic species. These studies would also support the Philippine Government's *Balik Sigla sa Ilog at Lawa (BASIL)* program of restocking inland water bodies with native aquatic species.

The Philippines has about 361 freshwater fish species found in inland water bodies, with 181 considered as native aquatic species (Froese & Pauly, 2019). Also, the country has more than 80 lakes (Palma, 2016) and the largest of which is the Laguna de Bay (**Figure 1**) located in Luzon Island. With a total area of 90,000 ha, Laguna de Bay is also the third largest freshwater lake in Southeast Asia having an average depth of about 2.8 m, and elevation of about 1.0 m above sea level.



Figure 1. Location of Laguna de Bay in Luzon Island, Philippines (Source: Google maps)

Laguna de Bay is home to a number of native freshwater fish species that have great potentials for aquaculture. **Figure 2** shows some of the species, such as the silver therapon (*Leiopotherapon plumbeus*), climbing perch (*Anabas testudineus*), Manila sea catfish (*Arius manilensis*), freshwater



Figure 2. Selected Philippine native freshwater fish species found in Laguna de Bay, Luzon Island, Philippines. (A) silver therapon, (B) climbing perch, (C) Asian sea catfish, and (D) freshwater Celebes goby (Source: fishbase.se)

Celebes goby (*Glossogobius celebius*), as well as the Asian catfish (*Clarias macrocephalus*), and striped snakehead (*Channa striata*).

Declining catch of native fishes in major lakes of the Philippines

Some native freshwater fish species of economic importance in the Philippines include mudfish (*Channa striata*), Manila sea catfish (*Arius manilensis*), and Asian catfish (*Clarias macrocephalus*). The latter species, however, is fast disappearing in their natural environment and considered near threatened, thus it is included in the IUCN Red List of Threatened Species (Vidthayanon & Allen, 2011). Production of the climbing perch, although was stable for some time, started to decline in 2015 (**Figure 3**) as it is being subjected to increasing anthropogenic exploitation.

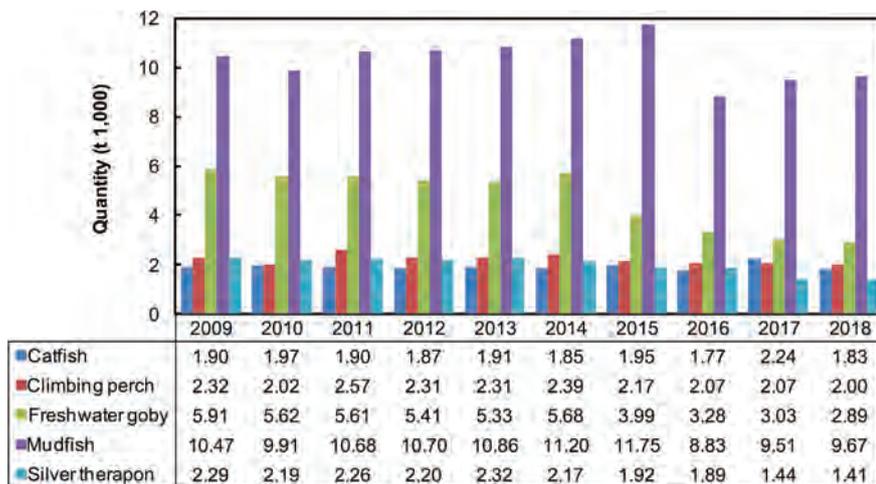


Figure 3. Production quantity (t, 1,000) of selected native freshwater fish species of the Philippines from 2009 to 2018

(Source: PSA, 2019)

For freshwater goby and silver therapon, there has been a continuous decline in the volume of production in recent years. This could have been brought about by the rampant and non-responsible fishing activities, contributing to the overexploitation of indigenous fish species, considering that rural communities near the lakes are dependent on subsistence capture fisheries for household consumption (Figure 4). Another threat to the production of native fish species is the introduction of invasive alien species such as the predatory fish *Chitala ornata* or knife fish (Figure 5). Naturally distributed in Cambodia, Lao PDR, Thailand, and Viet Nam, this ornamental fish is believed to be accidentally introduced in Laguna de Bay during the Typhoon Ondoy in 2009 (Guerrero III, 2014). Particular attention is paid on the containment of this invasive species for they heavily feed on small native fish species in lakes and other freshwater bodies.

Recently, a report on the feeding ecology of knife fish in Laguna de Bay found silver therapon as the most important component of its diet (Corpuz, 2018), resulting in the significant decline of wild silver therapon population in the lake. Consequently, it was also reported that the livelihood of



Figure 5. Knife fish, *Chitala ornata*, is a predatory fish that have caused the significant decline of native aquatic species in Laguna de Bay, Luzon Island, Philippines



Figure 4. Fresh (A) and dried (B) silver therapon sold in lakeside fishing communities, locals consume ayungin sinigang, a delicious Filipino sour soup dish (C)

many fisherfolk around Laguna de Bay was severely affected because about 40 percent of their daily catch was composed of knife fish (BFAR and PCAARRD, 2012).

This problem caused the fishermen to earn less income as compared before when most of their catch were the farmed bighead carp (*Aristichthys nobilis*), milkfish (*Chanos chanos*), and tilapia (*Oreochromis niloticus*) which command higher market prices and are more preferred commodities than the knife fish.

Government initiatives on habitat conservation and restoration of native aquatic species

There are two legal frameworks which safeguard the aquatic wildlife and their habitats in the Philippines. First is the Republic Act 9147 otherwise known as the Wildlife Resources Conservation and Protection Act of 2001 which mandates the State to conserve the country’s wildlife resources and their habitats for sustainability. Second, the Fisheries Administrative Order 233-1 in 2010 was issued by BFAR to protect and conserve the aquatic wildlife including the indigenous species. In addition, the five-year National Inland Fisheries Enhancement Program (NIFEP) was conceptualized and implemented by BFAR to restore the conditions of 16 lakes around the country and increase fish biodiversity by restocking of indigenous fish species in these lakes (Palma & Bartolome, 2016). Situated in San Antonio, Quezon Province in Luzon Island, Dagatan Lake is home to some indigenous freshwater fishes such as the Asian catfish, and has been restored successfully through the efforts of the NIFEP. The Program envisioned to: 1) establish a national center and gene bank for indigenous fishes; 2) develop breeding protocols for low trophic species; 3) repopulate, manage, and conserve indigenous fishes; and 3) develop a network of satellite regional government and private hatcheries to supply the fingerlings requirement (Palma & Bartolome, 2016).

To control and manage the proliferation of invasive species such as knife fish, an inter-agency technical working group was formed in 2013 involving various government agencies including BFAR, Laguna Lake Development Authority (LLDA), Technical Skills and Development Authority (TESDA), Department of Environment and Natural Resources (DENR), Philippine Council for Agriculture and Aquatic Resources Research and Development (PCAARRD), Department of Trade and Industry (DTI), Department of Social Welfare and Development (DSWD), and the Department of Interior and Local Government (DILG) as well as the academe (e.g. University of the Philippines in Los Baños or UPLB) to develop effective strategies to contain or eradicate this unwanted species in Laguna de Bay.

A website on invasive fishes was developed by BFAR and is already in place to serve as a repository of information on the reported invasive species in the Philippines as well as to provide updates on the strategies and interventions of the technical working group. In addition, UPLB has issued a technical bulletin on the biology of knife fish for the fisherfolk to understand the biology, behavior, and movement of this invasive species (PCAARRD, 2017).

Intensifying research programs on native freshwater fishes

Research on native fish species is very important to address their declining populations in the wild. Currently, there have been interests in studying the native aquatic species for conservation and aquaculture. The Binangonan Freshwater Station of Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), in collaboration with the University of the Philippines in Diliman has conducted research on several indigenous freshwater species such as silver therapon (Aya *et al.*, 2015a, b, c; 2016; 2017; 2019) and climbing perch aimed at domesticating these native aquatic species. At SEAFDEC/AQD, the life cycle of captive silver therapon has been successfully closed and the rearing protocols during the most critical phase of its culture, the larval stages, have been established (Figure 6). Other universities such as UPLB and Bataan Peninsula State University as well

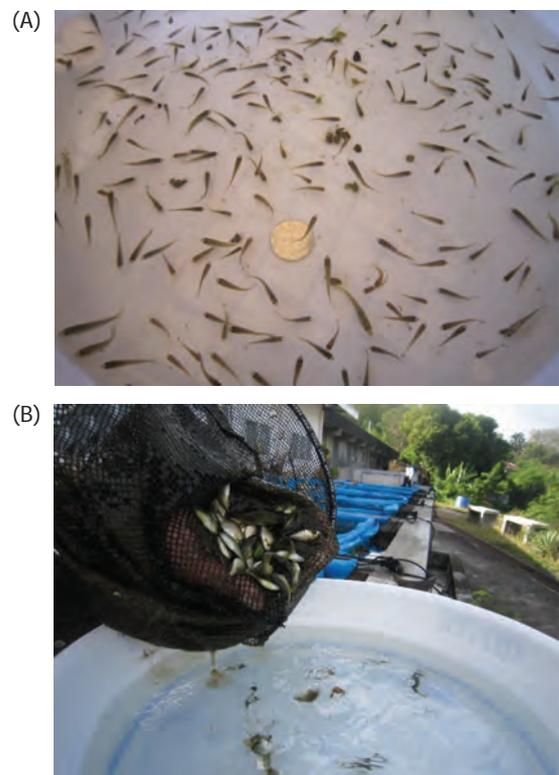


Figure 6. Early stage larvae (A) and advanced juveniles (B) of silver therapon produced at the hatchery facilities of SEAFDEC/AQD Binangonan Freshwater Station in Binangonan, Rizal, Philippines

as the National Fisheries Research and Development Institute (NFRDI) of BFAR are also doing complementary efforts to conserve and manage the natural populations of native freshwater fishes such as silver therapon, goby, and mudfish.

Most of the studies conducted to date are on the aspects of larval and reproductive biology of freshwater fish species. Information on the larval biology of silver therapon have been reported, particularly in the feeding traits (Aya *et al.*, 2015a, b), early life history (Aya & Garcia, 2016), larval and early juvenile development (Aya *et al.*, 2017), and the effect of physical substrate, including prey selection and diel feeding cycle of this species (Aya *et al.*, 2019). In addition, a preliminary study has been conducted on weaning and larval diets suitable for rearing silver therapon larvae (Aya *et al.*, 2015c). The findings on feeding biology and larval development studies of silver therapon are the key source of valid information to develop a viable hatchery seed production technology for this valuable food fish commodity. These are also important in understanding the biology of the species for the development of effective larval feeding schemes for aquaculture, and means to conserve and manage their natural populations. In addition, hatchery production of this species would support the national government's BASIL program of restocking natural waters with native fish species.

However, studies on the reproductive biology of silver therapon are outdated and limited. Reproductive studies have been focused on the effect of hormones and handling stress on spermiation of male silver therapon as well as on the gonad development and size-at-maturity of wild silver therapon in two Philippine volcanic lakes (Denusta *et al.*, 2014; 2019). Studies comparing wild-sourced and hatchery-bred silver therapon in terms of their breeding performance, reproductive development, nutritional composition, growth, and survival have also been completed. The development of broodstock diets to enhance the reproductive performance and eggs and larval quality of silver therapon is still in progress. Recently, a report of the reproductive biology of the climbing perch in a tropical wetland (Bernal *et al.*, 2015) could be useful in the efforts to successfully breed this fish species under captive conditions.

Preliminary work on climbing perch at SEAFDEC/AQD has also focused on developing artificial spawning and larval rearing protocols in the hatchery. Nonetheless, the existing hatchery seed production trials have remained tentative due to low survivorship of climbing perch during the early larval rearing stages. Therefore, further studies are needed to develop and improve seed production techniques for climbing perch.

Way Forward

Studies are extremely important for reviving the production of Philippine native aquatic species, many of which are facing threats of overfishing and possible extinction. The alarming decline of the freshwater fisheries catch emphasizes the need to manage the wild stocks, which requires an understanding of their reproductive and larval biology. There is a need also to conduct stock assessment or inventory of indigenous freshwater species in the Philippines to understand the status of their production in the wild. Studies that are geared towards the development of breeding and seed production techniques for native freshwater species are urgent and necessary before they become extinct in their natural habitat. SEAFDEC/AQD, government agencies, the academe, and other research institutions have initiated research interventions to immediately address the problem and save these Philippine native freshwater species from extinction. Reviving the production of these native freshwater species could help increase the local fish biodiversity and secure food fish supply in rural areas.

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About the Author

Dr. Frolan A. Aya is a Scientist of SEAFDEC Aquaculture Department based at the SEAFDEC/AQD Binangonan Freshwater Station, Binangonan, Rizal, Philippines. He can be reached through faya@seafdec.org.ph.