

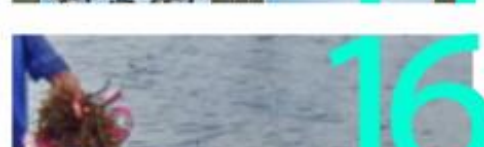
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Editorial:
Philippine Aquaculture in focus

Building Capacities for a
Climate Resilient
Tilapia Farming in
the Philippines

Change Has Come To
Laguna de Bay

The Ideal Brackishwater Breed

Circle Of Life

DA and FAO to Promote
Gracilaria Farming
in Sorsogon

Fish and Seaweed Processing
and Value Adding

Training on Developing
a HACCP Plan

Region in Focus:
Compostela Valley, Davao

R. A. 10654 Article III
Aquaculture

About the cover:

A female tilapia incubates eggs in her mouth. Mouthbrooding, an advanced reproductive tactic, is a form of intensive care where the eggs can be protected from the outside world until their development is more advanced. The eggs are fertilized by the male tilapia. The female tilapia then collects and incubates the eggs in her mouth.

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EDITOR'S NOTE

Philippine Aquaculture - In Focus



Half of the Philippine fisheries production comes from aquaculture. In 2015, the aquaculture subsector contributed more than 2.3 million metric tons valued at 93.34 billion pesos at current price. Aside from providing enough farmed fish supply to the local market, aquaculture also brings export revenues to the country. Thus, the notable role this industry plays in the economy and food security cannot be overstated.

In this issue of Fish Files, aquaculture takes the center stage. This is our way of giving importance to the industry while heightening the readers' awareness about the industry's gains and challenges. It is important to note that despite the milestones achieved through the years, myriad of challenges still confront our fish farmers.

Good thing, the Department of Agriculture (DA) under the new administration has identified aquaculture development as one of its priorities. In his policy statements, Secretary Manny Piñol pointed out that in order to achieve self food sufficiency, the Department will improve the state of the aquaculture industry.

Among the strategies identified to achieve this goal includes easy access to financing for fisherfolk who are into fish farming; adoption of best aquaculture practices such as the use of energy-saving fish farming systems and the implementation of development road map for bangus, tilapia, seaweeds, sea cucumber and shellfish as five priority commodities. ■

BUILDING CAPACITIES FOR A CLIMATE RESILIENT TILAPIA FARMING IN THE PHILIPPINES

A PROJECT BY UN FAO, BFAR AND PAGASA

Climate Change has been one of the major challenges hampering the growth of the fisheries sector. The aquaculture sub-sector, being vulnerable to weather and climate-induced stress, is one of the most exposed to the impacts of climate change. Tropical typhoons/storms, stronger natural phenomena like El Niño and La Niña, temperature rise and other climate-related phenomena put strain on off-shore and inland fisheries farming operations. The effects of climate and environmental stress over the years are reflected on the decrease in production in aquaculture recorded in 2011 and 2014.



This is why, as outlined in the 2016-2020 Comprehensive National Fisheries Industry Development Plan, one of the critical strategies to be employed by the sector is ensuring resilience to climate and disaster. This necessitates that the room for uncertainty when it comes to the climate variability and its effects is minimized through promotion of enabling policies and employment of technologies that tap into scientific and evidence-based information. Innovative and creative ways to mitigate the effects of climate change should also be implemented. These include technologies accessible to farmers and alternative means of financial recovery from crop failure brought about by climate change and disasters.

The DA-BFAR, with support from the Food and Agriculture Organization (FAO) of the United Nations and in partnership with DOST-Philippine Astronomical Geophysical Atmospheric Services Administration (PAGASA), implemented a project that focuses on the tilapia sub-sector as a pilot enterprise. Tilapia, as the second highest produced aquaculture commodity (except seaweeds), is a critical component to food sufficiency and economy, yet similar to other aquaculture sub-sectors, is also highly exposed to the risks of climate change.



The project titled "Building Capacities for a Climate Resilient Tilapia Farming in the Philippines," aims to improve the level of resiliency and adaptation of the tilapia sub-sector to climate-related risks by implementing effective adaptation tools, improved technologies, identification of viable livelihood options and policy measures that support them. The project was implemented in key tilapia-producing areas namely Minalin, Pampanga; Santiago City, Isabela; and Iriga City, Camarines Sur. BFAR-Inland Fisheries and Aquaculture Division oversees its implementation.



The project targets to address several issues of the sub-sector when it comes to climate resiliency and adaptability. To do this, BFAR first needs to address the lack of baseline information as far as socio-economic impacts to farmers and vulnerabilities and adaptability of the sector to climatic challenges are concerned. Additionally, viable livelihood options for farmers to cushion the effects of crop/ market failure due to the negative impacts of climate change should also be explored. As start, BFAR conducted a series of field surveys, focus group discussions, and key informant interviews with 200 farmers of major commodities from different key producing areas of different climate types. This information gathering was used to determine sensible and appropriate insurance scheme/programs and alternative livelihoods to promote financial recovery of farmers. Additionally, traditional climate-related risks mitigation measures were compiled into a techno-guide for dissemination to farmers.



The project also envisions providing creative and innovative tools that will equip farmers with quick and easy access to information needed for farm operations. Currently, affordable multi-use ICTS such as websites and an android application which is capable of receiving updated agro-meteorological information, farm-level weather advisories, computational capabilities applied to aquaculture operations and other functionalities that will provide knowledge assistance for efficient input and reduce exposure to climate/ weather related risks in the farm operations are being pilot-tested and are ready for deployment in some of the partner localities.

Automated Weather Stations (AWS) which will serve as Local Climate Information Centers for LGUs were already installed and turned over to LGUs during three Climate/ El Niño Forums. Together with deployed "Community Aqua-meteorologists" now being trained by BFAR, AWS will help with the mainstreaming of disaster risks reduction systems and agro-fishery programs. Community Aqua-meteorologists will act as extension agents both by BFAR and DOST-PAGASA by delivering information to the farmers regarding farm weather through the use of information and communication technology.





Capability-building programs are also being conducted by BFAR together with the partner LGUs to increase preparedness and practical farming knowledge of tilapia farmers. Over 400 participants attended a series of workshops regarding climate resilient aquaculture operations, damage assessment methods and farm management decision making. As mentioned, trainings for Aqua-meteorologists are also being given. Aside from these, information, education, and communication materials are being developed and disseminated to increase awareness of the stakeholders in climate risk reduction and management.

Aside from promoting enabling policies and introduce technology and information systems to farmers, the project also gave opportunity to the government to strengthen its linkages, build networks among the stakeholders, and develop strategies in effective engagement of communities to address key issues confronting the sector. Together, these efforts aim at creating more resilient tilapia farming communities that can overcome and adapt to the challenges posed by climate change. In the future, BFAR can bank on the learnings of this project to create an altogether robust and resilient aquaculture sector. Given the state of our marine resources, it is important to spur growth in the aquaculture sector to cushion the effects on food sufficiency as it is seen as the only alternative when it comes to foodfish production. ■



Change Has Come In Laguna De Bay

Laguna De Bay (Ba'i) is one of the richest inland bodies of water in terms of fishery resources. One of the main fishery industries in the lake is the fish pen/cage industry. The industry contributes to about 35 percent of the total bangus supply in Metro Manila on a weekly basis.

In his first State of the Nation Address, President Rodrigo Duterte ordered the dismantling of the illegal fish pens in Laguna De Bay. In particular, he mentioned that illegal fish pens affect the livelihood of subsistence fisherfolk. With this pronouncement, the president, ordered its environmental policy implementing arm - the Department of Environment and Natural Resources - to dismantle the illegal fish pens/cages in the lake to give way for an eco-tourism project. If illegal fish pens would be removed by the end of the year, what could be its effect to the fish supply in Manila and nearby provinces?

A Look into the Past

Fish pen industry has been profitably operated in the lake ever since the 1970s when the Laguna Lake Development Authority (LLDA) successfully cultured milkfish in fish pens at Cardona, Rizal. In a socio-economic study of fish pen aquaculture in Laguna De Bay by Nicolas and Librero (1977), in 1973, around 993 fish pens covering a total area of 4,802 hectares were installed in the area.



Photo by: Mag-Agri Toyo

According to the study of Mane (1981), in 1980, fish pens occupied around 7,000 hectares of the total land area of the lake which is equivalent to an annual yield of 25,000 to 30,000 tons of milkfish valued at approximately 200-250 million dollars (as cited in Dela Cruz, 1982).



Photo by: Mag-Agri Toyo

Laguna De Bay Today

Today, fish pens / cages occupy around 12,316 hectares of the total land area of Laguna De Bay. Section 51 of Republic Act 10654 otherwise known as the newly amended Philippine Fisheries Code stipulates “that not over ten percent (10%) of the suitable water surface area of all lakes and rivers shall be allotted for aquaculture purposes like fish pens, fish cages and fish traps.”



LLDA determined that the 10% surface area requirement of Laguna De Bay for fish pens/cages only constitutes 9,000 hectares. Hence, the current carrying capacity is in excess of 3,316 hectares of fish pens/cages. In pursuance of the law, the removal of this excess area will be enforced.



What needs to be done?

The Bureau of Fisheries and Aquatic Resources (BFAR) met with LLDA and fishery industry representatives to discuss the possible scenarios and craft a plan to mitigate the impacts of phasing-out fish pen/cage operations in the lake.

This back-up plan was in compliance with Agriculture Secretary Emmanuel Piñol's order to ensure stable fish supply in markets as a result of the on-going dismantling of fish pen/cages in Laguna De Bay.





At present, the 12,316 hectares capacity of Laguna De Bay supply approximately 346,213 kilos of the milkfish and 357,142 kilos of tilapia in Metro Manila per week. The fish pens also supply around 268,166 kilogram of bighead carp to the city with an overall total fish production volume of 972,521 kilogram per week.



If the excess 3,316 hectares of fish pen/cages will be removed, around 6,500 – 26,000 tons of milkfish and 3,000 tons of tilapia on a yearly basis will be lost. However, there will be negligible loss in the supply of bighead carps.

According to the Officer-in Charge of the BFAR-Inland Fisheries and Aquaculture Division Roy C. Ortega:

"The results of the impact assessment showed that farmers operating in Bulacan and other neighboring provinces can readily fill in the supply gap of both milkfish and tilapia in Metro Manila and other markets surrounding Laguna De Bay."

In addition, the removal of the excess fish pen/cages will have no apparent immediate and drastic impact on the retail prices of milkfish and tilapia. The assessment clarified that the 36% loss of fish supply in Metro Manila markets will only be a consequence of the enforcement of a zero-fish pen policy in Laguna De Bay.

Ortega added that the removal of excess fish pen/cages is also advantageous in the improving the growth of farmed fish in Laguna De Bay as it can be attributed to the increased carrying capacity of the lake.

However, the removal operation will affect around 4,000 to 5,000 aqua farm and ancillary workers (e.g. fish marketers, handlers, pen construction crew, etc.) in Laguna De Bay. In order to mitigate the socio-economic impact on this sector, BFAR and LLDA will intensify its livelihood and other labor intensive environmental programs to assist economically displaced fisherfolk.

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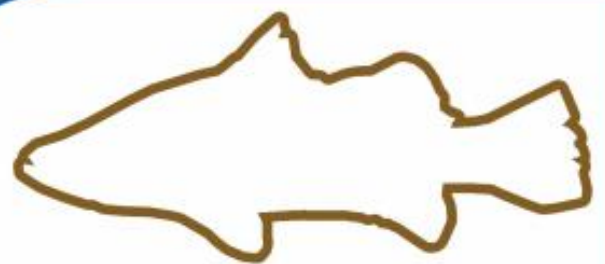
A Look Ahead

Indeed, the proliferation of illegal fish pens/cages, if it persisted, may have affected the productivity and carrying capacity of the lake and degrade the quality of farmed fish. In order to create sustainable environment for aquaculture in the lake, the dismantling of fish pens/cages will greatly improve the fishing sector in the area. This move is at par with BFAR's intensified campaign against illegal, unreported and unregulated fishing. Rest assured that with the help of other suppliers in the fisheries sector from different areas, the supply and price of milkfish and tilapia in Metro Manila and nearby areas will not be affected in the long run. ■

Sources:

MANE, A.M. 1981 *Management and maintenance of fisheries in Laguna de Bay*. Lecture given in training in small-scale pen culture for finfish. Sponsored by UNDP/FAO through SCSP. Mimeographed. 8p.

NICOLAS, E.S. and A.R. LIRERO. 1977 *A socio-economic study of fishpen aquaculture in Laguna Lake, Philippines*. Paper presented at the second Biennial Meeting of the Agricultural Economics Society of Southeast Asia. Iloilo, Mimeographed. 15p.



What **isda** name?

Turn to page 27

for some cool trivia about this fish

THE IDEAL BRACKISHWATER BREED

Just when you thought you knew everything about tilapia, it comes as a surprise that there is more to it. A new species, in fact!

A hybrid species called the *Molobicus* proves to be a tough contender in high-saline water environments – and with bigger, tastier gains too.

Developed through over 17 years of research, the *Molobicus* is a cross between the fast growing *Niloticus* and saline-resistant *Mossambicus* tilapia. Retaining the desirable qualities of both species, the *Molobicus* makes for a hardy, high-yield aquaculture commodity.

Development

It was in the 1990s when the country's black tiger shrimp industry was struck with disease. Shrimp production significantly declined and with the lack of an alternative culture species, brackishwater ponds were abandoned.

This was where the development of a tilapia hybrid came in. There was this need for a biomanipulator which could not only condition pond water for shrimp culture and discourage the growth of harmful bacteria but could also serve as a standalone and profitable aquaculture commodity.

So, in 1999, the *Molobicus* Tilapia program began. Led by the Bureau of Fisheries and Aquatic Resources' National Inland Fisheries Technology Development Center (BFAR-NIFTDC), the program sought to combine the high-salinity tolerance of the *Mossambicus* and the fast growth of the *Niloticus*.



Phase 1 of the program involved the crossbreeding of the two species until the desired salinity tolerance of the hybrid was attained. Phase 2, which moved to increase growth rate, developed subsequent generations of genetically-improved *Molobicus* hybrids.

During this phase, two *Molobicus* strains – one fed with natural food and the other with commercial feed – were put under selective breeding. Here, the heaviest individuals of each family were selected and used as breeders of the next generation, providing an increment growth of 7.3 %.

Now on their 8th generation (GO8), both strains are produced and distributed nationwide, and with Phase II still on-going, the *Molobicus* continues to improve as a fast growing, saline-resistant Tilapia hybrid.



The *Molobicus* Team. From left to right: Dominador V. Bilog, Jr., Joselito S. Garcia, Rolando A. Cancino, Angelica Venus R. Manantan, BFAR NIFTDC Center Chief Dr. Westly Rosario, Nerafe C. Muyalde, Anthony C. Magalong, Rowie Rosario. Back row: Frederick D. Carbonell and Marcelino G. Sabandal.

Performance

Specifically designed for culture in brackishwater ponds, the *Molobicus* Tilapia can withstand salinities beyond 35 ppt at temporary exposure – better than any Tilapia species or hybrids – and can tolerate direct transfer from 10 ppt to 35 without lethal consequences. This means that the hybrid can survive within the ocean's average salinity (which is also 35 ppt) and in uncertain waters where there are varying amounts of salt.

But what really makes the *Molobicus* special is that it not only survives – it thrives. The hybrid can still grow very well at 30ppt to 35 ppt or higher in ponds without any osmoregulatory problem. In fact, after four generations of selection, the hybrid's average body weight has even increased by 50 g.

It then comes as no surprise that the *Molobicus* fetches a higher marketable price than your usual freshwater Tilapia. The hybrid has become popular to consumers because of its small head and big, round body. Rich in omega-3 fatty acids, its meat is reminiscent and highly comparable to that of a marinenwater fish.



“*Molobicus* is now the most talked about Tilapia breed in my home province, Ilocos Sur. When we first introduced it in the market, local fishfarmers were sceptical. Ilocanos having been used to freshwater tilapia as a staple meal, didn't care much until their meticulous taste buds had a taste of what they now call as the best tasting Tilapia in Ilocos.”

Jennifer Mendoza and Maybelle Amata,
fishpond owners of AJJ Farm from Ilocos Sur



Harvested *Molobicus* hybrids weighing 300g each after 3 ½ months of culture at AJJ Farm in Ilocos Sur

Promotion

With fast growth, high salinity tolerance and great marine flavor, the *Molobicus* makes for the best candidate to expand Tilapia production in brackishwater areas. It promises to decongest freshwater ponds and bring sustainable, profitable aquaculture to some of the country's 10,000 hectares of brackishwater.



Hence, in line with Agriculture Secretary Emmanuel "Manny" Piñol's vision of turning the Philippines into one of the world's top Tilapia producer, the DA-BFAR, continues to promote the *Molobicus* Tilapia to both large and small-scale pond owners alike.

Trainings and seminars on the breeding and culture of the hybrid fish have been conducted by the NIFDTC in collaboration with the Asian Fisheries Academy. Last July, a total of 50 participants from BFAR Regional Offices (ROs), the private sector, and the academe gathered to learn the proper management of the fish in saline environment as well as the recent developments of the *Molobicus* project.

"The aim was to strengthen our partnership not only with the government sector but also the private sector for the commercial production and dissemination of *Molobicus* fingerlings throughout the country," said Nerafe C. Muyaide, Unit Head of the *Molobicus* Project.



With a total area of 14 hectares, the Swan Organic Farms and Stations is just one of the many fish farms growing and profiting from the *Molobicus* Tilapia.



The Center has also established hatcheries in select areas where *Molobicus* fingerlings can be disseminated to fisherfolk, BFAR ROs, local government units, and interested private individuals who will all be growing the fingerlings themselves.

"This will sustain the production of Tilapia in the Philippines, most especially in saline environments," said Dr. Muyalde.

And indeed, NIFDTC's long-term plan shows. As part of BFAR's Comprehensive National Fisheries Industry Development Plan (CNFIDP), 40 more satellite *Molobicus* hatcheries will be put up all over the Philippines. These hatcheries will be placed in strategic locations, following a selection criteria that will ensure the availability and acceptability of the *Molobicus*.

It is, after all, the DA-BFAR's mandate to provide enough fish for every Filipino, and as the ideal brackishwater breed soon to be a staple fisheries produce, the *Molobicus* Tilapia has become more than ready to take on this challenge.

Progress

While there is more to be done, such as providing technical assistance to fish farmers and monitoring their overall farm operation, the NIFDTC remains positive that their brackishwater champion can turn the Tilapia industry around.

With pilot farms and hatcheries being established and new research with partner institutions in the works, the *Molobicus* is well on its way towards optimizing the country's natural brackishwater territories and grasping the sustainable kind of fisheries production we could never have with our old freshwater breeds. ■



DEPARTMENT OF AGRICULTURE
BUREAU OF FISHERIES AND AQUATIC RESOURCES



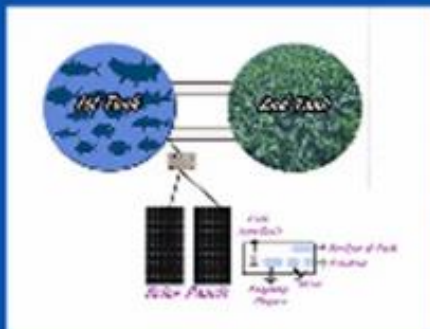
CIRCLE OF LIFE



TECHNOLOGY

The Circle of Life Technology is composed of two (2) circular tanks: Tank 1 holds the water for fish culture while Tank 2 for kangkong, eggplants, gabi and other vegetables. The aquaculture system from Tank 1 is fed to another nutrients and the water is then re-circulated back to the aquaculture system.

The re-circulating water is solar powered connected to the water motor on a re-circulating system with venturi technology.



WHAT ARE THIS TECHNOLOGY'S STRONG POINTS?

- Sustainable food production system
- Fish waste becomes nutrients for the crops
- Easy access to low-cost organic and locally produced food



MATERIAL SPECIFICATIONS

Size: 30 ft diameter

Height: 3 ft

Height of Water: 2.5 ft

Area: 706.86 ft² or 65.75 m²

Fish Stocking Density: 45 pcs/m²

2 Solar Panels: 50 hp



PROJECT SIMPLE COST AND RETURN OF THE TECHNOLOGY CIRCLE OF LIFE

BENEFITS

1. After four (4) months, the fish and the vegetables are readily available.
2. Additional income for fish farmers.
3. Maximizes limited resources such as water, electricity, space and time.
4. Production of organic tilapia and vegetables within your reach.
5. Empowers households to have a direct access to production of fish and vegetables



Assumptions:

Volume of Water:	50 m ²
Water Depth:	2.5 ft
Number of Tank:	1
Initial Weight of Fish:	100g
Stocking Density:	3, 000 / tank
Total Number of Fish Stock:	3, 000 pcs
Ave. Weight of Fish at Harvest:	310 grams
Culture Period:	120 days

Operating Expenses:

Particular	Quantity	Unit Price (PhP)	Cost (PhP)
Tilapia	3, 000	6.00	18, 000.00
Feeds	954.00	25.00	23, 000.00
Labor			
Caretaker (1)	404/day	4 mos. 25% contribution	12, 120.00

TOTAL 53, 920.00

Harvest Data

Total Fish Stock	3, 000.00
Total Number of Fish Harvested	2, 850.00
Survival Rate	95%
Ave. Weight at Harvest	310 g
Total Weight of Harvest	883.5 kgs.
Selling Price (Organic)	100.00

Simple Cost and Return

Gross Sales	88, 350.00
Less:	
Expenses:	53, 920.00
Net Income:	34, 430. 00
Return on Expenses	63.85%

DA-BFAR and FAO to promote *Gracilaria* farming in Sorsogon



Seaweed farming is one of the most important aquaculture activities in the Philippines, but the red seaweed species known as *Gracilaria* has not been the principal species in the country during these past years, mostly due to technical limitations and difficulties for adequate marketing.

Sorsogon is the southernmost province of Luzon Island, the Philippines. This province is characterized by an irregular topography subdivided into fourteen municipalities and one city. Except for one landlocked municipality, all the towns lie along the coast. The eastern coastal areas and Sorsogon Bay are endowed with eleven species of *Gracilaria* seaweeds. There are also *Gracilaria* seaweeds in other coastal areas of the province but it is only in these two areas where endemic *Gracilaria* seaweeds had been scientifically classified and documented. These characteristics make the province of Sorsogon a perfect and ideal location for *Gracilaria* farming.

Gracilaria farming has been promoted and developed in the province of Sorsogon by the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) through various projects and actions since the 90s, but despite these efforts, the Bureau of Agricultural Statistics (BAS) reflected "no data" of *Gracilaria* production from 1992 until 2013 in Sorsogon province.

Therefore, in order to revitalize *Gracilaria* production and promote sustainable farming strategies for *Gracilaria* in Sorsogon province the Food and Agriculture Organization of the United Nations (FAO) and BFAR joined efforts to put in place a realistic project, based on the real needs and limitations of the *Gracilaria* seaweed farming sector in this specific Province. This project is framed under the "FAO Blue Growth Initiative in Support of Food Security and Nutrition, Poverty Alleviation and Healthy Oceans".

Mr. Matthias Halwart, FAO Senior Fisheries Officers informed us that the FAO Blue growth concept looks to further harness the potential of oceans, seas and coasts to eliminate harmful fishing practices and overfishing, and instead, incentivize approaches which promote economic growth, improve conservation, build sustainable aquaculture and fisheries practises and end illegal, unreported and unregulated fishing. Furthermore, FAO is promoting this innovative concept to also act as a catalyst for policy development, investment and innovation in support of food security, poverty reduction, and the sustainable management of aquatic resources of relevance for fisheries and aquaculture.

The project was implemented and coordinated by BFAR officers from December 2015 to March 2016. Main outputs of the project have been:

- A technical, socio-economic and environmental assessment of the current *Gracilaria* species farming sector in Sorsogon of Region V of the Philippines, including major recommendation for sustainable expansion.
- A value chain analysis for *Gracilaria* species in Sorsogon.
- Relevant stakeholders involved on *Gracilaria* species farming in Sorsogon were trained in improved farming strategies and business models.

With regards to the last output, which is focused on the hands-on training of seaweed farmers and by far the most important one of this project, the training was devoted to the following topics: cultivation of *Gracilaria* (preparation of support structure, looping of propagules, installation, agar extraction, economic analysis of *Gracilaria* farming, and data crop logging).

Mr. Miguel Lagamayo, 58 years old and a resident of Barangay Talisay, Sorsogon City has been one of the most active beneficiaries of the project. He said he used to culture seaweeds but his knowledge was not enough. He learned more when he attended the training – workshop by FAO & BFAR.



"We are thankful that special attention is being given to the species *Gracilaria*. The *Gracilaria* farming project is advantageous to us – the marginalized fishers – as native *Gracilaria* seaweeds abound in the area. *Gracilaria* farming is also an alternative source of income for many fishers including myself," Lagamayo said.

Main Achievements of the Project

- A final report on the Technical, Environmental, Socio-Economic and Value Chain Assessment of the *Gracilaria* Seaweed Farming Sector in Sorsogon, Region V, the Philippines has been produced.

- A Training Course on *Gracilaria* (Taxonomy-Distribution-Biology and Ecology, Farming and Crop Management, Post-Harvest, Agar Extraction, Climate Change and Economics) was undertaken in January 2016.

- The results of the technical, environmental and socio-economic assessment and value chain analysis were disseminated to relevant stakeholders in February 2016.

- A Brochure on *Gracilaria* farming has been developed.

- Establishment of *Gracilaria* farms by the beneficiaries in selected municipalities of Sorsogon

Alfredo Pedrosa, President of the National Seaweed Association in the Philippines (SIAP), considers *Gracilaria* farming a good prospect for sustainable and viable livelihood for local fisherfolk. The initial results of *Gracilaria* harvest yield suitable fresh seaweeds for domestic market consumption and produced raw dried seaweeds of export quality at par with international market standards. In due time, the *Gracilaria* production would surely become a vibrant major component of the Philippine seaweed industry.

Innovative approaches of the project: *Gracilaria* farmed with other aquatic species

One of the most successful examples of this project is the implementation of integration of *Gracilaria* farming and other aquatic species, utilizing unproductive brackish fishponds, as a way to maximize productivity and production. It should be noted that the seaweed *Gracilaria* is naturally growing in intertidal mudflats and sometimes in brackishwater ponds.

Farming Strategy

The integrated farming sites are currently located in the province of Sorsogon in the Bicol Region. The sites are located in Prieto Diaz Village, near mangrove areas and close to a river, the main source of brackishwater. The pond bottom is sandy-muddy with a maximum water depth of 1 meter.

Gracilaria is grown as a secondary crop with milkfish (*Chanos chanos*), tiger shrimp (*Penaeus monodon*) or mangrove crab (*Scylla serrata*) as main crops. *Gracilaria* is planted first and then after two weeks, the milkfish, shrimp or mangrove crabs can follow suit.

Four species of *Gracilaria* (*G. changii* and *G. tenuistipitata*) from Barcelona, *G. firma* from Magallanes and *G. heteroclada* from Sorsogon City were planted in ponds, depending on the availability of propagules.



Due to *Gracilaria*'s high tolerance for salinity and temperature, it grows well on ponds. It is perhaps the largest red algae that thrive both in brackishwater with low water motion and full seawater. It, however, seems to favor water qualities with 8.1 pH, salinity of 25-28 ppt, and temperature of 27-29°C. Pond farming of *Gracilaria* has been practiced in certain Asian countries such as Indonesia and China with relative success.

Under the present project, farmers were trained in better integrated farming practices, including the following topics: farming seasonality, site selection, pond construction, pond management, water quality control, stocking densities for various species, pest and disease control, prevention and treatment, harvest, drying, pre-processing, processing and transportation.

REMINDERS:

- Proper stocking density for each commodity must be adopted to ensure maximum production per cycle.

- Filamentous green algae must be removed in order to avoid or minimize competition with *Gracilaria* in terms of nutrients, carbon dioxide and space.

- Pond growers must seek technical assistance from BFAR to improve farming practices

Main recommendations to farmers and extension / aquaculture officers:

- Data logging is of prime importance in monitoring the daily activities (water quality, weather conditions, initial biomass at planting and biomass at harvest).

- Utilization of abandoned brackish fishponds may be done to maximize productivity and production.

- Polyculture system of farming must be enhanced with science-based farming technologies.

Table 1: species integrated with *Gracilaria* species farming

Commodity	Size of pond (ha)	Stocking density	Stocking technique	Harvesting
Milkfish	1	2000	broadcasting	Total
	0.5	500	broadcasting	
Mangrove crab	1	500	broadcasting	Total
Shrimp	1	15,000 (larvae)	broadcasting	Total
<i>G. heteroclada</i> , <i>G. changii</i> , <i>G. firma</i>	1	50 Kg	broadcasting	Thinning

- Integrated Multi-Trophic Aquaculture (IMTA) must be adopted based on experiences of other countries with an ultimate objective of producing multi-products in one culture system and more importantly having a friendly environment with zero effluent discharge. ■



FISH AND SEAWEED PROCESSING AND VALUE-ADDING



With the mounting need to trim down fisheries post-harvest losses and, at the same time to generate additional income and livelihood opportunities for our fisherfolk, the Fisheries Post Harvest Technology Division (FPHTD) conducted the Training on Fish and Seaweed Processing and Value-Adding third quarter of last year as part of the capacity-building efforts for our regional staff.

The activity underscored the involvement of Gender and Development (GAD) and post-harvest focal persons from all BFAR regional offices to enable them to disseminate the technologies to their clients. Each region was requested to bring recipes utilizing fishery/seaweed products predominant in their areas for the techno-demo. The latter was held at the FPHTD laboratory while the presentation and sensory evaluation of finished products were conducted in the training venue.

Among the fishery value-added products presented were seafood spaghetti, seaweed siomai, fish chorizo, seaweed shing-aling and many more intended for thorough evaluation and further improvements for use in the development of IEC materials.

While the training course is certainly beneficial for the enrichment of the participants' skills and competencies, a continual capability building of regional potential trainers has been a long-term commitment of the Bureau in preparation for their future programs and projects. Taking into account the huge potential of fishery industry can offer to the country's economy, such training could similarly be of great help to address food security and maximize utilization of fishery resources by producing value-added products and making use of by-products from fish which is now a trend in the upswing. ■

SEAFOOD SPAGHETTI
(REGION 5)



SEAWEED PUTO PANDAN
(REGION 7)

SEAWEED STICK SHING-A-LING
(REGION 4A)



BAKED SHRIMP
(REGION 2)



FISH CHORIZO
(REGION 12)



TRAINING ON DEVELOPING A HACCP PLAN



Writer: Davis Glorioso
Photos: Post Harvest Technology Division

The Fisheries Post Harvest Technology Division (FPHTD) of the Bureau of Fisheries and Aquatic Resources (BFAR) has extended its support to the Fishery and Aquaculture Business Operators (FABOs) to assist the stakeholders conform with the food safety requirements for fishery products, promote exports, reduce post-harvest losses and ensure food security for the Filipinos.

The strong need to produce a high quality and safe fishery products that are globally competitive has urged the BFAR-FPHTD to conduct the Training on Developing a Hazard Analysis Critical Control Point (HACCP) Plan for Fish and Fishery Products for Batch 1-Luzon Cluster.

The participants were composed of twenty-four (24) Quality Assurance (QA) and Quality Control (QC) managers emanating from seventeen (17) fishery establishments operating in Regions 1-5, mostly seeking for HACCP accreditation.



The development of effective and functional Good Manufacturing Practices (GMP), Sanitation Standard Operating Procedures (SSOP) and HACCP programs is the core objective of the training to deepen the participants' understanding on the significance of implementing the food safety programs. Eighteen (18) exercises were successfully completed by the participants to enhance their knowledge on applying the principles of HACCP based on the 4th edition of USFDA Hazards and Control Guidance for Fish and Fishery Products. In addition, a visit to HACCP-certified plants in Metro Manila was also done to enable the participants to gain better appreciation of how a HACCP-certified facility operates.

Ultimately, the said training purposely brought the stakeholders closer to the BFAR's goal of making all the fishery establishments in the country become HACCP-certified soon. Three more batches of such training for the Visayas and Mindanao cluster and BFAR regional staff will follow as part of the series of trainings set to be conducted on February and March 2017. ■

Compostela Valley

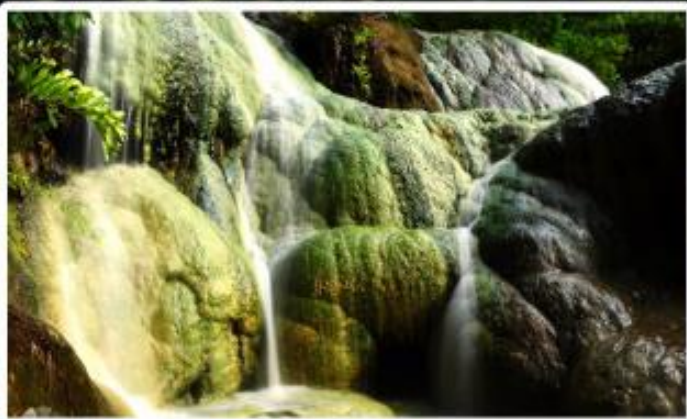
Captivating Landscapes of Mindanao

Compostela Valley (ComVal) has always been synonymous with mining but ironically, it also has one of the most captivating landscapes in this part of Mindanao. The almost two and a half hour land travel from Davao City can be uneventful but the paved highways are guaranteed to give you a smooth ride without the bump and grind.

While there are no scenic views along the way, the urban traveler would find the winding roads that traverse mountains a little exciting. The trip gets more exciting when you find the ComVal welcome sign atop a hill, a landmark that will surely earn the fancy of every self-respecting selfie addict or a reasonable tourist for that matter.







Tourism

What you see on the way to ComVal fails in comparison to the many natural attractions you will discover once you get to this eco-tourism destination. If you want to see the gold-rush areas of the province then you won't have a shortage of destinations considering that around ten out of the eleven municipalities in the province have mining areas.

But if you want to see the magnificent work of nature then a trip to ComVal's caves, mountain ranges, waterfalls, beaches and forests would make you realize that by visiting the province's eco-tourism attractions, you have actually struck gold.

If you're lucky to find yourself at the foothills of Mt. Candalaga then you might get to see the *Rafflesia mira* a parasitic plant which is a sight to behold but is notorious for its rotten smell.

ComVal is known for its many waterfalls namely Awao Falls in Monkayo, Tagbibinta Falls and Marangig Falls in Maragusan, Tanja Falls in New Bataan, Batinag Falls in Nabunturan and the sulfuric waterfalls in Maco.

Nearby Kopia Island where you will find stretches of mangroves will give you a glimpse of paradise on earth although getting access to the island could be tricky now as it is being developed by a private company. But you can go spelunking at the Mahayahay Cave and get your fill of the kabyaw or small fruit bats and a variety of stalactites and stalagmites.

The culturally-inclined might want to get to know the indigenous culture and native dances of the first settlers of the province by visiting the Mansaka Village in Maragusan.



Fishing

But while ComVal is known for its mining and tourism destinations, there is another resource that it can be truly proud of—its fisheries and aquatic resources.

ComVal is home to the Nabunturan Freshwater Demonstration Fish Farm and Nursery, which is being managed by the Bureau of Fisheries and Natural Resources (BFAR). Established in 1977, the 5.4-hectare demo farm is mandated to produce fingerlings for distribution to farmers and dispersal to the community.

BFAR Davao Region Director Fatma Idris narrated how in 1991 the station was renamed the Research Outreach Station for Freshwater Fisheries with the mandate of serving as a satellite station of the Regional Integrated Agricultural Research Center in freshwater development zone through technology adaptation and verification on major commodities in freshwater fisheries. Since then, it became BFAR's regional research and development arm.

Today, the Station has a 4-hectare pond area with three large operational ponds as well as 40 ponds of various sizes including breeding ponds, conditioning ponds, nursery and brood ponds.

Aside from showcasing development projects on freshwater aquaculture in the region, the Station conducts demonstration projects on freshwater aquaculture; facilitates the accreditation of tilapia hatcheries; maintains foundation stocks of the latest tilapia strains; produces fingerlings for broodstock purposes for distribution to accredited hatcheries and; readies breed broods for replacement/replenishment of station broods, production of quality fingerlings of tilapia, carp, ulang PL and dispersal of free of charge to government projects and at a cost to walk-in fisherfolk.

Another showcase of ComVal's fishing industry is the Pantukan Mariculture Park. Located at Brgy. Magnaga, Pantukan. Ordinance No. 12 series of 2007 paved the way for the declaration of 200 hectares of Pantukan's municipal waters as a Mariculture Development Zone/Park.

According to Provincial Agriculturist Rolando S. Simene, the benchmark for the Pantukan Mariculture Park when it was established in 2009 was the Panabo Mariculture Park. After all, the province has three coastal municipalities namely Maco, Mabini and Pantukan needed to be developed to help the fishing sector.

For now, local investors have established 18 10 by 10 bangus fishcages at the Pantukan Mariculture Park. The still large unoccupied area at the park prompted the local government to invite investors who want to cash in on the province's marine resources through fish production. ■



ARTICLE III AQUACULTURE

(Excerpt from the Implementing Rules and Regulations of Republic Act No. 8550 as amended by Republic Act No. 10654)

SEC. 45. Disposition of Public Lands for Fishery Purpose.

– Public lands such as tidal swamps, mangroves, marshes, foreshore lands and ponds suitable for fishery operations shall not be disposed or alienated. Upon effectivity of this Code, FLA may be issued for public lands that may be declared available for fishpond development primarily to qualified fisherfolk cooperative / associations: Provided, however, that upon the expiration of existing FLAs the current lessees shall be given priority and be entitled to an extension of twenty-five (25) years in the utilization of their respective leased areas. Thereafter, such FLAs shall be granted to any Filipino citizen with preference, primarily to qualified fisherfolk cooperatives / associations as well as small and medium enterprises as defined under Republic Act No. 8289: Provided, further, That the Department shall declare as reservation, portions of available public lands certified as suitable for fishpond purposes for fish sanctuary, conservation, and ecological purposes: Provided, finally, that two (2) years after the approval of this Act, no fish pens or fish cages or fish traps shall be allowed in lakes.

Rule 45.1. Declaration of Reserved Areas. – The DA-BFAR, in coordination with DENR, shall determine areas or portions of available public lands certified as suitable for fishpond purposes to be declared as reservation, fish sanctuary or for conservation, and ecological purposes.

Rule 45.2. Preference in the Issuance of New FLAs. – The DA-BFAR shall give preference to qualified fisherfolk cooperatives/associations in the issuance of new FLAs covering public lands declared available for fishpond development.

Rule 45.3 Preference in the issuance of Expired FLAs. – In the awarding of expired FLAs, the DA-BFAR shall give preference to qualified fisherfolk cooperatives/associations as well as micro, small and medium enterprise.

SEC. 46. Lease of Fishponds. – Fishpond leased to qualified persons and fisherfolk organizations/cooperatives shall be subject to the following conditions:

- a. Areas leased for fishpond purposes shall be no more than 50 hectares for individuals and 250 hectares for corporations or fisherfolk organizations;
- b. The lease shall be for a period of twenty-five (25) years and renewable for another twenty-five (25) years: Provided, That in case of the death of the lessee, his spouse and/or children, as his heirs, shall have preemptive rights to the unexpired term of his Fishpond Lease Agreement subject to the same terms and conditions provided herein provided that the said heirs are qualified;
- c. Lease rates for fishpond areas shall be determined by the Department: Provided, That all fees collected shall be remitted to the National Fisheries Research and Development Institute and other qualified research institutions to be used for aquaculture research development;
- d. The area leased shall be developed and producing on a commercial scale within three (3) years from the approval of the lease contract: Provided, however, That all areas not fully producing within five (5) years from the date of approval of the lease contract shall automatically revert to the public domain for reforestation;

e. The fishpond shall not be subleased, in whole or in part, and failure to comply with this provision shall mean cancellation of FLA;

f. The transfer or assignment of rights to FLA shall be allowed only upon prior written approval of the Department;

g. The lessee shall undertake reforestation for river banks, bays, streams and seashore fronting the dike of his fishpond subject to the rules and regulations to be promulgated thereon; and

h. The lessee shall provide facilities that will minimize environmental pollution, i.e., settling ponds, reservoirs, etc.: Provided, That failure to comply with this provision shall mean cancellation of FLA.

Rule 46.1. Reforestation. – The DA-BFAR, in coordination with the DENR, within one (1) year from the effectivity of this IRR, shall issue the guidelines, on the reforestation of river banks, bays, streams and seashores fronting the dike of the fishpond area covered by the FLA.

Rule 46.1. Reforestation. – The DA-BFAR, in coordination with the DENR, within one (1) year from the effectivity of this IRR, shall issue the guidelines, on the reforestation of river banks, bays, streams and seashores fronting the dike of the fishpond area covered by the FLA.

SEC. 47. Code of Practice for Aquaculture. – The Department shall establish a code of practice for aquaculture that will outline general principles and guidelines for environmentally-sound design and operation to promote the sustainable development of the industry. Such Code shall be developed through a consultative process with the DENR, the fishworkers, FLA holders, fishpond owners, fisherfolk cooperatives, small-scale operators, research institutions and the academe, and other potential stakeholders. The Department may consult with specialized international organizations in the formulation of the code of practice. fisherfolk cooperatives, small-scale operators, research institutions and the academe, and other potential stakeholders. The Department may consult with specialized international organizations in the formulation of the code of practice.

SEC. 48. Incentives and Disincentives for Sustainable Aquaculture Practices. – The Department shall formulate incentives and disincentives, such as, but not limited to, effluent charges, user fees and negotiable permits, to encourage compliance with the environmental standards and to promote sustainable management practices.

Rule 48.1. Incentive/Disincentive System. – The DA-BFAR, in coordination with the DENR, within eighteen (18) months from the effectivity of this IRR, shall establish a disincentive system, including but not limited to, fines and penalties for pollutants and effluents traceable to the government leased and privately owned fishponds and a system of incentives or awards for compliance with environmental regulation.

SEC. 49. Reversion of All Abandoned, Undeveloped or Underutilized Fishponds. – The DENR, in coordination with the DA-BFAR, LGUs, other concerned agencies and FARMCs shall determine which abandoned, undeveloped or underutilized fishponds covered by FLAs can be reverted to their original mangrove state and after having made such determination shall take all steps necessary to restore such areas in their original mangrove state.

Rule 49.1. Joint Guidelines. – The DA-BFAR, in coordination with the DENR, shall be guided in the implementation of this Section by the Joint DA-DENR General Memorandum Order No. 3, Series of 1991, which shall be reviewed and revised accordingly.

Rule 49.2. Identification of Abandoned, Undeveloped, Underutilized Fishponds. – The DA-BFAR, in coordination with the DENR, shall review and update fishpond surveys and identify abandoned, undeveloped or underutilized fishponds, which, after due process, can be set aside for Aquaculture Stewardship Contracts to be awarded primarily to qualified fisherfolk cooperatives/associations as well as micro, small and medium enterprises, for the cultivation of mangroves to strengthen the habitat and the spawning grounds of fish pursuant to Section 81 of this Code, or reverted to forest lands where applicable.

SEC. 50. Absentee Fishpond Lease Agreement Holders. – Holders of fishpond lease agreements who have acquired citizenship in another country during the existence of the FLA shall have their lease automatically cancelled and the improvements thereon to be forfeited in favor of the government and disposed of in accordance with rules and regulations promulgated thereon.

Rule 50.1. Proof of Citizenship. – In accordance with the process stated in Rule 65.2, the DA-BFAR shall issue a regulation requiring all fishpond leaseholders to submit proof of citizenship.

SEC. 51. License to Operate Fish Pens, Fish Cages, Fish Traps and Other Structures for the Culture of Fish and Other Fishery Products. – Fish pens, fish cages, fish traps and other structures for the culture of fish and other fishery products shall be constructed and shall operate only within established zones duly designated by LGUs in consultation with the FARMCs concerned consistent with national fisheries policies after the corresponding licenses thereof have been secured. The area to be utilized for this purpose for individual person shall be determined by the LGUs in consultation with the concerned FARMC: Provided, however, That not over ten percent (10%) of the suitable water surface area of all lakes and rivers shall be allotted for aquaculture purposes like fish pens, fish cages and fish traps; and the stocking density and feeding requirement which shall be controlled and determined by its carrying capacity: Provided further, That fish pens and fish cages located outside municipal waters shall be constructed and operated only within fish pen and fish cage belts designated by the Department and after corresponding licenses therefore have been secured and the fees thereof paid.

Rule 51.1. Carrying Capacity of Lakes. – The DA-BFAR, in coordination with relevant research centers, shall determine the carrying capacity of lakes and inland waters. The determination may serve as guidance for the LGUs in delimiting the suitable water surface area for aquaculture purposes.

SEC. 52. Pearl Farm Leases. – The foregoing provisions notwithstanding, existing pearl farm leases shall be respected and allowed to operate under the terms thereof. New leases may be granted to qualified persons who possess the necessary capital and technology, by the LGUs having jurisdiction over the area.

Rule 52.1. Inventory. – The DA-BFAR shall conduct an inventory of existing pearl farms.

Rule 52.2. Regulation. – The DA-BFAR shall prepare a model municipal fisheries ordinance that the LGUs may adopt as basis for their issuance of permits for the operation of pearl farms.

SEC. 53. Grant of Privileges for Operations of Fish Pens, Cages, Corrals/Traps and Similar Structures. – No new concessions, licenses, permits, leases and similar privileges for the establishment or operation of fish pens, fish cages, fish corrals/traps and other similar structures in municipal areas shall be granted except to municipal fisherfolk and their organizations.

SEC. 54. Insurance for Fishponds, Fish Cages, and Fish Pens, Inland fishponds, fish cages and fish pens shall be covered under the insurance program of the Philippine Crop Insurance Corporation for losses caused by force majeure and fortuitous events.

Rule 54.1. Coverage. – The DA-BFAR shall coordinate with the Philippine Crop Insurance Corporation (PCIC) to include as eligible for insurance coverage, fishpens, fish cages, seaweed farms, other aquaculture projects and non-agricultural assets such as ice plants, cold storage and other post-harvest facilities.

SEC. 55. Non-Obstruction to Navigation. – Nothing in the foregoing sections shall be construed as permitting the lessee, licensee, or permittee to undertake any construction which will obstruct the free navigation in any stream, river, lakes or bays flowing through or adjoining the fish pens, fish cages, fish traps, and fishponds, or impede the flow of the tide to and from the area. Any construction made in violation hereof shall be removed upon the order of the Department in coordination with the other government agencies concerned at the expense of the lessee, or occupants thereof, whenever applicable. The Department shall within thirty (30) days after the effectivity of this Code formulate and implement rules and regulations for the immediate dismantling of existing obstruction to navigation.

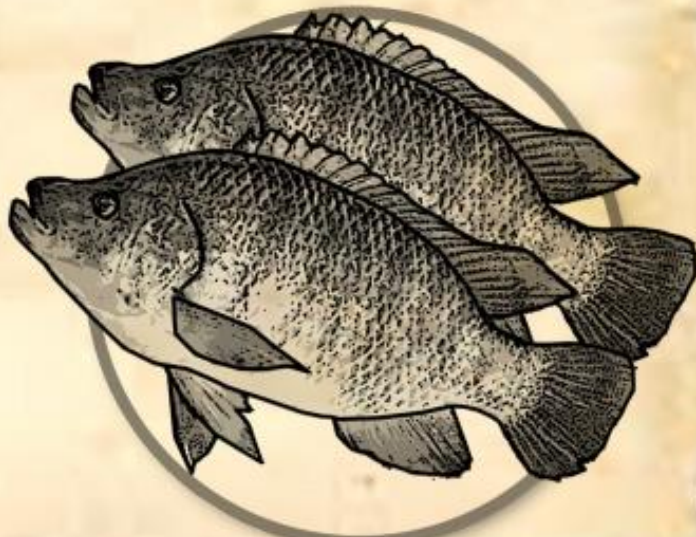
Rule 55.1. Regulation. – The DA-BFAR, in consultation with LGUs and/or other agencies and FARMCs, shall update FAO No. 216, Series of 2001, for purposes of this Section.

SEC. 56. Non-Obstruction to Defined Migration Paths. – Nothing in the foregoing sections shall be construed as permitting the lessee, permittee, or licensee to undertake any construction which will obstruct any defined migration path of migratory fish species such as river mouths and estuaries within a distance determined by the concerned LGUs in consultation with and upon the recommendation of the FARMCs.

Rule 56.1. Regulation. – The DA-BFAR, in consultation with LGUs and/or other agencies and FARMCs concerned, shall update FAO No. 217, Series of 2001, for purposes of this Section.

SEC. 57. Registration of Fish Hatcheries and Private Fishponds, etc. – All fish hatcheries, fish breeding facilities and private fishponds must be registered with the LGUs which shall prescribe minimum standards for such facilities in consultation with the Department: Provided, That the Department shall conduct a yearly inventory of all fishponds, fish pens and fish cages whether in public or private lands: Provided, further That all fishpond, fish pen and fish cage operators shall annually report to the Department the type of species and volume of production in areas devoted to aquaculture.

Rule 57.1. Power of DA-BFAR to Issue Rules and Regulations. – The DA-BFAR, in coordination with the LGUs, shall issue regulations on the registration and operation of fish hatcheries, fish breeding facilities and private fishponds in accordance with Rule 65.2 of this Code and Section 16 (b) of RA 10611 or the Food Safety Act of 2013. ■



READER'S CORNER



For your comments
and suggestions,
please send them to
dabfar_iprg@yahoo.com
or you may call us at
02 454 5863.
These will be
published on the
Readers' Corner in the
next issue of
Fish Files.

What is da name?



Lates calcarifer
(Bloch, 1790)

Common Names: Asian seabass,
Barramundi, Barramundi
perch, Giant perch,
Giant sea perch, Palmer,
Silver barramundi

Local Names: Apahap, Bulgan, Katuyot,
Matang pusa

Characteristics:

- Native in the Philippines.
- It's a relatively hardy species that tolerates crowding and has wide physiological tolerances, thus an ideal aquaculture species.
- Has an elongated and compressed body with a deep caudal peduncle (portion between the body and the tail). The scales are ctenoid (comb-like) and large. The head is pointed, with concave dorsal profile becoming convex in front of dorsal fin. The mouth is large and slightly oblique with the upper jaw extending behind the eye and has villiform teeth (slender and crowded teeth resembling bristles of a brush). The anal and caudal fins are rounded. Color in two phases, either olive brown above with silver sides and belly (usually juveniles) or green/blue above and silver below. Fins or the body do not have spots or bars. Mature seabass reaches 29-60 cm in length.
- A protandrous hermaphrodite (sex changes from male to female).
- A diadromous fish, seabass inhabits rivers before returning to the estuaries to spawn. Found in coastal waters, estuaries and lagoons, in clear to turbid water. Larvae and young juveniles live in brackish temporary swamps associated with estuaries, and older juveniles inhabit the upper reaches of rivers. Have preference for cover on undercut banks, submerged logs and overhanging vegetation.
- Feeds on fishes and crustaceans.
- Can reach 1500-3000 g in one year in ponds under optimum conditions.

Interest to fisheries: High-valued aquaculture fish

Sources:

<http://www.fishbase.org/summary/Latescalcarifer.html>

<http://www.fao.org/fishery/spedes/3068/en>

http://www.fao.org/fishery/culturedspecies/Lates_calcarifer/en

NFRDI-NFBC, Botong, Batangas

