









by Bureau of Fisheries and Aquatic Resources (BFAR)-PHILMINAQ

# Managing aquaculture and its impacts a guidebook for local governments

Managing aquaculture and its impacts: a guidebook for local governments Published by Bureau of Fisheries and Aquatic Resources - PHILMINAQ Project Philippine Coconut Authority Building, Elliptical Road, Diliman, Quezon City Philippines

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# Photo credits:

The photos used in the front cover of this guidebook provide some insights into the practice of aquaculture in the Philippines. The photos showing aquaculture production technologies (cage construction, seaweeds, and mangrove reforestation) were provided by the Bureau of Fisheries and Aquatic Resources – Fisheries Policy and Economics Divisions through Mr. Sammy Malvas, OIC-Chief, and Arnel Valenzuela; the main photo of fish cages in Taal Lake was provided by Mr. Patrick White of Philminaq; while the fish kill photos were sourced from the University of the Philippines Marine Science Institute-Bolinao Marine Laboratory and from the files of Dr. Ronald Villanueva.

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# Acronyms

Administrative Order (AO) Autonomous Region of Muslim Mindanao (ARMM) Bureau of Agricultural Statistics (BAS) Bureau of Animal industry (BAI) Bureau of Fisheries and Aquatic Resources (BFAR) Bureau of Soils and Water Management (BSWM) Coastal and Marine Management Office (CMMO) Comprehensive Fishery Research and Development Program (CFRDP) Cooperative Development Authority (CDA) DENR Administrative Order (DAO) Department of Agriculture (DA) Department of Environment and Natural Resources (DENR) Department of Fisheries and Aquatic Resources (DFAR) Department of Health (DOH) Department of Interior and Local Government (DILG) Environmental Impact Statement (EIS) Environmental Management Bureau (EMB) Environmentally Critical Area (ECA) Environmentally Critical Project (ECP) Executive Order (EO) Fisheries and Aquatic Resources Management Councils (FARMCs) Fertilizer and Pesticide Authority (FPA) Fish Health Section (FHS) Fisheries Code (FC) Fisheries Industry Development Support Division (FIDSD) Fisheries Policy and Economics Division (FPED) Fisheries Post-Harvest Technology Division (FPHTD) Fisheries Regulatory and Quarantine Division (FRQD) Fishpond Lease Agreements (FLA) Food and Agriculture Organization (FAO)

Hazard Analysis Critical Control Point (HACCP) Indigenous Cultural Communities (ICC) Indigenous Peoples (IP) Inland Fisheries and Aquaculture Division (IFAD) Integrated Fisheries and Aquatic Resources Management Councils (IFARMCs) Lands Management Bureau (LMB) Local Government Code (LGC) Local government unit (LGU) Muslim Mindanao Autonomy Act (MMMA) National Commission on Indigenous Peoples (NCIP) National Economic and Development Authority (NEDA) National Fisheries Industry Management and Development Plan (NFIMDP) National Integrated Protected Areas System (NIPAS) Law, the agency in charge is Protected Areas and Wildlife Bureau (PAWB) National Irrigation Authority (NIA) National Mapping and Resource Information Authority (NAMRIA) National Water Resources Board (NWRB) non-government organizations (NGOs) people's organizations (POs) Philippine Coast Guard (PCG) Philippine National Police-Maritime Group (PNP-MG) Presidential Decree (PD) Protected Areas Management Board (PAMB) Regional Fisheries Training Centers (RFTC) Regional Outreach Stations (ROS) Republic Act (RA) Solid Waste Management (SWM) Strategic Agriculture and Fisheries Development Zones (SAFDZ)

Forest Management Bureau (FMB)

# Message

Aquaculture will continue to be the main source of food fish for the Philippines and the main driver of growth for the agricultural sector. My vision for the aquaculture sector is one that will provide more food, more employment, and more foreign exchange rather than an aquaculture sector that results in habitat destruction, pollution, and farming-induced calamities such as fish kills. There should be no compromise where the environment is concerned.

Thus, I congratulate the PHILMINAQ project for conceiving this Guidebook entitled "Managing aquaculture and its impacts: a guidebook for local governments" for I believe that a stronger partnership between national agencies such as BFAR and local government units will pave the way for a sustainably managed aquaculture sector. This Guidebook signals the beginning of a partnership that is nurtured through information exchange and clarification of jurisdiction.

To the readers of this Guidebook, I wish to reiterate BFAR's commitment to work with local governments through the transfer of environment-friendly technologies, training and education for fishfarmers on various aspects of aquaculture management, and identification of new products and markets. In the same way, I exhort the readers of this Guidebook to fully utilize the strength of our national policies in order to prevent and mitigate the environmental impacts of aquaculture.

MALCOLM I. SARMIENTO

Director Bureau of Fisheries and Aquatic Resources

# Introduction

This guidebook is written to help local governments and the communities whom they govern, address the negative environmental impacts associated with aquaculture. Fish kills, red tide, eutrophication, and other forms of aquatic pollution are among the negative impacts of aquaculture which should be managed, avoided, and mitigated. Whether the impact is an episodic event such as a fish kill or a recurrent case of effluent discharge, the severity of impacts can only be assessed after several years when habitats and natural populations of aquatic species have been destroyed, when human health has been risked, when private and public sector investments have gone sour, and when the officials and managers in charge have duly completed their terms of office.

Mitigating the negative impacts of aquaculture is one of the many responsibilities of Local Government Units (LGU)s --- be it the province, cities/municipalities, or barangays. Aquaculture, whether land-based or water-based, is practiced within an LGU territory and is subject to local planning, regulation, policy formulation, taxation, and revenue generation. Thus, LGUs, being subsidiaries of national government, have the duty to share national government's goals and aspirations one of which is the "management and maintenance of ecological balance within their territorial jurisdiction" subject to the provisions of the Local Government Code or Republic Act (RA) 7160 and national policies. As a corporate entity, the LGU must perform its function to the approval of its shareholders, in this case the general citizenry, the private sector, and small fishers and farmers who are engaged in aquaculture.

Bad farm practices such as overstocking and overfeeding can be aggravated by natural conditions such as flushing rate, wind patterns, and water temperature. Bad farm practices can be traced primarily to the attitudes of aquaculture operators especially those who would take unnecessary risks in the hope of short-term gains. For some operators, it is pure stubbornness and the lack of concern for the environment; yet, for others, lack of information is the culprit.

While governance of aquaculture systems is the main focus of this guidebook, what can not be ignored is the fact that some aquaculture activities result to negative environmental impacts because of bad planning and absence of informed decision making tools. Thus, aquaculture located in critical habitats, which when altered have no chance of restoration, and aquaculture sited in areas where alternative uses might prove more valuable, are bad practices per se and will need to reconsider an overall planning and resource use framework beyond the scope of this guidebook.

Owing to the lack of financial and personnel resources, national government is still struggling to transmit as much information (technologies, policies, and national standards) as possible to support devolved functions of LGUs. BFAR has issued several administrative orders in support of best aquaculture practices<sup>1</sup> but LGUs, even those who are actively engaged in aquaculture are not aware of its provisions. Moreover, the plurality of policies that govern environmental management makes understanding and harmonization at the local level even more difficult. Admittedly, governance is not all about providing and using information. But it is a good start.

<sup>1</sup> FAO 214 is the Code of Practice for Aquaculture.

Aquaculture is a fast-growing source of food and raw material supply for industry and the Philippines occupies a significant role in the world market. Nevertheless, negative consequences of growth are as significant and should not be ignored. In summary, this guidebook will help LGUs and other local level partners and stakeholders to:

- appreciate the potential of aquaculture to contribute to national goals of food security, income generation, and employment;
- recognize the threats posed to the environment as a result of bad farm practices and lackluster governance;
- appreciate and understand the national policies governing aquaculture and environmental management and use these as an arsenal for better governance;
- understand the role of national agencies vis-à-vis their own; and
- implement best management practices to mitigate the negative impacts of aquaculture on the environment.

# Organization of the Guidebook

There are five main Chapters in this Guidebook. The first chapter is an orientation on the "good and bad" of aquaculture starting off with the contribution of aquaculture to food security, improved incomes, employment, and trade, and ending with a caution against unmanaged aquaculture. The breadth and severity of environmental impacts of aquaculture close the Chapter with fish kills, destroyed habitats, and red tide providing some shock effect. However, this dousing effect is not allowed to linger any further by the prompt introduction in Chapter 2 of the roles of national agencies in aquaculture planning and mitigation of its environmental impact and in Chapter 3, by the presentation of a policy arsenal for local governments. Chapter 4 reiterates the information presented in Chapters 2 and 3 in a question and answer format. Chapter 4 is an "enabling" format where the selected questions and answers are written from an LGU perspective. Chapter 5, entitled "15 Action Points for LGUs" provides a succinct and action-oriented conclusion. The summary table appended at the end of the Chapter is a subliminal encouragement to the reader to make a mental inventory of what has been done and what has yet to be done to attain good aquaculture practice.

Throughout this guidebook, the LGU is depicted as the main player in the game with national agencies providing support through policy formulation and standard setting, technical assistance, and information dissemination. Furthermore, this guidebook's theme gravitates towards a "can do" attitude given the right information and the right tools. With this in mind, the evils associated with aquaculture can be minimized if not totally eradicated.

# How this Guidebook Came About

PHILMINAQ, a nickname for the project entitled "Mitigating impact from aquaculture in the Philippines," begun its 18-month old involvement in the Philippines in August 2006 through a collaborative arrangement with the Bureau of Fisheries and Aquatic Resources (BFAR) and the University of the Philippines Marine Science Institute (UP-MSI). Its first major activity is an International Conference on "Mitigating the Impacts of Aquaculture in the Philippines" held in December 2006 at the UP-MSI.

The mainplatform for cooperation under the European Union International Cooperation (INCO)-CT-2006-031640 6th Framework Programme is promote the development of a safe and responsible fisheries and aquaculture sector. With BFAR spearheading the component on policy analysis and advocacy, it was determined that major policy interventions should be implemented at the LGU level. At the joint meeting between BFAR, UP-MSI, the Scottish Academy for Marine Sciences (SAMS) and AKVAPLAN-NIVA, the main Project Coordinator, the role of LGUs in local level aquaculture management and the application of national policies to manage the environment was identified as a key and urgent intervention. Further to this, the Asian Development Bank Advisory Technical Assistance (ADB-ADTA 4708) Strategy for Sustainable Aquaculture Development for Poverty Reduction in the Philippines recommended for the development of such guidelines for LGU use. Thus, this Guidebook was conceptualized.

A series of Inter-Agency Working Group Meetings were held in August, September, and October 2007 involving various offices under the Department of Environment and

Natural Resources (DENR), the Department of Interior and Local Government (DILG), and the League of Municipalities of the Philippines (LMP). Participants contributed significantly to defining the framework, scope, and major elements of this Guidebook from its inception to completion.

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Managing aquaculture and its impacts



# Overview of aquaculture in the Philippines The good & the bad

# 1.1 What is aquaculture and why is it important?

RA 8550 (Fisheries Code of 1988) defines aquaculture to include all fishery operations involving all forms of raising and culturing fish and other fishery species in fresh, brackish and marine areas. The Aquaculture Steering Committee of the Fisheries Department of the Food and Agriculture Organization (FAO) of the United Nations defined aquaculture in the following terms:

"Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture, while aquatic organisms which are exploitable by the public as a common property resource, with or without appropriate licences, are the harvest of fisheries."

Definition of Aquaculture, Seventh Session of the Indo-Pacific Fisheries Council (IPFC) Working Party of Experts on Aquaculture, 1988, Bangkok, Thailand.

Further to this, FAO defined sustainable aquaculture as the management and conservation of the natural resource base and the orientation of technological and institutional change in such as manner as to ensure the attainment and continued satisfaction of human needs for present and future generations.

Aquaculture and capture fisheries are different. Aquaculture involves some control of the natural environment such as stocking, feeding, and water management, while capture fisheries is more akin to hunting for fish species in the wild. Aquaculture and capture fisheries are the two main sources of fish in the Philippines and in other countries as well. Not all species caught in the wild can be cultured or cultivated!

Aquaculture's importance in the Philippines can be attributed to the following:

# Continued growth in total fish production.

Aquaculture production has contributed an annual average of 1.4 million tons from the period 2000-2005 representing 41% of total production compared to commercial capture fisheries, 30%, and municipal capture fisheries, 29% (Fig. 1). Production growth has averaged 10%, on an annual basis, compared to 3% for commercial and municipal fisheries over the same period.

### Contribution to food security.

Capture fisheries, both commercial and municipal, are on a continuous decline due to overfishing, use of deleterious gears, and degradation of habitats that support fisheries. Aquaculture, on the other hand, has steadily contributed to food supply. A succinct example is the commercial fisheries production of roundscad, which, after peaking at 250,000 MT in 2003, declined to 215,000 MT as of end 2005. Meanwhile, milkfish cultured in brackishwater ponds, pens, and cages, and those from freshwater systems have exhibited production increases. The same trend is seen for tilapia.

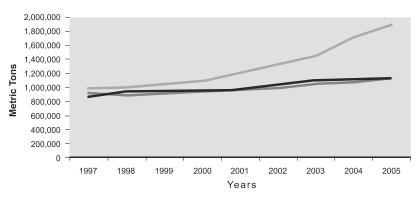


Fig. 1. Volume of Philippine fisheries production, by sector, from 1997-2005

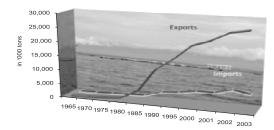
### **Contribution to economic growth**

In 2003, the fisheries sector contributed 2.2% (PhP95.49 billion) to the country's gross domestic product (GDP) of PhP4,359 billion at current prices, or 4.1% (PhP44.86 billion) of the GDP amounting to PhP1,093 billion at constant prices (BAS undated). It accounted for 15.1% (PhP95.5 billion) of the gross value added (GVA) in agriculture, fishery and forestry group amounting to PhP632 billion at current prices, or 20.9% (PhP44.9 billion) of the GVA of PhP214.3 billion at constant prices. As of the third quarter of 2004, the sector's contribution to the GVA in the agricultural group (PhP158.3 billion at constant prices) was 22.3%, the second largest share next to that of agricultural crops.

# Contribution of the fisheries sector to foreign exchange earnings

Since 1977, foreign trade of fishery products has generated a surplus balance of trade, which means earnings from exports have exceeded payments for imports (Fig.2). Currently, the top fishery exports of the Philippines are tuna, shrimps and prawns, seaweeds, octopus, and crab and crab fat. Altogether, these commodities account for about 82% of total fishery exports. The major destinations of Philippine fish and fishery products are Japan, USA, Hong Kong, Taiwan, and Korea (BAS undated).

# Fig. 2 Exports and imports of fisheries products, 1965-2003



# Contribution of the fishing industry to income and employment.

The fisheries sector provides employment to over one million people. This is roughly about 12% of the entire agriculture, fishery and forestry sector labor force, and about 5% of the country's total labor force. Of this total, 9.2% (74,537) are fishfarmers engaged in aquaculture (Ginintuang Ani 2002-2004). Also, ancillary activities such as fish marketing, fish processing, and boat building generate additional employment.

# Box 1. Fast facts on aquaculture

- Aquaculture produces one third of all fish and almost half of all fish eaten (FAO 2007).
- Asia accounts for 87% of all aquaculture production in the world (www.wwf.org)
- Aquaculture produces 63% of world salmon supply and 30% of all shrimp supply (www.wwf. org)
- One shrimp cocktail can require anywhere from 0.25 to 200 cubic meters of water depending on production systems used (www.wwf.org)
- 1/3 of all wild-caught fish is used to make feed for aquaculture
  - it takes 10 to 22 kg of feed to produce 1 kg of tuna
  - it takes 5-12 kg of feed to produce 1 kg of finfish such as grouper, snapper, and seabass using wet fish diets (www.wwf.org) and 2 to 4 kg of wild fish using dry diets
- In 2003, the Philippines ranked 8th among the top producers in the world accounting for 2.5% of global production (BAS undated).
- The Philippines is the second top producer of seaweeds. Seaweed accounts for about 25% of total aquaculture production globally (www. wwf.org) and 75% of production locally (BAS undated)
- 300,000 hectares of mangroves were converted to give way to fish and shrimp ponds, salt beds, agriculture, and industrial/commercial establishments in the Philippines (Primavera 1995)
- About 160,000 tons of wildfish/feeds are wasted in tilapia pens, cages, and ponds while more than 180,000 tons are wasted for bangus culture (Philminaq)
- A simple ratio: one kilo of fish = one kilo of wastes (Philminaq)
- P 400 million estimated economic losses as a result of Bolinao fish kill in 2002 (Jacinto 2002) while P100 million estimated economic losses as a result of Bolinao–Anda fish kill in 2007 (Sotelo-Fuertes 2007).

# 1.2 Aquaculture systems and farmed species

Aquaculture activities can be classified according to production environments, farming systems, farming technology, and production scale.

# 1.2.1 Classification of aquaculture according to production environments

Aquaculture in the Philippines is carried out in three major aquatic environments: brackishwater, freshwater and marine (Table 1). Potential for freshwater aquaculture is much more than brackishwater and mariculture in the immediate future. Brackishwater aquaculture is limited to intertidal flats, mangrove swamps, and estuarine areas, while mariculture is limited to shallow or deep coastal waters only. However, new technologies in mariculture will likely enable a huge expansion in the future given the length of the Philippines' coastal waters. Other environments for freshwater aquaculture include irrigated lowland rice farms, small water impoundments, and irrigation canals.

Freshwater	Brackishwater	Mariculture
Lakes	Intertidal flats	Shallow coastal
Reservoir	Mangrove swamps	Deep coastal
Dams	Estuarine areas	Intertidal flats
Rivers		
Streams		
Creeks		
Ponds		
Swamps		

Table 1. Classification of aquaculture according to production environments

**Brackishwater aquaculture** is the largest in terms of extent and value of production. Average annual production of brackishwater fishponds, pens, and cages from 2003 to 2005 reached 265,000 tons representing 16% of total aquaculture production and more than half of food-fish production (Worldfish Center and PRIMEX 2007). Milkfish and black tiger shrimps are the two main products of brackishwater fishponds. Other species include mangrove crabs, grouper, siganids, seabass, mangrove snapper, and shrimps. It is now difficult to strictly categorize brackishwater ponds on a cultured species basis because of the practice of switching from one species to another depending on the financial capability, the market, and technology developments. Thus some erstwhile milkfish ponds may have been converted to shrimps only to reconvert to milkfish or shift to crabs or grouper or any combination of species that the operator chooses. Furthermore many brackishwater fishponds may routinely shift from milkfish to shrimps depending on the prevailing salinity.

**Freshwater aquaculture** began in the early 1950s with the introduction of Mozambique tilapia and the subsequent promotion of backyard tilapia culture. The first real break for freshwater aquaculture occurred in the mid 1970s with the discovery that milkfish can be grown at commercial levels in fish pens in Laguna de Bay without feeding and production of >10 t per ha dwarfs what can be obtained in brackishwater fishponds. This was followed shortly after with the successful farming of tilapia in cages also initially in Laguna de Bay but later expanding to other lakes, dams, and reservoirs. The intensive culture of tilapia in ponds has also developed rapidly.

**Mariculture** is used to mean culture in open coastal waters outside the confines of any impoundment regardless of actual salinity regime. Mariculture began before freshwater aquaculture in the Philippines with oyster culture reported to have started as early as the 1930s. However the real growth in mariculture did not take place until the farming of carrageenophyte seaweeds was introduced in the 1970s. With seaweeds, mariculture now produces more than brackishwater and freshwater combined. Seaweeds alone comprises 70% of total production in volume terms. Mariculture gradually diversified with improvements in technology. The production of milkfish in cages is now widespread. Meanwhile, the number of mariculture species continues to grow and now includes green mussels, grouper, rabbitfish, lobsters, abalone, and high-valued marine finfishes.

### 1.2.2 Classification of aquaculture according to farming systems

Farming systems vary according to cultured species and water source. The types of farming systems in the three environments are listed below (Table 2). In freshwater environments such as lakes, pens and cages are the common farming systems while in brackishwater environments, earthen ponds are most common.

1 5 5 7				
Freshwater	Brackishwater	Mariculture		
Freshwater hatcheries	Aqua-silviculture	Marine hatcheries		
Earthen ponds	Earthen ponds	Floating net cages		
Fish pen	Fish pen	Fish pen		
Floating net cages	Shallow fish cages	Mussel/oyster beds		
Concrete tanks		Seaweeds farm		
Integrated fish farming		Ornamental fish production		
Ornamental fish production				

Table 2. Aquaculture classification according to farming systems



**Photo #1. Fish pen.** A *fish pen* is an artificial enclosure constructed within a body of water for culturing fish and fishery/aquatic resources made up of poles closely arranged in an enclosure with wooden materials, screen or nylon netting to prevent escape of fish. A fish pen can be constructed in any of the three environments.



**Photo #2. A fish tank** refers to culture facilities of varying sizes and shapes (circular as can be seen in above photo, rectangular, etc) made of fiberglass, canvass, and/or marine plywood, concrete, or ferrocement. A fish tank is land-based, needing a small parcel of land. Water is either gravity-fed or pumped; thus making water supply a critical factor in deciding to set up tank systems. Tanks are relatively more secure to manage because the small area can be easily fenced in.

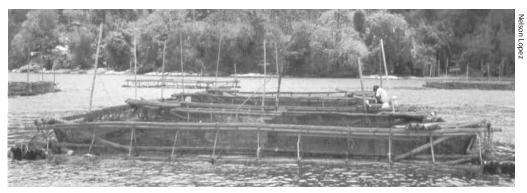


Photo #3 .Fish cage.



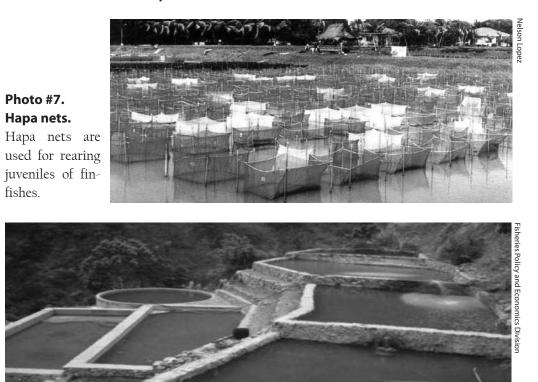
**Photo #4. Fish cage.** A *fish cage* refers to an enclosure which is either stationary or floating made up of nets or screens sewn or fastened together and installed suspended in the water with opening at the surface or covered and held in a place by wooden/bamboo posts or various types of anchors and floats as in above. Modern types of fish cages, such as those of circular design, use lighter and more durable materials such as fiberglass and PVC pipes.



**Photo #5. Mangroves and fish pens.** Mangrove swamp areas along the intertidal zone are ideal sites for brackishwater fishponds and fishpens where the water is sourced from both from the sea and rivers. The most dominant fish cultured in brackishwater are milkfish and shrimp. Mudcrab and grouper were recently introduced in commercial scale to maximize utilization of the ponds. Aqua-silviculture and fishpen farming system are also done, as in photo.



Photo #6. Brackishwater pond.



**Photo #8. Fishponds/fish terraces.** These fishponds are located in an upland environment, i.e. fish terraces.



**Photo #9. A fish pond** located in a coastal wasteland. Special plastic lining (for example made of polyethylene) is used as ground cover which functions as a hydraulic barrier to pond dikes and bottoms. The pond liner is used for water containment and helps preserve biosecurity by preventing pathogens from entering and infecting the pond.



**Photo #10. Integrated farming system, here rice-fish.** Fish farming utilizes the irrigation water in canals adjacent to rice paddies.



Photo #11. Family members readying seaweeds for planting.

Farming systems can also be classified as (i) water-based systems such as cages and pens located both inshore or offshore; (ii) land-based systems such as rainfed ponds, irrigated or flow-through systems, tanks and raceways; (iii) recycling systems (high control enclosed systems, more open pond based recirculation); and (iv) integrated farming systems (e.g. agri-aqua by integrating crops, livestock, and poultry to fish).

# 1.2.3 Aquaculture according to production scale

Aquaculture according to production scale can be classified as intensive, semi-intensive and extensive depending on stocking density of fry or seed, feed introduction, and labor and capital usage. Extensive farming systems rely on natural food such as phytoplankton and zooplankton. Introducing fertilizers into the pond system enhances the growth of both phytoplankton and zooplankton but also risks occurrence of algal blooms.

In intensive systems, fish production can be controlled for as long as there is sufficient oxygen, fresh water, and food. Since feed is introduced, these systems naturally incur a higher cost. Also, dependence on oxygen implies constant aeration while freshwater demand must be supported by an efficient filtration system. When fish densities are high, infections such as fish lice, intestinal worms, and protozoa are more likely to occur (http://www.wikipedia.org).

Aquaculture can assume any of the three scales in fresh, marine and brackishwater environments depending on the management practice.

Interestingly, the production scale, farming system, and farming technology for a single species may change across the life cycle of the species starting from broodstock, and then progressing to hatchery, nursery, grow-out, and quarantining. Holding of broodstock (such as in milkfish) is usually done in tanks, cages, or pens. Hatchery and nursery operations may be done in ponds and tanks while grow-out may occur in fish pens, ponds, and cages in freshwater and marine environments.

# 1.2.4 Aquaculture species or farmed commodities

Aquaculture is as diverse as agriculture and involves the farming of many aquatic species by many different methods. The Philippines reports annually to the Food and Agriculture of the United Nations statistics for the production of about 30 farmed aquatic species or commodities although Philippine aquaculture statistics indicate that at least 18 species are currently being farmed with only 6 commodity groups or species contributing substantially either by volume or value terms to total production: seaweeds, milkfish, tilapia, penaeid shrimps (principally the black tiger shrimp, Penaeus monodon), mussels and mud crabs (Scylla spp.) (Table 3).

Species	Volume		Value	
species	Quantity (t)	Share (%)	Amount ('000 P)	Share (%)
ALL SPECIES	1,895,847	100	49,169,788	100
Seaweeds	1,338,597	70.60	6,040,899	12.28
Milkfish	289,153	15.25	17,577,207	35.74
Tilapia	163,003	8.59	8,900,613	18.10
Black Tiger Shrimp	37,721	1.98	13,623,435	27.70
Mussels	20,159	1.06	138,863	0.28
Carps	17,228	0.90	365,705	0.74
Oysters	16,495	0.87	105,974	0.21
Mud Crab	6,861	0.36	1,694,588	3.44
Catfish	2,355	0.12	146,546	0.29
White Shrimp	1,519	0.08	158,357	0.32
Groupers	273	0.01	101,566	0.20
Siganids	151	0.01	22,389	0.04
Other Species	2,334	0.12	293,646	0.59

Table 3. Volume and Value of Aquaculture Production. Philippines 2005

Source: Bureau of Agricultural Statistics

# Seaweeds

Seaweeds farmed in the Philippines comprise two major groups: (i) those farmed for extraction of industrial chemicals, i.e., eucheuma; and (ii) edible species, principally caulerpa. The farming of seaweeds is the Philippines' largest aquaculture operation and the Philippines is the world's largest producer of farmed eucheuma. ARMM is the most important seaweed producing region followed by Region IV-B, Region IX, and Region VII. All other regions except for CAR now produce seaweeds, some on a seasonal basis.

# Milkfish

Milkfish (bangus) thrive in fresh-, brackish- and marine waters and are a popular fish to farm in earthen ponds, net cages, and pens. The Philippines is the top milkfish producing country in the world with 289,952 t produced in 2005. The top three milkfish producing regions are Regions VI, I and III, all producing more than 60,000 t each. Despite being the most important farmed fish species in terms of both quantity and value, it is not even among the ten most important fishery export products of the Philippines because it is consumed locally. Production technology of milkfish ranges from traditional systems (shallow brackishwater fishponds) using purely natural food to intensive shrimp ponds converted to milkfish production using pumps and aerators. Extensive systems for bangus were producing 500 kg per hectare per 4 to 5 month cycle compared to 10 t per ha per cycle for intensive systems with the latter incurring higher energy costs. Aside from ponds, milkfish is also raised in freshwater fish pens such as that practiced in Laguna de Bay and in pens and cages in marine waters as practiced in Lingayen Gulf.

# Tilapia

Tilapia is the third most important species produced in the Philippines with a production of 163,003 t in 2005 contributing 8.6% to total aquaculture production by quantity and 18.1% by value. It is produced mainly in Regions III and IV-A, each producing 72,346.60 and 53,965.10 t, respectively. Most of the country's 14,531 ha of freshwater fishponds are located in Region III while tilapia production from Region IV-A comes mainly from fish cages in Laguna de Bay and Taal Lake.

# Shrimps

In the early 1990s, the Philippines was the third most important shrimp producing country after Thailand and Indonesia, with a production of over 90,000 t, primarily of black tiger shrimps (Penaeus monodon). However, bacterial disease caused the industry to collapse to half its production levels and has not yet fully recovered. Current interest is spurred by P. Vannamei, which originated from the Pacific side of south America, and which was met with strong opposition from local NGOs and producers alike. BFAR lifted the ban on its production in January 2007 after experimenting on a Specific Pathogen Free broodstock and drafting specific guidelines on its culture.

# **Oysters and Mussels**

Oysters and green mussels are the only two species of mollusks farmed significantly in the Philippines for food. Oyster farming has remained in shallow sub-tidal areas where the spats are collected. These areas are now increasingly subjected to domestic pollution with its consequential effect on quality and food safety. While mussels are farmed in deeper waters, these areas also face problems of contamination due to increasing organic loading from urbanization. Both oysters and mussels are affected by periodic harmful algal blooms, especially of red tide organisms which cause paralytic shellfish poisoning.

A listing of major farmed species, their common names, production environments and farming systems are summarized in Table 4.

Species	Common Filipino Name / Local Name	Marine	Brackishwater	Freshwater
	Fi	nfish		1
Nile tilapia	Pla pla; tilapia	Cages and pens	Ponds	Ponds, cages, tanks
Common carp	Carpa			Ponds, pens, and cages
Freshwater Ornamental fish	Various (koi, guppy, goldfish)			Tanks, water receptacles
African catfish	Hito			Ponds, tanks
Giant freshwater prawn	Ulang			Ponds, tanks
Bighead carp	Carpa, maya-maya			Ponds, cages
Milkfish	Bangus	Cages, pens	Ponds, pens, and cages	Pens and cages
Seabass	Apahap	Cages, pens	Ponds	
Grouper	Lapu-lapu	Cages, pens	Ponds	
Pompano	Pampano	Cages, pens		
Rabbitfish	Danggit, barangen, samaral	Cages, pens	Ponds	
Sergeantfish	Cobia	Cages		
	Aqua	tic plants		
Seaweeds	Eucheuma, Caulerpa	Floating lines, stakes, monolines		
	Shells and	d crustaceans		
Oysters	Talaba	Stakes, lines, and rafts		
Mussels	Tahong	Stakes, lines, and rafts		
Tiger prawn	Sugpo		Ponds	
Penaeus vannamei	Hipong puti; white shrimp	Pens, cages	Ponds	Ponds
Mudcrab	alimango		Ponds, cages, pens	

Table 4. Common farmed species, their common names, culture environment and culture systems

# 1.3 Environmental impacts of aquaculture

# **1.3.1** Biological, chemical and physical impacts of aquaculture on the environment

Aquaculture is highly dependent on the consumption of a range of environmental goods and services. If the rate of consumption of seed, feed, and water exceeds their natural supply or if the capacity of the environment to assimilate wastes is weakened, environmental degradation is bound to occur. In aquaculture, the manifestation of negative environmental impacts can be classified as biological, chemical, and physical.

Biological impacts of aquaculture may include fecal discharge of fish, waste food, and impacts on genetics and biodiversity. Aquaculture, like many other human activities, produces wastes which, if not managed properly, may negatively affect the environment. In intensive aquaculture, increased deposition of organic wastes such as uneaten food, faeces, and excreta increases biochemical oxygen demand, nitrates and phosphates in receiving waters. This may not necessarily be a problem as natural breakdown processes or dilution in the receiving waters can assimilate this, provided that natural waters are not overloaded. Aquaculture potentially has several adverse effects on wild species, including disease transmission, escape, and capture for broodstock or rearing among others. Reliance on high protein, fishmealbased feed for carnivorous species often requires many pounds of wild fish to produce one pound of edible aquaculture product. While the transmission of disease from farmed to wild stocks is still uncertain, the contagion from one farm to another is a serious risk.

impacts include oxygen Chemical depletion and eutrophication which are caused by the production of nutrient-loaded effluents, presence of antifoulants used in boats and nets, industrial wastes and medications and treatments for fish, shellfish, and seaweeds (although minimal chemical used for seaweed culture) which can harm wildlife and the

Box 2. What bad aquaculture practices result to negative impacts on the environment?

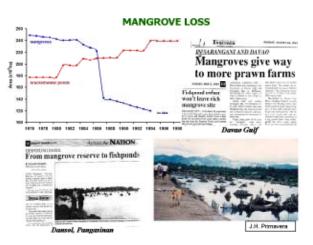
- · Poor siting which may include conversion of sensitive habitats, setting up of structures such as seaweed floats in coral reef areas, and ponds which require too much pumping of groundwater. The lack of appropriate planning and zoning is a main reason for poor site selection.
- Overcapacity. Refers to the establishment of structures such as cages and pens beyond the carrying capacity of the lake, river, or coastal area. Too many pens that obstruct the free flow of water and physical congestion are tell-tale signs of overcapacity.
- Overstocking. Similar to overcapacity but limited to the confines of a cage or pen or pond unit. Means that the number of fish (fry or fingerlings) stocked is beyond the recommended number. Overstocking ultimately results to higher demand for feed, higher wastage, and increased demand for oxygen and nutrients from the water.
- Overfeeding. Either too much feed or use of inefficient feeds with low-quality binders, i.e., the feed crumbles and settles to the bottom before it is eaten. Usually done to hasten growth of fish and result in bigger sizes.

environment, and may lead to antibiotic resistance.

Physical impacts range from the aesthetics (poor zoning and proliferation of cages and pens can be eyesores), to net friction causing poor water exchange, and to the extremes of altering critical habitats such as wetlands and mangroves. A particularly serious type of impact due to detritus from fish farms has been identified by Heinig (2000) to be the presence of lost or discarded nets on the bottom. These nets can have some potentially beneficial effects, such as providing refugia for mussels and other benthic epifauna, but in general their presence should be viewed as a negative impact since once they become buried in the bottom sediments they are almost impossible to find and remove, and they can interfere with alternate uses of the area if fish farming is discontinued. The conflict over the use and conversion of natural resources as well as access to remaining resources and the privatization of public commons has resulted in serious conflicts and questions pertaining to equitable use of resources. Massive water use can result in water shortages as well as salt water intrusion and other hydrological changes or waste disposal issues. The allocation of space, especially coastal waters, highlights the user conflicts especially aquaculture

operations that require a huge area, such as seaweeds. Seaweed farms that locate near or above are observed to inhibit coral growth because of shading although the overall effect on benthic communities and primary production has not yet been well studied (FAO 1990). Over-intensification has been shown to cause diseases such as the ice-ice disease.

**Habitat loss and modification.** Aquaculture affects sensitive coastal environments either by conversion, as in the case of mangroves, or habitat alteration as can be observed in coral reef, seagrass and benthic substrates where Fig. 3. PHILMINAQ slide summarizing impact of aquaculture on mangrove ecosystems based on San Diego-McGlone and White (2006)



fish pens and cages are located. In the Philippines, more than 300,000 hectares of mangroves have been converted to fish ponds, salt beds, agriculture, and industrial/ commercial establishments. From a level reaching 500,000 hectares in the 1900s, the area of mangroves declined to 112,000 hectares in 1998; present coverage has risen to 290,000 hectares due to massive reforestation efforts (Burgonio 2007). Mangrove conversion completely obliterates the ecosystem; thus, the important ecological services such as nursery grounds for fish and crustaceans, sediment trapping, and flood control, valued at US\$600 per hectare (White and Cruz-Trinidad 1997) are totally wiped out and may never be restored to its original state. Damage to sensitive habitats occur when fishpens or cages are situated near or too close to coral reef/ seagrass areas. Waste materials such as uneaten feeds and fecal matter settle on the bottom of the structure causing sedimentation and nutrient enrichment. This occurrence favors some species more than the rest; thus, changing the ecosystem interactions in that area. Uneaten feeds are observed to smother seagrass beds,

Fig. 4. PHILMINAQ slide showing impact of aquaculture on seagrass based on San Diego-McGlone and White (2006)

# <image>

# Effect of Aquaculture on Seagrass Habitats

especially those directly under cages and results in sediment anoxia and sulfide toxicity.

Seagrass diversity is reduced as a result. Coral reefs are also affected by sedimentation and eutrophication. Fish excretion and pellet leaching add to nutrients to the water column which can lead to eutrophication.

**Introduction of exotic species.** The world-wide expansion in aquaculture has resulted in an increase in the number of species of aquatic animals and plants which are moved beyond their native ranges (Welcomme1988). These translocations may have adverse effects on aquaculture and wild species, either through introduction of new diseases or competition with native species. Philippine aquaculture relies on alien species, particularly in freshwater systems. The major farmed freshwater fish, Nile tilapia, most of the lesser farmed freshwater species – including bighead carp, African catfish, common carp – and all freshwater aquarium species are alien species and others are being eyed as possible candidates for aquaculture. This always carries potential risks, as the Philippines found at great cost to rice farmers after allowing the importation of the golden apple snail on spurious grounds that exports of escargots would result (Acosta and Pullin 1991).

**Biodiversity.** Aquaculture can affect local biodiversity in many ways. The use of wild-caught fry is still common for some particular marine species. Repeated fishing for the juveniles of certain species can drastically alter species composition by preventing some of them from bring recruited into the reproductive population. The escape of alien species such as salmon and tilapia can also have deleterious effects on biodiversity.

**Spread of pests and diseases.** Intensive aquaculture has a risk of transmitting pathogenic organisms to wild fish stocks. Diseases and parasites from outside the farm can easily be introduced by transporting fry/fingerlings from other parts of the country and by importing fish from abroad with proper quarantine procedures. Diseases and parasites acquired or developed under hatchery conditions can be transmitted to the wild population as fry/fingerlings are stocked in cages. Viral and bacterial diseases due to "self-pollution" decimated the shrimp farming industry in the 1990s. In Negros Occidental, which was the leading province for intensive shrimp culture, production of shrimps dropped from a high production level of 90,426 metric tons in 1984 to 25,000 mt in 1994 to white spot disease.

**Misuse of chemicals and antibiotics.** Pharmaceuticals such as antibiotics used to treat diseased fish can have effects on wild fish populations and other organisms although it is difficult to estimate these secondary effects on the surrounding ecology and environment. In shrimp farms, the use of antibiotics (e.g. chloramphenicol and nitrofurans) was the first line of defense against the bacterial pathogens applied by shrimp farmers in the Philippines at the height of the disease outbreak. In brackishwater fishponds, a former practice of controlling snail pests (e.g. Cerithidea cingulata) and fish predators in the past was with non-environmentally friendly organo-phosphate and tin-based chemicals which are now banned. Pesticides used in agricultural farms, i.e., mainly organochlorines, pollute the aquatic environment

as run-off which is both harmful to fish and humans. Indiscriminate use of such chemicals and the potential hazard to human health and possibility of bacterial resistance development are major concerns.

**Dependence on raw (trash) fish and fish meal.** The dependence of cultured fish on wild-caught fish is astounding. Fish oil and fish meal, which are essential ingredients of feeds, ultimately come from wild stocks. Studies have shown that 1/3 of all wild-caught fish is used to make feed for aquaculture. On average, it can take 5-12 kg of feed to produce 1 kg of finfish such as grouper, snapper, and seabass (www.wwf.org). Based on PHILMINAQ's estimates, about 160,000 tons of wildfish/ feeds are wasted in tilapia pens, cages, and ponds while more than 160,000 tons are wasted for bangus culture. While some argue that trash fish is not suitable for human consumption, in less developed countries such as the Philippines, even trash fish is eaten. Furthermore, these small fish species have vital roles in the ecosystem mainly as food for larger species of fish.

**Alteration of physical environment.** The nets of cages, pens, and associated moorings change the environment by preventing efficient water exchange and changing the current patterns caused by friction to the water currents. Friction from the nets can alter the residence time of water in a bay. Sometimes these structures can also cause obstruction to navigation routes and migration paths of different species of fish.

**Feed wastage.** There is still significant feed wastage in aquaculture and this excess feed does not get consumed and goes into the environment, which can have significant impacts. Some of the feed is in the form of dust that is too small to be eaten by the fish, some feed gets lost through over feeding of the fish, or if the feed pellets are the wrong size for the fish. Excess pellets settle to the sediments where they may be consumed by wild fish, consumed by benthic organisms or breakdown into nutrients by benthic assimilation. To be discussed

**Release of wastes.** Aquaculture, like any other animal production activity, produces wastes in the form of particulate (mainly the uneaten food and faeces) and soluble substances (excreta) which increase biochemical oxygen demand, nitrates and phosphates in receiving waters. The risk of negative impacts of aquaculture wastes is greatest in enclosed waters or sites with poor water exchange rates such as in slow moving rivers, lakes and shallow bays. In these conditions, aquaculture production can lead to a build up of organic sediments and addition of nutrients to the water column. This, in turn, can lead to secondary effects such as eutrophication, algal blooms and low dissolved oxygen levels.

A summary of environmental impacts associated with the culture of specific species is shown in Table 5.

Cultured species	Specific environmental impact		
Seaweeds	Benign, generally, but absorption of nutrients from the sea may cause changes to marine ecosystem structure and function, alteration of currents and increasing shading of bottom environments. Nutrient stress, perhaps caused by too much seaweed culture in an area, has also been implicated in 'ice-ice' disease		
	Shading of coral reefs and use of mangrove poles for stakes		
Mussel and oyster	Mussel and oyster farming also result in increased biodeposition of wastes on the seabed, the resulting organic enrichment inducing changes in sediment chemistry and biodiversity.		
Abalone	Increased dissolved and solid nutrient wastes		
Sea urchins	Negligible yet		
Mudcrab	Over-harvesting of wild juveniles, clearing of mangrove areas, and wastes; may be mitigated with development of hatchery technology		
Shrimps			
P. vannamei	Risk of escape and threat to local biodiversity and ecosystems		
P. monodon	Badly sited ponds and overfeeding result to discharge of large quantities of wastes that are poorly dispersed and can lead to self-pollution. Effluents from shrimp ponds are high in both dissolved and particulate nitrogen and phosphorus which elevates nutrient levels in receiving waters and promotes eutrophication. Antimicrobials, once widely used by the industry in order to try to control disease, were discharged with wastewater into the environment where potentially they promoted the development of antibiotic-resistant strains of bacteria. They are now used in much smaller quantities.		
Milkfish	Overfishing of wild fry		
	In brackishwater ponds, intensification of production methods can result in greater production of wastes which unless intercepted and treated (filter traps, settlement ponds, biofiltration beds), are discharged into the coastal environment causing eutrophication and self-pollution problems in some areas of the country (e.g., Bolinao). A chronic problem in milkfish pond culture is the resident mud snail, which can multiply to very high numbers and compete with milkfish for natural food. Eradication has often been through the application of banned organotin compounds that are toxic to other aquatic organisms and have food safety implications.		
	Fishpens in freshwater environment result in net nutrient loss		
	In cages, eutrophication caused by uneaten food and fish excreta, sedimentation and in cases of overstocking, fish diseases and fish kills		
Tilapia	Environmental impacts of too many ponds sited in the wrong place, intercepting or abstracting too much water and releasing untreated, nutrient-rich pond effluents and sediments during harvesting		
	Organic loadings (waste feed and fish excreta) that inevitably result from cage aquaculture cause eutrophication, as manifest by higher phytoplankton biomass and primary productivity and depletion of dissolved oxygen and accumulation of H2S in bottom waters. Under certain conditions – cooling of surface water following rain, for example, or the draw-down of a reservoir – up-welling of bottom water to the surface can occur resulting in fish kills.		

# Table 5. Environmental impacts associated with specific cultured species

Adapted from Draft Final Report, ADB ADTA 4805

# 1.3.2 Major environmental events

# Red Tide and Harmful Algal Blooms (HABs)<sup>2</sup>

Red tide is a term used to describe all phenomena where the water is discolored by high algal biomass or concentration of algae. The discoloration may not necessarily be red in color but it may also appear yellow, brown, green, blue or milky, depending on the organisms involved. It may either be harmful or harmless. Harmful algal bloom (HAB) is a term used to describe events associated with the blooms of algae, which cause harmful effects

### Box 3. Causes of fish kills

- **Oxygen depletion** arising from algal bloom, algal die-off, thermal destratification, and overstocking
- Pollutant toxins such as acidic runoff, oil spills, and toxic gases and chemicals
- Natural toxins such as blue-green algae dinoflagellates, and aflatoxins
- Diseases from bacteria, fungi, parasites, and virus

Adapted from BFAR Fish Health Section / M. Bantaya

to the environment, living organisms and humans. It refers to blooms of toxic and non-toxic algae that discolor the water, as well as to blooms that are not sufficiently dense to change the color of the water but which are dangerous due to the algal toxin they contain or the physical damage they cause to other biota.

Harmful algal blooms are one of the marine environmental problems and resource management issues that confront the Philippines. It has been recognized as a catastrophic phenomenon that affects public health and economy of the country since 1983. The first recorded occurrence of blooms of Pyrodinium bahamense var. compressum, a toxin-producing dinoflagellate was in 1983 in central Philippines, and since it was the first time that the country has experienced such kind of phenomenon, its impact in terms of public health and economy was great. Harmful algal blooms in the country, particularly Pyrodinium have expanded both in time and space. Blooms of Pyrodinium spread to around 22 coastal areas of the country. Paralytic shellfish poisoning due to Pyrodinium has increased in severity during the last two decades with the country experiencing more than 540 outbreaks of harmful algal blooms with subsequent shellfish poisoning episodes between 1983 and 2002.

Some species recur in the same geographic regions each year, while others are episodic, leading to the unexpected deaths of local fish, shellfish, mammals, and birds. Azanza (2005) observed a first-time occurrence of a Prorocentrum minimum bloom at a maximum cell density of 4.7 × 105 cells in 2002 in Bolinao, where intensive and extensive aquaculture of Chanos chanos (milkfish) in fish pens and cages has been practiced for years now. The fish kill, which lasted almost simultaneously with the bloom of the organism, had its peak when the organisms bloom was declining. Lack

of oxygen in the cages and pens was the fundamental cause of the fish kill.

# Fig. 5. Number of fish kill occurrences in the Philippines, 1998-2007

### 40 35 30 25 20 15 10 5 0 1998 2007 1999 2000 2001 2002 2003 2004 2005 2006

# Fish kills

A fish kill is any unusual and noticeable increase of mortality due to infectious or non-



<sup>2</sup> Summarized from the BFAR webpage at www.bfar.da.gov.ph

infectious causes in wild or captive fish or shellfish population. Oxygen depletion, pollutant toxins, natural toxins, and disease are four common causes of fish kill which can be traced directly or indirectly to aquaculture activities.

Based on BFAR Fish Health Section monitoring records that commenced in 1998, there are 192 documented cases of fish kills with almost half of the causes being attributed to aquaculture. Five incidences of fish kills were observed in 1998 with the most significant being the Lake Buhi case which was caused by overstocking of tilapia in fish cages and which was estimated to cost P33 million. In 1999, there were six cases recorded with four of them arising from Laurel, Batangas; one occurred in Murcieliagos Bay, Zamboanga del Norte, due to mercury and cyanide contamination. The fish kill that occurred in Lingayen Gulf in that same year was due to the stranding of an oil tanker and the spill that resulted. The year 2003, closely followed by 2005 had the highest number of fish kill occurrences (see chart) due to overfeeding and overstocking which were observed in perennial areas such as Taal lake but also including aquaculture activities in Isabela, Cebu, and Bohol and covering various species including tilapia, milkfish, shrimp and grouper. Incidences of fish kills due to pesticides, bacteria and parasites were very high during this year. For this year, aside from the widely publicized Bolinao-Anda fish kill, there were five other fisk kill occurrences in Camotes, Bais, Davao del Sur, and Cotabato affecting milkfish broodstock, siganids, and various types of freshwater species. Twenty seven occurrences were recorded in 2000, occurring mostly in the months of May and August and in municipalities bordering Taal lake and all due to aquaculturerelated causes.

In terms of economic losses, some occurrences were valued at a few thousand pesos while the major fish kills costs hundreds of millions of pesos. The Bolinao fish kill in 2002 was reported to have cost P200 million while the most recent one that occurred in June 2007 was estimated to cost between P40 to P100 million. In May of 2005, two separate incidents occurring in Taal Lake, i.e., Mataas na Kahoy and Agoncillo, reportedly cost P42 million. On the same month of the following year, another fish kill incident occurred in Mataas na Kahoy, Batangas involving more than 600 MT, mainly of tilapia, and costing another P46 million.

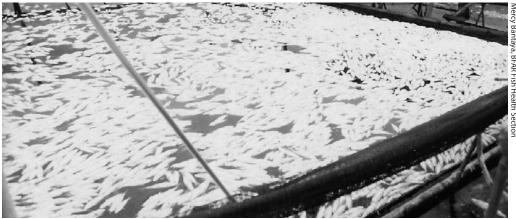


Photo #12. Fish kill incident.



# National agencies

with mandates towards aquaculture management

This section identifies national agencies which perform functions related to aquaculture management and mitigation of its negative impact on the environment. First, the national agencies with mandates pertaining to production processes in aquaculture are identified and their mandates briefly discussed. The focus is mainly on the production side due to the more pronounced impacts of various inputs and processes on the environment whilst lesser impacts arise from post production activities such as marketing and transport. Second, the national agencies which perform support functions to aquaculture management are identified and lastly, the mandates of the Department of Agriculture (DA)-Bureau of Fisheries and Aquatic Resources (BFAR) in aquaculture management are presented.

While the focus of this section is on national agencies, most of the responsibilities discussed herein are in fact shared with LGUs.

# 2.1 National agencies with jurisdiction over specific aquaculture processes

Table 6 summarizes the production processes and inputs, identifies the national agencies with mandates, regulatory functions, or policy setting functions that affect specific production processes, and determines the likely impacts on the environment of specific production processes and inputs. As a first step in the production continuum, site selection issues may be addressed by several national agencies depending on the site selected.

Firstly, aquaculture, and more specifically fishponds (see also Chapter 4, question number 2), are covered by the Environmental Impact Statement (EIS) system (Presidential Decree (PD) 1586 and subsequent administrative orders to implement/clarify/or amend specific provisions of said law) and is thus within the jurisdiction of the DENR Environmental Management Bureau (EMB). Small cages and fish pens are not considered as Environmentally Critical Projects (ECP)s and are thus exempted from the EIS system unless they are located in Environmentally Critical Areas (ECA)s. If the selected site is within mangrove areas, the jurisdiction belongs to the DENR Forest Management Bureau (FMB) by virtue of PD 705 or the Forestry Code, EO 263 or the Community Based Forest Management Strategy, DENR Department Administrative Order No. 15, s. 1990, on regulations governing mangroves, and RA 7161, which prohibits the cutting of mangroves.

Aquaculture operations that occur in lands of the public domain, including foreshore lands, are also under the jurisdiction of the DENR Lands Management Bureau (LMB) per Commonwealth Act 141. In cases where aquaculture activities exist in areas within protected areas under the National Integrated Protected Areas System (NIPAS) Law, the agency in charge is the DENR-Protected Areas and Wildlife Bureau (PAWB) or the designated Protected Areas Management Board (PAMB), if it so exists. Likewise, the nature of aquaculture operations in said area must comply with the Protected Area Management Plan, if such exists already before the conduct of aquaculture. The DENR bureaus identified herein may be consulted regarding policy issues; however, implementation issues are best addressed at the different DENR regional offices.

In freshwater environments such as dams and large irrigation projects, the National Irrigation Authority (NIA) per Presidential Decree 1702 has jurisdiction while small irrigation projects are both under the concerned LGU and the Bureau of Soils and Water Management (BSWM) per Executive Order 116. In cases where deep wells are to be developed, the National Water Resources Board (NWRB) is the permitting authority.

The selection of species to be cultivated and the sourcing of seeds has serious implications on overharvesting and biodiversity especially if sourced from the wild; in such cases, seed caught in the wild are under the jurisdiction of LGUs if sourced in ecosystems within municipal waters, and the DENR, if the waters are included as protected seascapes under the NIPAS Law. DENR, through the Wildlife Act (RA 9147) also assumes jurisdiction over cases of invasive species per Section 13. Hatcheries and breeding facilities are to be monitored by both the LGU and BFAR as per Fisheries Code with the latter providing construction and operational standards.

Three inputs to production: feeds, fertilizers and pesticides, and chemicals, are considered environmental threats if used improperly. The use of fertilizers and pesticides is regulated by the Fertilizer and Pesticide Authority (FPA) by virtue of PD 1144. Regulations cover efficacy and quality standards, environmental impact, and product safety and agrioccupational health. Meanwhile, feeds are under the jurisdiction of the Bureau of Animal industry (BAI) while drugs including antibiotics, organotins, probiotics, hormones,

anaesthetics, chemotherapheutants, are under the jurisdiction of the Bureau of Food and Drugs Administration. The BFAR Fish Health Section is also involved in disease control and food safety through their residue monitoring program and together with the Department of Health (DOH), implements regular activities to identify/ban certain substances proven harmful to fish health.

Among the banned substances per DA-DOH Administrative Orders No. 61 and 90, series of 1990, and DA-DOH AO. No. 2, series of 2000, are antibiotics, namely, chloramphenicol and nitruforans, due to its carcinogenic, mutagenic and genotoxic properties. In a MOA executed by BFAR and the BAI, the Fish Health Section of BFAR was recognized as having the capability for the monitoring of feeds, veterinary drugs, and biologics in aquaculture, and as such has deputized BFAR Fish Health Officers as Aquatic Animal Feed and Veterinary Drug and Product Control Officers (see also Chapter 4, question 13).

There are two special cases governed by two laws which affect the conduct of aquaculture operations: (a) ancestral domain areas and (b) provinces which are included in the Autonomous Region of Muslim Mindanao (ARMM).

First, territories classified as being within ancestral domains as defined by RA 8371 or the Indigenous Peoples' Rights Act of 1997, are under the jurisdiction of the Indigenous Cultural Communities (ICC) or Indigenous Peoples (IP)s therein, who have full authority over "ancestral lands, forests, pasture, residential, agricultural, and other lands individually owned whether alienable and disposable or otherwise; hunting grounds: burial grounds; worship areas; bodies of water; mineral and other natural resources; and lands which may no longer be exclusively occupied by ICCs/IPs, but from which they traditionally had access to, for their subsistence and traditional activities, particularly the home ranges of ICCs/IPs who are still nomadic and/or shifting cultivators".

The ICC/IPs, through their designated Council of Elders have the following regulatory/ control functions within their territories: (i) regulating entry of migrants and other entities; (ii) regulating use of activities that may adversely affect their airspace, bodies of water and lands; and (iii) review and monitoring of development projects through submission of the Environmental Conservation and Protection Program. Air and water pollution are acts which can be penalized by the ICC/IP Council consistent with their customary laws.

RA 6734, an act providing for an organic act for the ARMM, and covering the provinces of Sulu, Tawi-Tawi, Maguindanao, Lanao del Sur, and the latest to join the group, Sharif Kabunsuan, paved the way for the enactment of a localized Fisheries Law, the ARMM Aquatic and Fisheries Code of 1999, also known as Muslim Mindanao Autonomy Act (MMMA) No. 86. Said law applied and adapted the Fisheries Code and created local institutions for its implementation, i.e, the Department of Fisheries and Aquatic Resources (DFAR), devolved regulatory functions to said institutions, but retained the main provisions of the Fisheries Code. Among the highlights of MMAA No. 86 which are relevant to aquaculture include the following: (i) approval of fishpond lease agreements (FLA)s by Regional Governor; (ii) determination of lease rates by the DFAR; (iii) provision of environmental mitigation facilities such as settling ponds by the fishpond lesee; (iv) joint identification of abandoned, unutilized fishponds by DENR-ARMM and Regional Department for subsequent reversion to forest lands. MMAA 86 recognizes the role of municipalities in zoning, permitting, and licensing of aquaculture activities and fishing operations within their jurisdiction.

Aquaculture process	Main national agency with jurisdiction*	Environmental impacts
Site selection	<ul> <li>DENR-FMB if within mangrove areas;</li> <li>DENR-PAWB if within Protected Seascapes under NIPAS or PAMB, if organized;</li> <li>DENR-LMB, if within public lands such as foreshore areas;</li> <li>DENR-EMB for compliance and monitoring under EIS System;</li> <li>ICC/ICPs, or through the National Commission on Indigenous Peoples (NCIP), if in ancestral domains;</li> <li>ARMM-DFAR, if located in ARMM provinces;</li> <li>NIA, if in dams and large irrigation;</li> <li>BSWM, if in small irrigation projects;</li> <li>NWRB, for construction of deep wells</li> <li>BFAR, if beyond municipal waters</li> </ul>	Destruction of sensitive ecosystems, flora and fauna; Increased demand for water sources
Inputs to production processes (hatchery, nursery, grow- out phases)		
Seed supply from wild	DENR, if within protected areas under NIPAS ICC/ICPs, or through the NCIP, if in ancestral domains	Overharvesting of seeds from the wild leading to biodiversity loss and changes in ecosystem
Seed supply from hatchery facilities	BFAR to prescribe minimum standards for fish hatcheries and fish breeding facilities	Disease threats, poor growth if seed integrity is not established
Feeds	Animal Feed Standard Division of the BAI BFAR Fish Health Section BFAR Post Harvest Division	Overfeeding and inefficient feed conversion leads to changes in water quality, increased turbidity, and sedimentation
Fertilizers	Fertilizer and Pesticide Authority	Run-off from ponds and farms
Drugs	Bureau of Food and Drugs Administration	Used to treat fish diseases and prophylactics Run-off
Post-harvest processes	BFAR	Solid waste and water pollution processing activities

Table 6. National agencies with jurisdiction over specific aquaculture processes and inputs and summary environmental impacts

\* Jurisdiction is shared with LGUs in issues pertaining to site selection, sourcing of seeds, and supply of seeds from hatchery faclities.

Lastly, Department of Interior and Local Government (DILG) assists the President in the supervision of the LGUs, promotion of local autonomy, and the implementation of the Local Government Code. It provides assistance towards legislation, law enforcement and public safety and through its attached agencies, mainly the Local Government Academy, and provides human resources training to enhance all aspects of local governance.

### 2.2 National agencies with support functions to management of environmental impacts of aquaculture

Not all mandates of national agencies have direct impact on aquaculture production processes. However, there are other functions which are critical to planning, information management, and enforcement, which, in turn, contribute to better management practice. These national agencies are shown in Table 7 below.

Support function	National Agency	Specific function(s)
Planning	DA	Identification of and planning for Strategic Fisheries and Agricultural Development Zones
	DA-BFAR	Formulation and implementation of the Comprehensive Fishery Industry Development Plan
	National Economic and Development Authority (NEDA)	Formulation of Medium Term Development Plan
Information management	DA-BFAR	Approval of Investment Projects GIS maps of coastal areas covered by the Fisheries Resource Management Project
	Bureau of Agricultural Statistics (BAS)	Statistics on production, prices, trade
	DENR, Coastal and Marine Management Office (CMMO)	Data on habitats such as mangroves, coral reefs, etc.
	DENR, FMB	Data on mangrove area
	DENR, EMB	Water bodies classification, effluent standards, EIS approval
	DENR, National Mapping and Resource Information Authority (NAMRIA)	Maps and technical descriptions of municipal waters
Enforcement	Philippine Coast Guard (PCG)	Enforcement of marine pollution laws
of pollution	Philippine National Police-	Enforcement of any criminal
control laws	Maritime Group (PNP-MG)	activities in municipal waters

Table 7. National agencies with support functions to management of environmental impacts of aquaculture

#### 2.3 BFAR as the main national agency for aquaculture management

The BFAR is the country's premier fisheries management agency. In coordination/ cooperation with other national government agencies, BFAR has jurisdiction over the management, conservation, development, protection, utilization and disposition of all fisheries and aquatic resources of the country, except those within municipal waters. In municipal waters, BFAR will coordinate with and assist the LGUs, FARMCs and other concerned agencies in undertaking the functions specified earlier. The Fisheries Code of 1998 reconstituted BFAR as a line agency and enumerated its functions per Section 65 as follows<sup>1</sup>:

- (a) prepare and implement a Comprehensive National Fisheries Industry Development Plan;
- (b) issue licenses for the operation of commercial fishing vessels:
- (c) issue identification cards free of the charge to fisherworkers engaged in commercial fishing;
- (d) monitor and review joint fishing agreements between Filipino citizens and foreigners who conduct

<sup>1</sup> Functions pertaining solely to commercial fishing were culled from the above list.

fishing activities in international waters, and ensure that such agreements are not contrary to Philippine commitment under international treaties and convention on fishing in the high seas;

- (e) formulate and implement a Comprehensive Fishery Research and Development Program, such as, but not limited to, sea farming, sea ranching. tropical/ornamental fish and seaweed culture, aimed at increasing resource productivity, improving resource use efficiency, and ensuring the long-term sustainability of the country's fishery and aquatic resources;
- (f) establish and maintain a Comprehensive Fishery Information System;
- (g) provide extensive development support services in all aspects of fisheries production, processing and marketing;
- (h) provide advisory services and technical assistance on the improvement of quality of fish from the time it is caught (i.e. on board fishing vessel, at landing areas, fish markets, to the processing plants and to the distribution and marketing chain);
- (i) coordinate efforts relating to fishery production undertaken by the primary fishery producers, LGUs, FARMCs, fishery and organizations/cooperatives;
- (j) advise and coordinate with LGUs on the maintenance of proper sanitation and hygienic practices in fish markets and fish landing areas;
- (k) establish a corps of specialist in collaboration with the Department of National Defense, Department of Interior and Local Government, Department of Foreign Affairs for the efficient monitoring, control and surveillance of fishing activities within Philippine territorial waters and provide the necessary facilities, equipment and training therefor.
- (1) implement an inspection system for import and export of fishery/aquatic products and fish processing establishments consistent with international standards to ensure products quality and safety;
- (m) coordinate with LGUs and other concerned agencies for the establishment of productivity enhancing and market development programs in fishing communities to enable women to engage in other fisheries/economic activities and contribute significantly to development efforts;
- (n) enforce all laws, formulate and enforce all rules and regulations governing the conservation and management of fishery resources, except in municipal waters, and to settle conflicts of resource use and allocation in consultation with the NFARMC, LGUs and local FARMCs;
- (o) develop value-added fishery-products for domestic consumption and export;
- (p) recommend measures for the protection enhancement of the fishery industries;
- (q) assist the LGUs in developing their technical capability in the development, management, regulation, conservation, and protection of the fishery resources;
- (r) formulate rules and regulations for the conservation and management of straddling fish stocks and highly migratory fish stocks; and
- (s) perform such other related functions which shall promote the development, conservation, management, protection and utilization of fisheries and aquatic resources.

Several functions have relevance to the aquaculture sub-sector while there are others that explicitly mention coordination and/or support for LGUs. Items (a) and (e) refer to two plans: the first refers to a fishery industry development plan while the second covers

research with the latter explicitly mentioning aquaculture activities such as sea farming, sea ranching, and the culture of tropical/ornamental fish and seaweed. Item (f) refers to a fishery information system while item (g) refers to general development support in all aspects of production, marketing and processing. Coordinative linkages with LGUs are stated in items (i), (j), (m) and (q) which deals with improving productivity, sanitation and hygienic practices, productivity enhancement including improving access of women to livelihood opportunities, and general technical support to LGUs in the management, regulation, conservation, and management of fishery resources.

Beyond these general mandates, a closer examination of the Fisheries Code will show the various functions specific to aquaculture management which includes the following:

#### **Regulation and Monitoring**

- issuance and re-issuance of fishpond areas covered by Fishpond Lease Agreements (FLA)s and determination of rentals;
- monitoring of FLA grantees' citizenship as grounds for cancellation;
- collection of data pertaining to fish hatcheries, fish breeding facilities and private fishponds; and
- determination of abandoned, undeveloped, and underutilized fishponds suitable for mangrove reversion.

#### **Standard setting**

- assistance to LGUs in prescribing minimum standards for fish hatcheries, fish breeding facilities and private fishponds;
- · drafting and implementation of code of practice for aquaculture; and
- · determination of carrying capacity of lakes and rivers.

#### **Protection/Conservation**

 determination of, and in coordination with the DENR, areas or portions of available public lands certified as suitable for fishpond purposes to be declared as reservation, fish sanctuary for conservation and/or ecological purposes.

#### **Technical Assistance**

- conduct of verification studies for technology testing;
- · zonation, i.e., determining suitable areas for mariculture operations; and
- · establishing a registry of municipal fisherfolk.

#### **Marketing assistance**

· assistance in preparation of feasibility studies.

#### Credit

• provide soft loans through the Aquaculture Investment Fund

#### Organizing/strengthening of people's organizations

• Provide assistance in organizing/strengthening fisherfolk organizations and cooperatives in coordination with the Cooperative Development Authority (CDA), non-government organizations (NGOs), people's organizations (POs) and other concerned agencies.

A detailed discussion on the organizational structure of BFAR and the mandates/ functions of its divisions with primary concern for aquaculture can be found in Appendix 1. In addition, a listing and description of main functions and activities of the different Regional Fisheries Units (RFU), technology centers, and training centers can be downloaded from the BFAR webpage at www.bfar.da.gov.ph.



### LOCAL IEVEL aquaculture management

In this section, the jurisdiction of LGUs (be it barangays, municipalities, cities, or provinces) to manage aquaculture is given more emphasis and the policy framework for LGU powers and functions is further explained. The second section culls specific provisions of the Local Government Code (LGC) with direct and indirect applications to aquaculture while the last section identifies pre and post Local Government Code policies which may be directly implemented by LGUs or used as guidance for local legislation, planning, and enforcement.

#### 3.1 Jurisdiction

Two major policies, RA 7160 or the Local Government Code (LGC) and RA 8550 or the Fisheries Code (FC), provide the scope for fisheries and aquaculture management of LGUs. Both policies explicitly recognize the jurisdiction of LGUs to manage all aquaculture occurring in municipal waters. The authority of LGUs to manage the environmental impacts of land-based aquaculture can be derived from its general powers of land use planning, maintaining peace and order, maintaining ecological balance, taxation, enforcement, and legislation, which is guaranteed by the LGC as well as other national policies.

The LGC defined municipal waters in Book II, Local Taxation and Fiscal Matters, taking off from the definition earlier provided in PD 704 but expanding the area of municipal waters from three (3) nautical miles to fifteen (15) kilometers from it.

Sec 131 (r) of the LGC defines municipal waters to "include not only streams, lakes, and tidal waters within the municipality, not being the subject of private ownership and not comprised within the national parks, public forest, timber lands, forest reserves or fishery reserves, but also marine waters included between two lines drawn perpendicularly to the general coastline from points where the boundary lines of the municipality or city touch the sea at low tide and a third line parallel with the general coastline and fifteen (15) kilometers from it. Where two (2) municipalities are so situated on the opposite shores that there is less than fifteen (15) kilometers of marine waters between them, the third line shall be equally distant from opposite shores of the respective municipalities".

Consistent with the spirit of Book II which explains the revenue-generating and taxation powers of LGUs, Sec. 149 identifies fishery rentals, fees and charges as revenue sources, and reiterates the exclusive authority of municipalities to grant fishery privileges in municipal waters. Section 149 highlights the following concepts relevant to aquaculture: (i) erection of fishing/aquaculture structures such as for oysters, mussels, or bangus fry area within a definite zone; (ii) preferential right given to organizations and cooperatives of marginal fishers; (iii) exemption of marginal fishers who gather, take, or catch bangus fry, prawn fry, or kawag-kawag free of any rental, fee, or charges; and (iv) provide penalties for any forms of deleterious fishing.

The Fisheries Code, per Rule 3.1, clearly defines the jurisdiction of the BFAR visà-vis LGUs, as follows: "the Department, through the Bureau of Fisheries and Aquatic Resources (BFAR), in cooperation with concerned national agencies, shall have the responsibility and jurisdiction in the management, conservation, development, protection, utilization, and disposition of all fisheries and aquatic resources of the country, except municipal waters. <u>However, in municipal waters the DA-BFAR</u> may coordinate with and assist the LGUs, FARMCs, and other government agencies concerned in the development, conservation, protection, utilization and management of fisheries and aquatic resources."

Jurisdiction is accompanied by the functions exercised by LGUs including management, conservation, development, protection, utilization, and disposition of all fish and fishery/aquatic resources within their respective municipal waters. With reference to governance functions of planning, legislation, and enforcement, i.e., "the municipal/city government may, in consultation with the FARMC, enact appropriate ordinances for this purpose and in accordance with the National Fisheries Policy. The ordinances enacted by the municipality and component city shall be reviewed pursuant to Republic Act No. 7160 by the sanggunian of the province which has jurisdiction over the same. The LGUs shall also enforce all fishery laws, rules and regulations as well as valid fishery ordinances enacted by the municipality/city council."

LGUs have sufficient general and regulatory jurisdiction under the provisions of the LGC to implement the various provisions of the Fisheries Code until otherwise overruled by a national regulation issued by the DA-BFAR.<sup>2</sup> This is reinforced by regulatory powers over all activities occurring within their territories, especially the power to:

- (a) prescribe reasonable limits and restraints on the use of property within their territorial jurisdiction,<sup>3</sup>
- (b) adopt a comprehensive land use plan,<sup>4</sup>
- (c) regulate businesses within the municipality as well as the conditions under which a license for such business may be issued or revoked,<sup>5</sup>
- (d) protect the environment and impose appropriate penalties for acts which endanger the environment,  $^{\rm 6}$

These provisions imply that the jurisdiction of LGUs on aquaculture activities is not limited to municipal waters alone but covers even land-based culture systems such as tanks, concrete ponds, and small water impoundments, to name a few.

Options available to local governments for aquaculture management as provided by the Fisheries Code include, among others, the following:

- grant fishing privileges or license fishing operations in municipal waters,<sup>7</sup>
- zone and plan land and water use;<sup>8</sup>
- conserve and restore habitats (i.e., establishment and maintenance of marine protected areas, fish sanctuaries and refuges, mangrove reforestation, coral reef conservation, etc.);<sup>9</sup>
- construct infrastructure and facilities (e.g. roads, cold-storage, markets, etc.),<sup>10</sup>
- provide credit, agriculture, and fishery extension services and livelihood training;<sup>11</sup>
- enact a municipal ordinance delineating the boundaries of municipal waters and providing rules and regulations for licensing and permits;<sup>12</sup>
- enact, in consultation with BFAR, special ordinances declaring special demarcated fisheries areas, closed seasons, environmentally critical areas and sanctuaries;<sup>13</sup>
- maintain a registry of municipal fisherfolk;<sup>14</sup>

<sup>2</sup> This is due to the interplay of Sec. 5(a) of the Local Government Code, which allows for any provision on the power of LGUs to be interpreted its favor, Sec. 16 of the Fisheries Code which mandate the LGUs to enforce all fishery laws, rules and regulations as well as their own fishery ordinances, and the general regulatory powers of LGUs. Since the validity and effectivity of laws is not affected by the absence of administrative rules, and the LGUs are charged with a general mandate to implement all national laws, it may be validly argued that LGUs may enact ordinances that provisionally determine how such laws are implemented and enforced within their territories in the absence of implementing rules issued by the pertinent national agency in order to prevent a vacuum in the enforcement of the law. In deciding whether a provision of the Fisheries Code can be implemented by the LGU even in the absence of an implementing rule issued by a national agency, the question that must be asked is whether the provision is so worded as to make its implementation dependent on exclusive action by the latter.

<sup>3</sup> Local Government Code, Sec. 447(a)(2)(vi), 458(a)(2)(vi)

Local Government Code, Sec. 447(a)(2)(vii), 458(a)(2)(vii)
 Local Government Code, Sec. 447(a)(3)(ii), 458(a)(3)(iii)

Local Government Code, Sec. 447(a)(3)(ii). 458(a)(3)(ii)
 Local Government Code, Sec. 447(a)(1)(vi), 458(a)(1)(vi)

<sup>7</sup> Fisheries Code, Sec. 17

<sup>8</sup> Fisheries Code, Sec. 51 and Local Government Code, Sec. 20(c), Sec. 447 (a)(2)(vii), (a)(2)(viii), (a)(2)(ix)

<sup>9</sup> Local Government Code, Sec. 16 and Fisheries Code, Sec. 46, 81,92

<sup>10</sup> Local Government Code, Sec. 17

<sup>11</sup> Local Government Code, Sec. 17(b)(3)(ix)

<sup>12</sup> Fisheries Code, Sections 16, 60, and 123

<sup>13</sup> Fisheries Code, Sections 16 and 18

<sup>14</sup> Fisheries Code, Sec. 19

• and enforce fishery laws, rules and regulations and municipal ordinances including the following: (i) obstruction to navigational paths; (ii) obstruction to migration paths of particular species; and (iii) aquatic pollution.<sup>15</sup>

#### 3.2 Using the Local Government Code to manage aquaculture

LGUs are partners or agents of national government in the common pursuit of development goals and "maintenance of ecological balance." LGUs should thus be aware of all national laws which assign specific functions to them and refer to said national laws as standards on which to base local regulations. This section reiterates the provisions of the Local Government Code and explains its relevance to the management of environmental impacts associated with aquaculture.

#### 3.2.1 Provisions related to sanitation and solid waste management

A BARANGAY should provide "services and facilities related to general hygiene and sanitation, beautification, and solid waste collection" —Sec 17b(1)(iii)

A MUNICIPALITY should provide "solid waste disposal system or environment management system and services or facilities related to general hygiene and sanitation"—Sec 17b(2)(vi)

#### Why is this provision relevant to aquaculture?

- Aquaculture that is not zoned properly lacks aesthetic appeal
- Solid waste collection system must also include those generated by aquaculture in freshwater, brackishwater, and marine waters such as:
  - ♦ Uneaten feeds
  - Cage materials (poles, bamboos, nets, etc), feed bags, human waste, and dead fish
- Conflict of aquaculture area with other uses such as tourism; also threat to hygiene and sanitation
- Solid waste management plans should be developed by cities/municipalities and should include wastes from aquaculture
- Provincial solid waste management boards should provide efficient clustering of municipalities for solid waste processing/collection.

#### 3.2.2. Provisions regarding extension, research, and cooperativism

A MUNICIPALITY SHOULD PROVIDE "extension and on-site research services and facilities related to agriculture and fishery activities which include dispersal of livestock, poultry, fingerlings, and other seeding materials for aquaculture; .... And enforcement of fishery laws in municipal waters including the conservation of mangroves —Sec 17b(2)( i)

A PROVINCE should provide "agricultural extension and on-site research services and facilities which include the prevention and control of plant and animal pests and diseases; dairy farms, livestock markets, animal breeding stations, and artificial insemination centers; and assistance in the organization of farmers and fishers cooperatives and other collective organizations, as well as transfer of appropriate technology"—Sec 17b(3)(i)

<sup>15</sup> Fisheries Code, Sec. 124 and Local Government Code Section 17(b)(2)(i)

#### Why is this provision relevant to aquaculture?

- Extension services for aquaculture should be based on best aquaculture practices. LGUs may accredit private organizations such as those manufacturing and marketing feeds, drugs, and pesticides to ensure that advise given to farmers are consistent with best aquaculture practices.
- Municipalities and Cities may request BFAR to advise or assist in providing extension services to farmers
- Municipalities and Cities may request DENR to provide technical assistance on planting of mangroves, establishment of nurseries, etc.
- Municipalities and Cities may require FLA lessees to plant mangroves
- The Province may establish hatcheries, integrated buying centers (*bagsakan*), and provide assistance in monitoring of water quality to prevent pests and diseases.
- The Province may establish cooperatives and other organizations of fish farmers. FLA lessees may be required to plant mangroves

### **3.2.3** Provisions regarding management of forests, pollution control, and protection of the environment

A MUNICIPALITY SHOULD "pursuant to national policies and subject to the supervision, control, and review of the DENR, implement community-based forestry projects which include integrated social forestry programs and similar projects; manage and control communal forests with an area not exceeding 50 sq km, establish tree parks, greenbelts, and similar forest conservation projects" —Sec 17b(2)(ii)

A PROVINCE SHOULD "pursuant to national policies and subject to supervision, control, and review of the DENR, enforce forestry laws limited to community-based forestry projects, pollution control law, and other laws on the protection of the environment; and mini-hydro electric projects for local purposes" — Sec 17b(3)(iii)

#### Why is this provision relevant to aquaculture?

- Municipalities and Cities may require FLA lessees to plant mangroves
- Municipalities and Cities, as partners of national government may assist BFAR and DENR in the identification of underutilized, undeveloped, and abandoned fishponds and contribute to mangrove reversion process
- Municipalities and Cities may establish mangrove reforestation projects with technical assistance from DENR
- Municipalities and Cities should enforce national laws pertaining to conservation of mangroves
- Province should enforce pollution control laws and other laws on the protection of the environment

#### 3.2.4 Provisions regarding Fishery Rentals, Fees and Charges

(a) Municipalities shall have the exclusive authority to grant fishery privileges in the municipal waters and impose rentals, fees or charges therefor in accordance with the provisions of this Section.

- (b) The sangguniang bayan may:
  - (1) Grant fishery privileges to erect fish corrals, oyster, mussels or other aquatic beds or bangus fry areas, within a definite zone of the municipal waters, as determined by it: Provided, however, That duly registered organizations and cooperatives of marginal fishermen shall have the preferential right to such fishery privileges: Provided, further, That the sangguniang bayan may require a public bidding in conformity with and pursuant to an ordinance for the grant of such privileges: Provided, finally, That in the absence of such organizations and cooperatives or their failure to exercise their preferential right, other parties may participate in the public bidding in conformity with the above cited procedure.
  - (2) Grant the privilege to gather, take or catch bangus fry, prawn fry or kawagkawag or fry of other species and fish from the municipal waters by nets, traps or other fishing gears to marginal fishermen free of any rental, fee, charge or any other imposition whatsoever.
  - (3) Issue licenses for the operation of fishing vessels of three (3) tons or less for which purpose the sangguniang bayan shall promulgate rules and regulations regarding the issuances of such licenses to qualified applicants under existing laws.

Provided, however, That the sanggunian concerned shall, by appropriate ordinance, penalize the use of explosives, noxious or poisonous substances, electricity, muro-ami, and other deleterious methods of fishing and prescribe a criminal penalty therefor in accordance with the provisions of this Code: Provided, finally, That the sanggunian concerned shall have the authority to prosecute any violation of the provisions of applicable fishery laws, (Sec 149).

#### Why is this provision relevant to aquaculture?

- The power to grant fishery privileges also comes with the power to withhold certain rights subject to local ordinances
- Rentals/fees for use of municipal waters to be based on resource rent or cost recovery approaches
- Aquaculture can be a "social justice" tool by ensuring preferential treatment for marginal fisherfolk and their organizations
- Zonation scheme to be developed in consultation with FARMCs
- Enact ordinances in support of FAO 214 and prescribe penalties

#### 3.2.5 Provisions regarding powers and duties of LGU officials

The punong barangay, as the chief executive of the barangay government, shall exercise such powers and perform such duties and functions, as provided by this Code and other laws including:

- The enforcement of all laws and ordinances which are applicable within the barangay;<sup>16</sup>
- Negotiate, enter into, and sign contracts for and in behalf of the barangay, upon authorization of the sangguniang barangay;<sup>17</sup>

<sup>16</sup> Section 389 (a)(1)

<sup>17</sup> Section 389 (a)(2)

- Organize and lead an emergency group whenever the same may be necessary for the maintenance of peace and order or on occasions of emergency or calamity within the barangay,<sup>18</sup>
- In coordination with the barangay development council, prepare the annual executive and supplemental budgets of the barangay;<sup>19</sup>
- Enforce laws and regulations relating to pollution control and protection of the environment;<sup>20</sup> and
- Promote the general welfare of the barangay.<sup>21</sup>

The municipal mayor, as the chief executive of the municipal government, shall exercise such powers and perform such duties and functions as provided by this Code and other laws including.

(1) Exercise general supervision and control over all programs, projects, services, and activities of the municipal government, and in this connection, shall:

Determine the guidelines of municipal policies and be responsible to the sangguniang bayan for the program of government;<sup>22</sup>

- Direct the formulation of the municipal development plan, with the assistance of the municipal development council, and upon approval thereof by the sangguniang bayan, implement the same;<sup>23</sup>
- Initiate and propose legislative measures to the sangguniang bayan and, from time to time as the situation may require, provide such information and data needed or requested by said sanggunian in the performance of its legislative functions,<sup>24</sup>
- Upon authorization by the sangguniang bayan, represent the municipality in all its business transactions and sign on its behalf all bonds, contracts, and obligations, and such other documents made pursuant to law or ordinance;<sup>25</sup>
- Carry out such emergency measures as may be necessary during and in the aftermath of man-made and natural disasters and calamities;<sup>26</sup>
- Call upon any national official or employee stationed in or assigned to the municipality to advise him on matters affecting the municipality and to make recommendations thereon, or to coordinate in the formulation and implementation of plans, programs and projects, and when appropriate, initiate an administrative or judicial action against a national government official or employee who may have committed an offense in the performance of his official duties while stationed in or assigned to the local government unit concerned;<sup>27</sup>

- 19 Section 389 (a)(7)
- 20 Section 389 (a)(9)
- 21 Section 389 (a)(14)
- 22 Section 444(1)(i)
- 23 Section 444(1)(ii)
- 24 Section 444(1)(iv)25 Section 444(1)(vi)
- 26 Section 444(1)(vii)
- 27 Section 444(1)(xvi)

<sup>18</sup> Section 389 (a)(6)

(2) Initiate and maximize the generation of resources and revenues, and apply the same to the implementation of development plans, program objectives and priorities as provided for under Section 18 of this Code, particularly those resources and revenues programmed for agro-industrial development and country-wide growth and progress, and relative thereto, shall:

- Issue licenses and permits and suspend or revoke the same for any violation of the conditions upon which said licenses or permits had been issued, pursuant to law or ordinance;<sup>28</sup>
- Adopt adequate measures to safeguard and conserve land, mineral, marine, forest, and other resources of the municipality; provide efficient and effective property and supply management in the municipality; and protect the funds, credits, rights and other properties of the municipality;<sup>29</sup> and

(3) Ensure the delivery of basic services and the provision of adequate facilities as provided for under Section 17 of this Code.

#### Why is this provision relevant to aquaculture?

- Role of local chief executives in enforcement, legislation, and delivery of basic services.
- LGU has a corporate function.
- LGU has authority to revoke permits for illegal structures or those that do not comply with provisions of the contract
- LGU has powers to react to localized emergencies (such as fish kills) and secure support from national agencies for assistance
- Aquaculture and zoning of municipal waters, in particular, must be part of municipal development plan

#### 3.3 Blending national policies for local governance

This section consists of two parts. First, policies that were enacted after the LGC (or post LGC) will be highlighted focusing on main provisions and specific roles of LGUs in implementation of said law. The second part shall list policies enacted prior to the LGC (or pre LGC) providing standards and procedures which LGUs should comply with.

These policies provide the overall framework for LGUs to manage the environmental impacts of aquaculture in terms of preventing and mitigating water pollution, managing solid wastes, protecting critical species and habitats, and providing for the institutional, marketing, and cooperative structures for joint management.

<sup>28</sup> Section 444(3)(iv)

<sup>29</sup> Section 444(3)(vii)

#### 3.3.1 Post LGC Policies

#### RA 9275 Clean Water Act (2004)

#### What this policy is all about:

RA9275coverstheprotection and preservation of fresh, marine and brackishwater resources with its main objectives being the (i) control of pollution of waters; (ii) development of an integrated water quality management framework; (iii) greater accountability for short and long term impacts of pollution; and (iv) environment friendly enterprises. The law also defines beneficial use of water to include aquaculture activities.

#### Role of LGUs in implementing RA 9275

- LGUs are responsible for the management and improvement of water quality within their territorial jurisdictions. Through the Environment and Natural Resources Office (ENRO), established through the LGC, the following duties have been assigned, i.e., monitoring of water quality, emergency response, and prevention and control of water pollution. In provinces/cities/municipalities where there are no ENROs, the local executive concerned may, with the approval of the Secretary of the DENR designate any of his official and/or chief of office preferably the provincial, city or municipal agriculturist, or any of his employee who must have sufficient experience in environmental and natural resources management, conservation and utilization.
- LGUs are directed to participate as a member of Water Quality Management Area governing board, contribute to the development of a water quality management area action plan, and prepare a compliance scheme to said plan. in areas where pollutants have exceeded water quality guidelines, LGUs should prepare and implement contingency plans and other measures including relocation, whenever necessary.
- LGUs should participate in the development of a national program for sewerage and septage management and enter into an agreement with the DENR to incorporate programmatic environmental impact assessment into the preparation, updating or revision of local land use plans and area development plans.

#### RA 9147 Wildlife Act (2001)

#### What this policy is all about:

RA 9147 seeks to conserve the country's wildlife resources and their habitats. RA 9147 also clarifies the jurisdiction of the DENR and the DA in the implementation of the law, as follows: the DENR shall have jurisdiction over all terrestrial plant and animal species, all turtles and tortoises and wetland species, including but not limited to crocodiles, waterbirds and all amphibians and dugong while the DA shall have jurisdiction over all declared aquatic critical habitats, all aquatic resources including but not limited to all fishes, aquatic plants, invertebrates and all marine mammals, except dugong. In the Province of Palawan, jurisdiction

herein conferred is vested to the Palawan Council for Sustainable Development pursuant to Republic Act No. 7611 or the Strategic Environmental Plan.

• RA 9147 allows for the designation of critical habitats outside protected areas under Republic Act No. 7586, where threatened species are found.

#### Role of LGUs in implementing RA 9147

• Contribute to efforts in the protection of critical habitats and spearhead conservation efforts to protect endemic species in their territories.

#### RA 9003

#### Ecological Solid Waste Management Act (2000)

#### What this policy is all about:

- RA 9003 adopts a systematic, comprehensive, and ecological solid waste management program that ensures protection of public health and environment through use of environmentally-sound methods that maximize the utilization of valuable resources and encourage resource conservation and recovery.
- RA 9003 defines agricultural waste as those generated from planting or harvesting of crops, trimming or pruning of plants and wastes or run-off materials from farms or fields thus covering wastes generated by aquaculture operations, both water-based and land-based. The law requires the development of a ten-year solid waste management plan and the establishment of a city/municipality and provincial solid waste management board.

#### Role of LGUs in implementing RA 9003

- The LGUs are in charge of implementing and enforcing the law within their respective jurisdictions. Segregation and collection of biodegradable, compostable and reusable wastes are to be conducted at the barangay level while collection of non-recyclable materials and special wastes shall be the responsibility of the municipality or city.
- Establishment of a Provincial Solid Waste Management (SWM) Board to include all mayors of component cities and municipalities as well as City and Municipal Solid Waste Management Boards. Main functions of said board are the development of a solid waste management plan; provision of the necessary logistical and operational support to its component cities and municipalities in consonance with subsection (f) of Sec.17 of the Local Government Code; and recommend measures and safeguards against pollution and for the preservation of the natural ecosystem. A barangay SWM Board shall likewise be created with its main functions being the formulation of a solid waste management program consistent with city municipality plan and the segregation and collection of biodegradable, compostable, reusable wastes.

• Establishment of multi-purpose environment cooperatives or association in every LGU to promote the implementation and/ or directly undertake projects in compliance with the provisions of the law.

#### RA 8435

#### Agriculture and Fisheries Modernization Act (AFMA) (1997)

#### What this policy is all about:

- RA 8435 seeks to modernize the agriculture and fisheries sector by transforming the sector from a resource-based to a technology-based sector. RA 8435 envisions increased profitability for farm and fishery operators, enhanced food security for the populace, and improved market competitiveness.
- An important feature of RA 8435 is the identification of Strategic Agriculture and Fisheries Development Zones (SAFDZ), spanning various LGU territories. SAFDZ will feature an integrated development plan consisting of production processing, investment, marketing, human resources and environmental protection components. RA 8435 shall also develop medium to long-term Agriculture and Fisheries Management Plans, rationalize credit delivery, improve irrigation services delivery, and provide adequate and timely information for marketing support.

#### Role of LGUs in implementing RA 8435

- In implementing RA 8435, LGUs should collaborate with the DA in identifying SAFDZs and model farms. LGUs should also assist in the establishment of the National Information Network for market assistance and support services and together with national agencies such as the Department of Public Works and Highways, evaluate infrastructure support needs.
- Per Section 90 of RA 8435, LGUs are tasked with the delivery of direct agriculture and fisheries extension services with the provincial governments in charge of integrating the operations for the agriculture extension services.

#### RA 8371

#### Indigenous Peoples' Rights Act (1991)

#### What this policy is all about:

• RA 8371 promotes equal rights ICCs/IPs and bestows upon them ownership and beneficial use of ancestral lands/domains which is defined according to traditional practice and shall consist of lands, inland waters, coastal areas, minerals and other natural resources.

#### Role of LGUs in implementing RA 8371

• Incorporate Ancestral Domain Sustainable Development Plans into the municipal or provincial development plans.

#### RA 7586

#### National Integrated Protected Areas System (NIPAS) Act (1991)

What this policy is all about:

- RA 7586 establishes a national protected area system in high biodiversity areas. Categories of protected areas are strict nature reserves, natural parks, natural monuments, wildlife sanctuaries, protected landscapes and seascapes, resource reserve, natural biotic areas, and other categories established by law, conventions or international agreements.
- Protected seascapes are excluded from municipal waters. Aquaculture operations within NIPAS sites have to conform to the regulations provided in the Management Plan. Activities which fall beyond the scope of the Management Plan have to comply with the EIA system. Lastly, user fees and other charges expended within the territory of the protected area shall redound to a Protected Area Fund which is disbursed by the DENR for projects related to NIPAS area management.

#### Role of LGUs in implementing RA 7586

• LGUs whose territorial jurisdiction or parts therein which are found within a NIPAS site shall participate in the development of the Protected Area Management Plan and shall be a member of the PAMB.

#### Other laws affecting aquaculture and management of environmental impact

Other policies which have relevance to aquaculture include *RA 7881*, enacted in 1994 and which amended certain provisions of *RA 6657 or the Comprehensive Agrarian Reform Law (CARL)*, exempting fishponds from land reform. RA 7161, enacted in 1991, and which amended the *National Internal Revenue Code of 1977,* specifically mentions the ban on cutting of all mangrove species. Said ban on cutting is interpreted to include mangrove trees which were replanted by communities<sup>30</sup>. Mangrove reforestation and beneficial use to local communities can be guided by *Executive Order 263,* issued in 1995, providing guidelines for community-based forest management program and establishing tenurial instruments for local communities. The participation of local communities in planning, regulation, and enforcement, through the Fisheries and Aquatic Resources Management Councils (FARMCs) is articulated by the Fisheries Code and reinforced through *EO 240 (1995)* and DA-DILG-DENR-DOJ Joint Memorandum order No.2 (1996) which provides guidelines on the implementation of EO 240.

The *National Integrated Coastal Management Strategy*, enunciated in *Executive Order 533*, should also be regarded as an important guidance document for aquaculture planning. Said policy, while implemented primarily in marine and coastal areas, also recognizes the inter-linkages with associated ecosystems such as watersheds and wetlands. Best planning practices enunciated by the policy

<sup>30</sup> DENR, DA-BFAR, DILG and CRMP. 2001. Philippine Coastal Management Guidebook No. 2: Legal and Jurisdictional Framework for Coastal Management. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines, 170 p.

are relevant to aquaculture management, including: zoning, sustainable fisheries development, conservation of critical habitats, and integrated management of wastes and other coastal development activities such as ports and security.

#### 3.3.2 Pre-LGC Laws, defining natural standards

Several laws, enacted prior to the Local Government Code, are still useful and relevant for managing the environmental impacts of aquaculture. LGUs can refer to these laws which (i) set an upper limit on prohibited acts and/or (ii) provide national standards and guidelines. RA 6969, Toxic and Hazardous and Nuclear Wastes Act (1990), enumerates and defines what are toxic and hazardous wastes. The law regulates and restricts the importation, manufacture, processing, sale, distribution, use and disposal thereof. LGUs should be provided with or should demand appropriate information concerning some drugs and chemicals used in aquaculture. Said use should be adequately monitored to ensure that no aquaculture operation utilizes any of the toxic and hazardous chemicals banned by law. PD 856, Sanitation Code of the Philippines (1975) specifically rules that oysters shall be planted and grown only in areas approved by the Secretary or his duly authorized representatives and in places duly licensed by the Bureau of Fisheries and Aquatic Resources. Likewise, oysters offered for sale, if not originating from approved areas, shall be confiscated and destroyed by the local health authority. The same is true for fish caught in radioactive zones as well as in areas contaminated by toxic substances or high in mercury count.

**PD 984, the Pollution Control Law of 1976** prohibits any form of disposition of any organic or inorganic matter or any substance in gaseous or liquid form that shall cause pollution to any of the water, air and/or land resources of the Philippines. **PD 979, or the Marine Pollution Decree of 1976** specifically deals with marine pollution arising from the dumping of wastes and other matter. PD 979, while recognizing the assimilative capacity of the seas to dilute waste matter, also accepts its limited capacity. Waste materials generated by mariculture activities defined by law as being either discharge or refuse should not be dumped or discharged into the seas from any floating structures. The prohibition for dumping also includes coastal areas and banks of rivers where deposits of pollutants may be flushed to water bodies during rains or floods. A related law is **PD 1067, or the Water Code of the Philippines of 1976,** which establishes recreation/easement zones in banks of rivers and streams and shores of seas and lakes. The siting of aquaculture operations should conform to the rules on easement as provided by PD 1067.

**PD 1152, Philippine Environment Code of 1977** prescribes environmental quality standards for air, water, land, fisheries, and aquatic resources, wildlife, soil, and mineral resources. However, the provision which is most relevant to aquaculture management is the establishment of water quality management standards; classification of Philippine waters; and identification of beneficial use of said bodies of water. DENR Administrative Order (DAO) 34, series of 1990, implements PD 1152

by providing water usage and classification/ water quality criteria while DAO 35, series of 1990, provides for effluent standards. PD 1586 establishes the Environmental Impact Statement (EIS) system; the applicability of the EIS system to aquaculture is discussed in greater detail in Chapter 4.

Enforcement of national laws and local ordinances is one of the inherent functions of LGUs but knowing which national agency can be of assistance in enforcement is an advantage. Policies related to enforcement of pollution laws and coastal environment protection are as follows: (i) *RA 6975 (1990)* which creates the Maritime Police Unit and tasks it to perform all police functions over Philippine territorial waters and rivers; (ii) *PD 600 (1974)* which assigns to the Philippine Coast Guard the primary responsibility to enforce laws, rules, and regulations governing marine pollution; (iii) *PD 601 (1974)* which revises RA 5173 or the Philippine Coast Guard (PCG) Law, consolidates fragmented functions, and transfers the PCG to the Department of Transportation and Communications; (iv) *PD 1160 (1977)* which directs the Secretary of Natural Resources to train barangay officials as deputy fish wardens and/or deputy forest wardens; (v) *Executive Order (EO) 117 (1993)* establishes the Inter-Agency Task Force for Coastal Environment Protection; and (vi) *Administrative Order (AO)* 114 (1989) – constitutes the Presidential Committee on Illegal Fishing and Marine Conservation.

Copies of legislation, executive orders and pertinent administrative orders may be obtained from the following internet sources:

www.bfar.da.gov.ph www.chanrobles.com www.congress.gov.ph www.da.gov.ph www.denr.gov.ph www.emb.gov.ph elibrary.supremecourt.gov.ph



Understanding national policies on aquaculture management and mitigation of environmental impacts

## A Question & Answer Guide

1. What is aquatic pollution and which agency(ies) have jurisdiction over aquatic pollution?

The Fisheries Code provides a definition for aquatic pollution: "the introduction by human or machine, directly or indirectly, of substances or energy to the aquatic environment, which results or is likely to result in such deleterious effects as to harm living and non-living aquatic resources, pose potential and/or real hazard to human health, hindrance to aquatic activities as fishing and navigation, including dumping/disposal of waste and other marine litters, discharge of petroleum or residual products of petroleum or carbonaceous materials/substances and other radioactive, noxious or harmful liquid, gaseous or solid substances, from any water, land or air transport or other humanmade structure. Deforestation, unsound agricultural practices such as the use of banned chemicals and excessive use of chemicals, intensive use of artificial fish feed, and wetland conversion, which similar hazards and deleterious effects shall also constitute aquatic pollution". BFAR is the national agency mandated to implement the Fisheries Code. The DENR's jurisdiction over aquatic pollution is supported by several laws. First is through its implementation of RA 9275 or the Clean Water Act which covers the protection and preservation of fresh, marine, and brackishwater resources. Among the objectives of RA 9275 are to control pollution of waters, develop an integrated water quality management framework, encourage more accountability for short and long term impacts of pollution, and encourage environment friendly enterprises. RA 9275 also defines beneficial use of water to include aquaculture activities. The DENR is also the implementing authority for PD 984, the Pollution Control Law; PD 825 which penalizes improper waste disposal; and RA 6969, Toxic Substances and Hazardous and Nuclear Wastes Control Act.

PD 979, the Marine Pollution Decree of 1976, vests on the DENR-EMB the authority to promulgate rules and policies concerning marine pollution due to dumping of wastes; however, the enforcement of said law is assigned to the Philippine Coast Guard (PCG) per PD 601 while RA 6975 gives authority to the PNP-Maritime Group to enforce all laws, including those of marine pollution, in all waters of the Philippines.

### 2. How can the EIS system be used to prevent, mitigate, and monitor potential environmental impacts of aquaculture?

The establishment of the Philippines' Environmental Impact Statement (EIS) system began in 1978 and has since evolved to adapt to emerging environmental issues, changing institutional characteristics within the DENR and its major clients, and expediency. Presidential Decree 1586 formally established the Philippine EIS system in 1978 in cognizance of the need to balance socio-economic goals with environmental quality and devise a procedure and a set of regulatory instruments. This was supported by Presidential Proclamation 2146 which enumerated and classified projects that were Environmentally Critical (ECP) or those that were located in environmentally critical areas (ECA). Being classified as a resource extractive industry, fishery projects, and in particular, the construction of dams for fishpond development falls under the category of ECP. Various forms of aquaculture activities occurring in areas classified as critical by PP 2146 also fall within the scope of the EIS, including the following:

- All areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries;
- Areas set aside as aesthetic potential tourist spots;
- Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine Wildlife (flora and fauna);
- Areas of unique historic, archaeological, or scientific interests;
- Areas which are traditionally occupied by cultural communities or tribes;
- Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.);
- Areas with critical slopes;
- Areas classified as prime agricultural lands;
- Recharged areas of aquifers;
- Bodies of water characterized by one or any combination of the following conditions;
  - tapped for domestic purposes
  - within the controlled and/or protected areas declared by appropriate authorities
  - which support wildlife and fishery activities

•

- Mangrove areas characterized by one or any combination of the following conditions:
  - with primary pristine and dense young growth;
  - adjoining mouth of major river systems;
  - near or adjacent to traditional productive fry or fishing grounds;
  - which act as natural buffers against shore erosion, strong winds and storm floods;
  - on which people are dependent for their livelihood.
- Coral reefs, characterized by one or any combinations of the following conditions:
  - o With 50% and above live coralline cover;
  - o Spawning and nursery grounds for fish;
  - o which act as natural breakwater of coastlines.

With this exhaustive list, the scope for application of the EIS system is enormous and covers both ECPs and projects in ECAs. Aquaculture activities are found in protected areas (Sarangani Seascape); areas with scientific interests (Bolinao reefs); areas with endangered or indigenous species (*maliputo* and *tawilis* in Taal Lake); and areas near or at mangrove areas and coral reefs. However, the coverage of the EIS system evolved through the years.

Technical definitions of ECPs were later articulated via Revised Procedural Manual for DAO 2003-30 which clarified the inclusion of fishponds located in inland water bodies such as lakes and rivers, etc, and those which are greater or equal to 100 hectares as being environmentally critical. PD 704, which was operative during this period, provides that fishpond lease agreements take on the maximum area of 50 hectares for individuals and 500 hectares for corporations implying that all fishpond projects subsequently developed after issuance of PD 1586 and its administrative instruments, and subscribing to the maximum area prescribed by PD 704 are all environmentally critical projects.

DAO 2003-30 clarifies procedures for the granting of ECCs and that of certificate of noncoverage for exemptions as well as levels of levels of authority within the DENR. DAO 30 states that the processing of ECCs for ECPs are to be done by EMB-Central Office while projects located in ECAs are to be done in the region. Furthermore, ECPs are required to go through the entire EIA process which includes scoping and public hearing, while ECAs are to submit *Initial Environmental Examination Report* (to include relevant data, mitigating measures, monitoring and process documentation of *Social Impact Assessment*). Outlines of EIS and IEE Report required of ECPs and projects in ECAs are also appended to this order.

DAO 30 also stresses public participation and social acceptability and the establishment of the Environmental Guarantee Fund for which contributions will be required from the proponents. The conduct of the EIS shall be the main function of the proponent while the role of the LGU is to ensure public participation through the conduct of public hearings and provision of information pertinent to the project.

#### 3. What is the scope of EIS Programmatic Compliance?

DAO 2000-05 which explains conditions for the EIS Programmatic Compliance covers projects that fall within the following categories: a) a program consisting of a series of similar projects, or a project subdivided into several phases and/or stages whether situated in a contiguous area or geographically dispersed, such as energy projects; or b) a project consisting of several components or a cluster of projects co-located in a designated area such as an industrial estate or export processing zone.

Programmatic compliance with the environmental impact assessment system shall be guided by carrying capacity assessments determined from ecological profiles. Ecological profiles shall identify environmental constraints and opportunities in programmatic areas as well as account for cumulative impacts and risks. Consistent with the provisions of the Local Government Code, the DENR may enter into agreement with LGUs to incorporate programmatic EIA into the preparation, updating or revision or local land use plans and area development plans.

#### 4. Are mariculture parks subject to EIS?

Yes. Mariculture can be classified as an Environmentally Critical Project (ECP) or located in an Environmentally Critical Area, and are thus within the scope of the EIS system, as explained in question number 2. Mariculture parks, which consist of several projects (each cage or locator can be considered a separate project in itself), located in contiguous areas, and is subject to a carrying capacity criteria, is thus covered by a programmatic EIS.

#### ENVIRONMENTAL COMPLIANCE CERTIFICATE (08-050221-0067-Fishery/Aquaculture Project

The Environmental Management Bureau, Department of Natural Resources, Region 8, hereby issues this Environmental Compliance Certificate (ECC) for the Basey, Mariculture Zone Project of the Bureau of Fisheries and Aquatic Resources, Region VIII, thru its Director, Gil A. Adora, CESO IV, located within the Municipal waters of Basey, Samar after complying with the Environmental Impact Assessment (EIA) requirement as prescribed in the promulgated guidelines, implementing Sec. 3 (b) of PD 1121 and Sec. 2 of PO. 1586 and DENR Administrative Order No. 2003-30.

Fisheries Office Order No. 317, s. 2006, contains the implementing guidelines and procedures in the establishment and management of mariculture parks/zones. Aside from habitat and water quality assessment, the procedures include zoning, public hearings, preparation of a municipal ordinance as well as a MOA between BFAR and the LGU(s) where the mariculture park is to be located, and filing for an ECC.

#### 5. Who monitors compliance to the EIS?

A Multi-partite Monitoring Team (MMT) shall be formed immediately after the issuance of an ECC for ECPs or for projects subject to Programmatic EIS. The composition of the Multisectoral Monitoring Team shall broadly represent the sectoral stakeholders of the project or program, and most particularly the local communities. The specific tasks of the members of the MMT shall be provided in a Memorandum of Agreement (MOA) negotiated by the proponent, the DENR and the major stakeholders and operationalization of the MMT shall be defined and guided through its Manual of Operation (MOO). The MMT shall be principally tasked to undertake monitoring of compliance with the ECC conditions, the EMP and applicable laws, rules and regulations. It shall also be tasked to validate impacts predicted in the EIS. The DENR Regional Office with the assistance of EMB shall initiate the formation of a Multisectoral Monitoring Team for an approved project or program and may serve as Chair of the Team's activities. Its principal function will be to provide general oversight over the conditionalities imposed in the ECC. The

composition of the Multisectoral Monitoring Team shall broadly represent the sectoral stakeholders of the project or program, and most particularly the local communities.

#### 6. Are fish cages and pens within the scope of the EIS?

There are two criteria to determine whether cages and pens fall within the scope of the EIS system: (i) whether they are located in an environmentally critical area (ECA) or (ii) whether they are environmentally critical projects (ECP). Cages and pens could not qualify as ECPs for reason of scale and also because the law specifically defines fishponds alone as being under the EIS system. Thus, cages and pens would be within the scope of the EIS system if they are sited in ECAs. Otherwise, they are not. However, for cages and pens to fall within the scope EIS system, they need to be encouraged to secure an ECC. Please refer to "Annex 2 1A of the Revised Procedural Manual for DAO 2003-30 for the details fo the scope and coverage of the Phlippines. EIS System which can be revised and downloaded from www.emb.gov.ph

### 7. Mariculture parks initiated by BFAR secure an ECC before operations. Can mariculture activities of LGUs subscribe to the EIS system?

Yes. The LGU, after site assessment, zoning, planning and enactment of ordinance, may elect to reserve a certain zone for mariculture. The LGU, on behalf of fish farmers (similar to the template of BFAR in mariculture parks), can go through the process of securing a programmatic EIS.

### 8. Why are permits of other government agencies and LGUs not required in processing the EIA?

Permits and licenses issued by other government agencies and LGUs are not required in processing the ECC Application in order to avoid undue decision-making influence on the EIA. Recommendations embodied in the ECC are intended for consideration by the LGUs and other agencies in their decision-making processes. By so doing, environmental concerns and measures become intrinsic parameters for planning and decision-making. Proponents providing permits/clearances generally are predisposed to use these documents to preempt findings of the EIA Process, thereby affecting objectivity and integrity of the undertaking (adapted from www.emb.gov.ph).

### 9. How can BFAR be of help to your specific aquaculture/environment concerns and which office can help you?

A listing of relevant BFAR offices is provided here without prejudice to the role of the regional offices, which should be the primary source of information and a first recourse to responding to these queries/concerns listed. The Research Division and the Fisheries Extension, Training, and Communication Division of the Regional Field Units (RFU)s can provide advice on technology applications relating to aquaculture. Questions pertaining to the policy/regulatory framework may also be coursed through the RFUs which will then seek clarification from the Central Office. Likewise the Technology Centers have been referred to in this table in a generalized manner; the expertise of each center being described in Appendix 1. Other national agencies such as research and academic institutions may also be tapped for the same issues.

Your query/concern	Which BFAR office can help you
You belong to a cooperative or people's	Fisheries Regulatory and Quarantine Division,
organization and you wish to apply for a new Fishpond Lease Agreement (FLA)	Fishpond Lease Section
	National FARMC Program Management Center
Your organization wishes to take over the "management" of an abandoned or underutilized	Fisheries Regulatory and Quarantine Division, Fishpond Lease Section
fishpond	National FARMC Program Management Center
You want to clarify the application of national	Inland Fisheries and Aquaculture Division
policies regarding aquaculture	Fisheries Policy and Economics Division
You want to set up a techno demo in your LGU	Inland Fisheries and Aquaculture Division
	Any of the Technology Centers
You need advice on zonation of municipal waters	Inland Fisheries and Aquaculture Division
to determine good mariculture sites	National Fisheries Research and Development Institute
You want your staff to be trained in water quality	Any of the Technology Centers
assessment	Fish Health Section
You want advice on cost-effective and good	Inland Fisheries and Aquaculture Division
quality feeds	Any of the Technology Centers
You want your LGU staff trained on good	Inland Fisheries and Aquaculture Division
aquaculture practices such as feeding requirements and stocking density	Fish Health Section
You want to apply for a programmatic EIS	Inland Fisheries and Aquaculture Division
	Fish Health Section
You want to know the carrying capacity estimates for a water body in your jurisdiction	National Fisheries Research and Development Institute
You want to coordinate your fisheries / aquaculture plans with your neighboring municipality	Inland Fisheries and Aquaculture Division
You want to harmonize local ordinance with	Inland Fisheries and Aquaculture Division
existing national laws on aquaculture	Fisheries Policy and Economics Division
You would like to develop operational standards	Inland Fisheries and Aquaculture Division
for a private sector investor to set up a hatchery	Any of the Technology Centers, depending on species
You would like to set up a marketing cooperative	National FARMC Program Management Center
involving small aquaculture operators	Fisheries Industry Development Support Division
You would like to undergo some fish stocking in your lake	Inland Fisheries and Aquaculture Division
You need GIS-based map for fisheries and aquaculture zoning	Fisheries Information and Management Center
You would like to know the total coverage of	Inland Fisheries and Aquaculture Division
	1
brackishwater fishponds in your municipality	Fisheries Regulatory and Quarantine Division, Fishpond Lease Section

You need to send fish samples to a laboratory for testing	Fish Health Management Section
An investor would like to set up fish cages in offshore waters (beyond municipal waters)	Fisheries Regulatory and Quarantine Division, Fishing Vessel Policy and Licensing Section, for permit
You want to enhance traceability of cultured species	Fisheries Post-Harvest Technology Division Inland Fisheries and Aquaculture Division
You want post-harvest facilities in your LGU to comply to existing international standards	Fisheries Post-Harvest Technology Division Fish Health Management Section
Your cooperative would like to tap the export market and you would like to know the procedures	Fisheries Post-Harvest Technology Division One-Stop Export Documentation Center

#### 10. What is a fish kill?

Any unusual and noticeable increase of mortality due to infectious or non-infectious causes in wild or captive fish or shellfish population.

### 11. What are the common causes of fish kills?

There are four major causes of fish kills: oxygen depletion,

pollutant toxins, natural toxins, and disease. Oxygen depletion arises due to algal bloom, algal die-off, thermal de-stratification, or overstocking of fish with the latter being most common. Thermal destratification or overturn occurs during period of heavy rains which causes colder water from the upper layers to sink (it is heavier). Waters from the lower level which have less oxygen (especially when there is no aeration) then move up (see Fig. 6).

#### 12. What are the usual sources of pollutants?

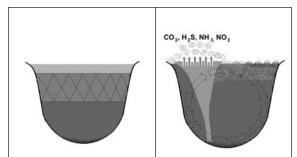
External factors such as those from oil spills, effluents from agriculture and industry, and sulfur upwelling. A common cause of pollution in fish cages and pens, however, is self-pollution, which arises from overfeeding and is aggravated by high stocking densities that also cause disease.

#### 13. Which national office is in charge of monitoring aquatic animal feeds?

It is the BFAR Fish Health Section subject to a MOA with Animal Feeds Standards Division of the Bureau of Animal Industry. The functions of the BFAR Fish Health Section with respect to aquatic animal feeds include: (i) planning and directing national programs on feeds; (ii) registration, evaluation, and inspection of establishments engaged in the manufacture, distribution, and sale of aquatic animal feeds and drugs; (iii) dissemination of information and education the aquaculture industry on the need for aquatic feeds; and assist in the inspection and examination of shipment of aquatic animal feeds and veterinary drugs and products prior to release by Customs.

#### 14. Where to go to have your fish samples analyzed?

Fish samples may be analyzed by BFAR Fish Health Laboratories for which its locations and contact persons are listed in Appendix 2. FAO 220 provides a schedule of fees for specific types of services offered including the following:



#### Fig. 6. Depiction of thermal destratification

- Conduct fish disease diagnoses;
- Conduct water quality analysis related to disease diagnosis, fish health problems and fish kill;
- Fish disease surveillance and reporting system;
- Provide technical support to the fish inspection and quarantine services;
- Conduct on-site visits to fish farms and places where there are fish health problems;
- Conduct fish kill investigations; and
- Provide technical support on quality control of animal feeds, veterinary drugs and chemicals in aquaculture.
- 15. Can the LGU declare a moratorium or ban specific aquaculture activities for particular areas or covering some months of the year?

Yes, the both the Fisheries Code and the Local Government Code provides the LGUs enough powers to manage their local environments by way of legislation and enforcement. The Fisheries Code assigns full jurisdiction to cities and municipalities over their municipal waters. The municipal/city government, in consultation with the FARMC, shall be responsible for the management, conservation, development, protection, utilization, and disposition of all fish and fishery/aquatic resources within their respective municipal waters. The municipal/city government may, in consultation with the FARMC, enact appropriate ordinances for this purpose and in accordance with the National Fisheries Policy. Section 9 of the same law provides for the establishment of closed seasons by the concerned LGU in consultation with the FARMC for conservation or ecological purposes. The FARMCs may also recommend the establishment of closed seasons in municipal waters, fisheries management and other areas reserved for the use of municipal fisherfolk.

Declaring a moratorium and/or banning specific aquaculture activities in a particular period or area, are consistent with provision of the Local Government Code in the maintenance of ecological balance (Sec 3(i)) and on the exclusive authority of municipalities to grant fishery privileges and impose appropriate payments for such. If the municipality can grant such fishery privileges, it may also elect not to do so.

#### 16. What policies support the joint management of fishery areas?

Both the Local Government Code (LGC) and the Fisheries Code (FC) provide for joint or cooperative undertakings among LGUs. Sec 3(f) of the LGC states that "LGUs may group themselves, consolidate or group their efforts, services, and resources for purposes commonly beneficial to them" while Section 33 reinforces this further by stating that such undertaking may be supported through an ordinance and the donation of assets, property and even personnel and be covered by a Memorandum of Agreement between and among the parties involved.

Integrated management is a concept espoused by the Fisheries Code; as such, the management of contiguous fishery resources such as bays which straddle several municipalities, cities or provinces, shall be done jointly, and not be based on political subdivisions of municipal waters in order to facilitate their management as single resource systems. The LGUs which share or border such resources may group themselves and coordinate with each other to achieve the objectives of integrated fishery resource

management. The Integrated Fisheries and Aquatic Resources Management Councils (FARMCs) established under Section 76 of this Code shall serve as the venues for close collaboration among LGUs in the management of contiguous resources.

#### 17. Can aquaculture activities be practiced even in NIPAS areas?

There are several categories of protected areas as provided for by RA 7586 or the National Integrated Protected Areas System Act (NIPAS) with protected landscapes/ seascapes being one of them. By definition, protected landscapes/seascapes are areas of national significance which are characterized by the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal lifestyle and economic activity of these areas. Presumably, since aquaculture can be denoted as an economic activity per definition, then there is no explicit ban against it. This holds for as long as the Protected Area Management Plan does not specifically ban aquaculture activities in certain areas.

#### 18. Can the LGU require a registry of aquaculture operators?

Yes, Section 57 of the Fisheries Code provides for the registration of fish hatcheries, fish breeding facilities and private fishponds with the LGUs. The LGUs shall prescribe minimum standards for said facilities in consultation with BFAR. Further to this, fish pens and cages and all other types of aquaculture operators must report the type of species and volume of production to BFAR. It would be of interest to the LGU to monitor all types of aquaculture operations for planning purposes, for revenue generation and taxation purposes, and for monitoring environmental impacts.

#### 19. Who has jurisdiction over the enforcement of fishery laws in municipal waters?

Both the LGUs and national enforcement agencies such as the Philippine National Police-Maritime Group and the Philippine Coast

Guard. Under Section 17 of the LGC, enforcement of fishery laws within municipal waters has been devolved to the city or municipality concerned. Section 16 of the Fisheries Code reiterates the enforcement function of LGUs.

### 20. Who is in charge of implementing environment laws?

The Environmental Management Bureau (EMB) Regional Director is responsible for the implementation in his/her regional jurisdiction of (brown) environmental laws and regulations such as the Pollution Control Law (PD 984),

### *Box 4*. What are some criteria to determine the limits of aquaculture impacts?

#### Aquaculture must NOT

- > be irreversible;
- harm human health or the safety of human beings;
- > jeopardize the future productive base for short term economic benefit;
- > adversely affect biodiversity or sensitive habitats; and
- > adversely affect essential ecological processes.

Environmental Impact Assessment Law (PD 1586), Proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the Environmental Impact Statement System Established under Presidential Decree No. 1586 (Proclamation No. 2146), the Philippine Environmental Policy (PD 1551), Philippine Environment Code (PD 1552), the Toxic, Hazardous and Nuclear Substances Act (RA 6969), the Clean Air Act (RA 8749) and the Ecological Solid Waste Management Law (RA 9003), and their implementing rules and regulations; enforcement of environmental standards such as those provided in DAO's 34 and 35, s. of 1992, the chemical control orders, and perform other functions that may be required by the various department Administrative Orders, international agreements and by local governments.

Small-scale mining laws and community forestry laws have been devolved to the Province although the DENR still retains its supervisory function.

#### 21. What policies provide penalties for violations of aquatic and/or marine pollution?

Three laws can be used to penalize violators of aquatic and/or marine pollution laws. First is the Marine Pollution Decree of 1976 (PD 979) which prohibits the following:

- a. discharge, dump, or suffer, permit the discharge of oil, noxious gaseous and liquid substances and other harmful substances from or out of any ship, vessel, barge, or any other floating craft, or other man-made structures at sea, by any method, means or manner, into or upon the territorial and inland navigable waters of the Philippines;
- b. throw, discharge or deposit, dump, or cause, suffer or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft or vessel of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state into tributary of any navigable water from which the same shall float or be washed into such navigable water; and
- c. deposit or cause, suffer or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed into such navigable water, either by ordinary or high tides, or by storms or floods, or otherwise, whereby navigation shall or may be impeded or obstructed or increase the level of pollution of such water.

Second is the Fisheries Code, specifically Section 102. Third is the Clean Water Act, RA 9275 (2004) which prohibits the following:

- Discharging, depositing or causing to be deposited material of any kind directly or indirectly into the water bodies or along the margins of any surface water, where, the same shall be liable to be washed into such surface water, either by tide action or by storm, floods or otherwise, which could cause water pollution or impede natural flow in the water body;
- Discharging, injecting or allowing to seep into the soil or sub-soil any substance in any form that would pollute groundwater.
- Operating facilities that discharge regulated water pollutants without the valid required permits or after the permit was revoked for any violation of any condition therein;
- Unauthorized transport or dumping into sea waters of sewage sludge or solid waste as defined under Republic Act No. 9003;
- Transport, dumping or discharge of prohibited chemicals, substances or pollutants listed under Republic Act No. 6969;
- Operate facilities that discharge or allow to seep, willfully or through gross negligence, prohibited chemicals, substances or pollutants listed under R. A. No. 6969 into water bodies or wherein the same shall be liable to be washed into such surface, ground, coastal, and marine water;
- Undertaking activities or development and expansion of projects, or operating wastewater/sewerage facilities in violation of Presidential Decree. No.1586 and its implementing rules, and regulations;

- Discharging regulated water pollutants without the valid required discharge permit pursuant to this Act or after the permit was revoked for any violation of condition therein;
- Non-compliance of the LGU with the Water Quality Framework and Management Area Action Plan. In such a case, sanctions shall be imposed on the local government officials concerned;

The Clean Water Act upgraded the penalties for violation of Section 4, PD 979 to a fine of not less than Fifty thousand pesos {P50,000.00} nor more than One million pesos (P1,000,000.00) or by imprisonment of not less than one  $\{1\}$  year nor more than six (6) years or both, for each offense, without prejudice to the civil liability of the offender in accordance with existing laws. Otherwise, violators of the Clean Water Act shall be fined by the DENR Secretary, upon the recommendation of the Pollution Adjudication Board in the amount of not less than Ten thousand pesos (P10,000.00) nor more than Two hundred thousand pesos (P200,000.00) for every day of violation. Failure to undertake clean-up operations, willfully, or through gross negligence, shall be punished by imprisonment of not less than two (2) years and not more than four (4) years and a fine not less than Fifty thousand pesos (P50,000.00) and not more than One hundred thousand pesos (P100,000.00) per day for each day of violation. Such failure or refusal which results in serious injury or loss of life and/or irreversible water contamination of surface, ground, coastal and marine water shall be punished with imprisonment of not less than six (6) years and one day and not more than twelve (12) years, and a fine of Five Hundred Thousand Pesos (P500,000.00) per day for each day during which the omission and/or contamination continues.

Violation of Section 102 of the Fisheries Code shall be punished by imprisonment of six (6) years and one (1) day to twelve (12) years and/or a fine of Eighty thousand pesos (P80,000.00) plus an additional fine of Eight thousand pesos (P8,000.00) per day until such violation ceases and the fines paid.

### 22. What sanctions can be imposed on LGUs who do not comply with water quality management plans?

Administrative sanctions can be imposed on LGUs who do not comply with the Water Quality Management Area Action Plan in accordance with the relevant provisions of R.A. No. 7160.

#### 23. Can fish wardens enforce environmental laws to apply to cages and pens?

Yes, for as long as they undergone training on law enforcement and they are duly designated fish wardens. Since they are authorized to enforce the Fisheries Code as well as other fishery regulations, they may invoke said laws in enforcing environmental damages caused by fish cages and pens. Furthermore, the Fisheries Code provides for penalties against entities who may cause aquatic pollution, or those who obstruct navigation, and migration paths of fish. Beyond what the Code provides, however, are under the jurisdiction of the DENR.

#### 24. Can cooperatives take over abandoned and unutilized fishponds?

Rule 49.2 does not discount the possibility of abandoned and underutilized fishponds to (i) revert to its original mangrove state or (ii) for its use rights to be transferred to qualified persons (including cooperatives and people organizations) in the same way that expired and new FLAs are to granted to these groups.

#### 25. What are illegal fishponds?

Illegal fishponds can be any of three things: (i) fishponds situated in areas released by DENR to BFAR but operating without FLAs; (ii) fishponds situated in areas not released by DENR to BFAR; and (iii) fishponds converted from mangrove areas after issuance of DAO 15, s.1990, which prohibits further conversion of thickly vegetated mangroves to fishponds.

## 26. What is the procedure for the reversion of abandoned, undeveloped, and underutilized fishponds?

The so-called fishpond reversion process is governed by Joint DA-DENR General MemorandumOrderNo.3, Series of 1991, which, as of this writing, needs to be reviewed and revised. The IRR of the Fisheries Code further provides for BFAR to identify through updated fishpond surveys, abandoned, undeveloped or underutilized fishpond, which, after due process, can be given to qualified persons or reverted to forest lands.

## 27. How can the FARMC contribute to environmental management of aquaculture?

The Fisheries Code and an earlier directive, EO 240, provides for genuine participation of fisherfolk as a consultative body with mandates to recommend certain interventions such as: (i) determination of license fees, catch ceilings, closed seasons, fish sanctuaries or refuges; (ii) enforcement of fishery ordinances;

#### Box 5. Mangroves and fishponds

### Which agency has jurisdiction over mangroves?

The DENR as provided by PD 705 or the Forestry Code of the Philippines, and various implementing rules such as DAO 15, s.1990, on mangrove conversion and conservation; DAO 96-29, s. 1990, on awarding of mangrove stewardship agreements; and DAO 76, s. 1987, on the establishment of buffer zones.

LGUs are also given some functions pertaining to mangroves although these are limited to conservation and establishment of social forestry projects under the supervision and control of the DENR (DAO 30 s 1992).

#### Who manages fishponds?

Fishponds which were released by DENR to BFAR and consequently leased out through Fishpond Lease Agreements are under the BFAR.

#### What is the LGUs role in the management of fishponds if FLAs are under the jurisdiction of BFAR?

The LGUs should include fishponds as part of their registry of aquaculture activities. It is to their interest to know who the operators (or caretakers) are for purposes of business permit issuance and local taxes. Also, as part of the LGUs role in maintaining ecological balance, effluents from fishponds should be monitored.

### *Can communities cut mangroves which they planted themselves?*

No, cutting of mangroves is unequivocally disallowed by RA 7161.

(iii) formulation of mechanisms to include or exclude certain fishers (and certain activities) from using municipal waters or undertaking fisheries activities; and (iv) general determination of priorities on fishing activities.

Although the Fisheries Code emphasizes the consultative role of FARMCs, this same organization can be more proactive and function as a fiscalizer by promoting and popularizing advocacies among their members, for example, on mitigation of negative impacts of aquaculture, or by agents of information dissemination on good aquaculture practices.

#### 28. What kinds of priority rights are assigned to small fisherfolk and their associations?

Fisherfolk organizations/cooperatives whose members are listed in the registry of municipal fisherfolk, may be granted use of demarcated fishery areas to engage in fish capture, mariculture and/or fish farming: Provided, however, that an organization/ cooperative member whose household is already in possession of a fishery right other than for fish capture cannot enjoy the fishing rights granted to the organization or cooperative.

No new concessions, licenses, permits, lease 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.

Based on the Implementing Rules and Regulations (IRR) of the Fisheries Code, qualified fisherfolk cooperatives/associations are to be given preference in the issuance of new and expired FLAS.

### 29. How can FARMCs, NGOs, and POs protect particular species in a habitat where aquaculture activities are to commence?

POs, NGOs, FARMCs, PAMBS, and LGUs may cause the declaration of a Critical Habitat pursuant to RA 9147 and per DENR Memorandum Circular 2007-02 which provides guidelines for the establishment and management of critical habitats. A critical habitat as defined refer to areas outside protected areas under RA 7586 or the NIPAS Act which are known habitats of threatened speices and designated as such based on scientific data taking into consideration species endemicity and/or richness, presence of man-made pressures/threats to the survival of wildlife living in the area.

#### 30. What is the relevance of AFMA in aquaculture management?

Aquaculture activities that occur in terrestrial areas are well within the scope of RA 8435 or AFMA with the agricultural sector being defined to include the raising of fish while agricultural lands covering fish or aquaculture production. The roles of LGUs per RA 8435 are as follows: (i) identification of model farms; (ii) participation in designation of Strategic Fisheries and Agricultural Zones (SAFDZs); (iii) devolution of communal irrigation systems from National Irrigation Administration; (iv) involvement in the National Information Network (NIN): (v) determine with DTI, DOTC, and DPWH infrastructure requirements in their respective areas including farm-to-market roads; and (vi) delivery of extension services in agriculture and fisheries, with specific mention of the province.

### 31. What is the role of the Department of Interior and Local Government (DILG) in aquaculture management?

DILG assists the President in the supervision of the LGUs, promotion of local autonomy, and the implementation of the Local Government Code. It provides assistance towards legislation, law enforcement and public safety and through its attached agencies, mainly the Local Government Academy, provides human resources training to enhance all aspects of local governance.

Per Section 10 of the AFMA Law, DILG shall impose penalties on cities and municipalities which fail to prepare their land use and zoning plans, subject to provisions of the LGC.

Managing aquaculture and its impacts



## 15 LGU action points

Having shown in the previous chapters how critical the role of LGUs are in aquaculture management and mitigation of environmental impacts, and laying down the policies which can be utilized as well as identification of national partner institutions, this section recommends some strategies which the LGU can apply.

### 5.1 Enact ordinances in support of national standards on good aquaculture practice

- Adapt Fisheries Administrative Order (FAO) 214<sup>1</sup>, Code of Practice for Aquaculture (Appendix 3) and provide penalty clauses.
- If the Municipal Development Plan or the Coastal Resource Management Plan identifies aquaculture as a core activity, use the EIS system as a planning tool! If the area considered for aquaculture is within a protected landscape or seascape, or contains critical habitats or species, make sure to comply with the EIS system. Otherwise, get the necessary permits or certificates of non-coverage and incorporate or adapt these in local ordinances.

Another useful reference is the SEAFDEC Code of Practice for Responsible Aquaculture in Mangrove Systems for issues related to mangroves and fishponds (www.seafdec.org.ph).

- LGUs can enact ordinances in cases where national laws are silent for as long as they conform to or do not contradict existing national laws.
- Enforce national policies and local ordinances in support of maintaining the integrity of the environment as vested by the Local Government Code!

# 5.2 Institute a licensing/permitting system consistent with measures of resource rent or resource value. Licenses and permits for the operation of cages and pens or any aquaculture activity for that matter should consider the following:

- Resource rent difference between normal financial profits and estimated economic profit taking into account opportunity costs of labor and capital, as well as costs of management and risk. With the assistance of research/academic institutions, this value may be computed based on estimates of producers surplus.
- Opportunity cost an alternative amount which the space/area would have earned had it been granted to the next best use! For example, a cage or pen operation may occupy a preferred fishing area or a snorkeling site. The opportunity cost, therefore, is what the area would have earned if it were used either for fishing or tourism.
- Cost recovery an amount based on the average cost to be spent by the manager of the resource, here the LGU. A cost recovery approach is based on the premise of a contract between the user of the resource who pays for the fee, and the provider of the resource who provides a specific service. The LGU, as a service provider, may charge the following expenses to the users: (i) monitoring of water quality; (ii) regular patrolling of farm areas; (iii) marketing campaigns; and (iv) maintenance of information system, to name a few.
- Resource use fee may be instituted as a performance bond which the LGU can keep in trust, return if farm ceases operation, or utilize in cases of emergency. Must be stated clearly in ordinance, though.
- Resource value a hectare of mangroves in relatively good condition is valued at US\$600 for its fish and wood products while an equivalent area of coral reefs in excellent condition is worth US\$2,500 per hectare (White and Cruz-Trinidad 1998)! Consider these when zoning aquaculture and determination of subsequent fees to be charged.
- The LGU must ensure that the terms and conditions of the permit are complied with consistent with the local ordinance. This may include the size of the cage, number of allowable cages per applicant, location, maximum weight, and stock density<sup>2</sup>.

#### 5.3 Institute a farm identification system.

Such identification shall be posted at strategic area of the farm and should contain some basic information such as the: (i) permit number; (ii) validity; and (iii) zone of operation.

<sup>2</sup> Based on B. Querijero, C. Pagdilao, and S. V. Ilagan 2006.

## 5.4 Protect and rehabilitate damaged ecosystems

Reforest mangroves and ensure that remaining stands are protected against cutting and conversion. Maintain buffer zones and plant and other suitable vegetation in dikes.

Maintain a l:l mangrove to pond ratio as a best practice. Protect existing coral reefs – limit aquaculture activities near or above coral reef areas as in the case of seaweed farming!



Photo #13. Mangrove reforestation project

# 5.5 Work with national agencies to monitor performance of feed suppliers

- Conduct regular monitoring and spot testing of feeds for efficiency (floats) and presence of banned ingredients
- Develop system for identification of accredited feed suppliers
- Inform farmers of accreditation list or how to identify accredited feed suppliers

# 5.6 Coordinate with national agencies to constantly provide farmers with simple advice on feed management

- STOP FEEDING IF THE FISH DOESN'T FEED ANYMORE!
- Advise farmers to record feeding protocols and periodically monitor these. Parameters include time, rate, and frequency of feeding, and type and source of feeds. These data, when consolidated, may provide estimates of organic loading and will thus indicate the overall health of the coastal waters<sup>3</sup>.
- Do not expose feeds to the elements/ contaminants.
- Provide farmers with guidelines for handling and storing dry pelleted feeds from the time of purchase.

## 5.7 Help the farmers manage their farms better!

- Apply best practice for site selection of mariculture projects (see Box 6)
- Apply best practices for farm management.

# *Box 6.* Criteria for site selection of mariculture projects

- Environment must be free of domestic, agriculture and industrial pollution
- Farm area must be far from river system or any freshwater tributaries
- There must be moderate water movement or current to ensure significant nutrient exchange and flushing, i.e., 20-40 cm/sec
- Bottom must be sandy or rocky and not sulphidic mud
- Location must be in a protected cove or bay area
- Site should not be exposed during low tide, i.e., water depth should be at least 2 meters during lowest tide level
- Accessibility to inputs (feeds, seeds) and market outlets

<sup>3</sup> Based on B. Querijero, C. Pagdilao, and S. V. Ilagan 2006

- Stock only healthy fry and fingerlings, and if possible, they should come from the same source and be of the same size.<sup>4</sup> Introduction of exotic organisms and genetically modified organisms (GMOs) need clearance from the DA-BFAR and must be consistent with the provisions of FAO 214.
- Fish production must be limited to only two (2) crops per year to allow for the environment to process and absorb all organic wastes. Fish production must be confined to nine (9) months only with the remaining three (3) months used for repair, cleaning and drying of nets.<sup>5</sup> Washing of nets to remove fouling organisms and facilitate water exchange must be done regularly, either onshore, or if not possible, onsite by changing old nets, scrubbing, or by swim-through method.<sup>6</sup>
- Fish cages must be installed such that there is a distance of at least 100 m between two cages.<sup>7</sup>
- Practice integrated aquaculture: culture shellfish and seaweeds alongside finfish cages to help absorb excess nutrients!

# 5.8 ALLOW THE environment to "rest" – FALLOW and continue monitoring until recovery is attained!

Fallowing is recommended for terrestrial systems such as ponds and marine-based systems such as cages and pens.

#### 5.9 Work within the environmental carrying capacity

There is a need to base aquaculture development on the sustainable carrying capacity or assimilative capacity of the resource and to develop quality standards for aquaculture that can act as a measure of compliance. BFAR has been tasked by the Fisheries Code (Section 51) to determine the carrying capacity of lakes and inland waters and to provide information on suitable water surface area for aquaculture purposes. LGUs should work with BFAR and other academic institutions to estimate environmental carrying capacity.

## 5.10 Monitor farm conditions

Conduct water quality spot-check. Using simple water quality assessment methods, perform testing for the following parameters: (i) dissolved oxygen; (ii) pH; (iii) biochemical oxygen demand (BOD); and (iv) total coliform count.

Conduct fish health spot-check. Collect fish samples and when in doubt send to BFAR Fish Health Section laboratories (Appendix 2).

To ensure that culture environments are safe and fit for rearing fish, BFAR has a team that provides technical assistance in the monitoring of water



**Photo #14. BFAR Fish Health Personnel** undergoing a water quality sampling

quality parameters such as salinity, temperature, and oxygen levels. Regular recording of this information is important in sustainable aquaculture management. This includes training LGU technicians in the use of simple water quality equipment, e.g. Hach kit.

Based on B. Querijero, C. Pagdilao, and S. V. Ilagan 2006

Based on Fisheries Office Order No. 73, s. 2000

<sup>6</sup> Based on B. Querijero, C. Pagdilao, and S. V. Ilagan 2006.

<sup>7</sup> Based on Fisheries Office Order No. 73, s. 2000

Watch out for these tell tale signs					
Oxygen depletion	Fish Disease	Pollution			
Fish are in or near the water surface Fish are gasping for air Fish stop feeding	There is over secretion of mucus Fish are scratching against bottom Fish have hemorrhages, ulcers or cyst, diarrhea, and pale gills Fish swim upside down Erosion of fins and fish is lethargic	Fish are convulsing and there is curvature of the spine Tetany or the fish look drugged Fish form in groups and circle the shoreline Presence of water bubbles and oily scum			

#### 5.11 Recognize signs of impending disasters and react immediately!

Based on Training Materials of Ms. Mercy Bantaya, BFAR Fish Health Section<sup>8</sup>



Photo #15. Overstocked fish cage resulting to fish kill.

Are there changes in the color and smell of water? Is there a rotten egg smell --- this is a sign that there is very little oxygen in the water! Is there a proliferation of algae and is the water changing color? A harmful algal bloom might be in the offing.

IF ANY OF THESE SIGNS ARE NOTICED, DO THE FOLLOWING:

- IMMEDIATELY HARVEST
- AERATE
- IF THE CAUSE IS FISH DISEASE, DISPOSE OF DEAD FISH IN A SANITARY MANNER
- REPORT THE INCIDENT TO BFAR OR DENR REGIONAL OFFICE!!!!

#### 5.12 Organize fishfarmer communities

Recognizing that local governments would benefit from consultation with fisherfolk and their organizations, the Fisheries Code provides for the creation of Fisheries and Aquatic Resources Management Councils (FARMCs). The Code encourages the formation of such councils at several levels – barangay, municipality/city, cross-municipalities and national. Membership in these councils includes representatives of government agencies and institutions, as well as fisherfolk, fishworkers and other stakeholders. At the municipal or city level, the FARMCs are expected to assist in the development of the Municipal Fisheries Development Plan, make recommendations for municipal fishery ordinances, assist in the enforcement of fishery laws, rules and regulations in municipal waters, and

<sup>8</sup> Some reference materials on fish kills include: Barica 1976; Helfrich and Smith 2000; and Van Dolah 2000.

provide advice, whenever necessary, to the municipal governments. In contiguous waters, the Fisheries Code supports the formation of Integrated Fisheries and Aquatic Resources Management Councils (IFARMCs) as venues for closer collaboration between and among local governments in the management of shared resources. In the manner of realizing the management joint resources, LGUs can be guided again by Section 9.2 of the Code of Conduct for Aquaculture, which governs trans-boundary issues.

# 5.13 Invest in collecting information for decision making

- Establish a registry of aquaculture farms and establish procedures thereof per FAO 218. The registration papers should ask for the following:
  - Personal Information
  - Location of Farm
  - Total Area of Farm
  - Species Cultured
  - Number of croppings/year
  - Number of stocks / cropping
  - Establish a registry of fish hatcheries and other breeding facilities
  - Maintain a listing of feeds, pesticides, and drug distributors
  - Use Maps, preferably GIS-based maps!

# 5.14 Incorporate aquaculture activities in local plans

- Include aquaculture in the Coastal Development Plan or Municipal Development Plan as enunciated by the Local Government Code, the Fisheries Code, and AFMA.
- Communicate local plans to Regional Development Councils and relevant national agencies in order for national plans to develop more realistic targets.

# 5.15 Promote cooperative management schemes

Recognizing that the environment is a shared resource, the Local Government Code, the Fisheries Code, and the AFMA Law all support cooperative undertakings among LGUs. Section 3(f) of the Local Government Code states that "LGUs may group themselves, consolidate or coordinate their efforts, services, and resources for purposes commonly beneficial to them". Section 16 of the Fisheries Code provides for the integrated management of contiguous fishery areas to facilitate management as a single resource system while the AFMA allows for the consolidation of Strategic Agricultural and Fisheries Development Zones that may encompass more than one LGU.

Some forms of management sharing schemes are as follows:

- Ecosystem-based management. LGUs that share a common ecosystem, say a bay, gulf or coral reef area, may bond together to establish joint management schemes. Examples of ecosystem-based management approaches in the Philippines are Bay Management Councils and Integrated FARMCs.
- Co-management. The co-management of aquaculture, in terms of monitoring of the environment, monitoring of production, and monitoring of licences, needs to be coordinated with national agencies such as the BFAR, DENR, and the academe, to ensure that jurisdictional authorities are maintained, expertise is shared, and operational resources are not wasted.

#### Table 9. Summary Sheet: 15 LGU Action Points

No.	Strategy or intervention	Action	
1	Enact ordinances in support of national standards on good aquaculture practice		
2	Institute a licensing/permitting system consistent with measures of resource rent or resource value.		
3	Institute a farm identification system that will allow farm inspectors or even workers of other farms to report occurrences needing immediate attention.		
4	Protect and rehabilitate damaged ecosystems		
5	Work with national agencies to monitor performance of feed suppliers		
6	Coordinate with national agencies to constantly provide farmers simple advice on feed management		
7	Help the farmers manage their farms better		
8	ALLOW THE environment to "rest" – FALLOW and continue monitoring until recovery is attained!		
9	Work within the Environmental Carrying Capacity		
10	Monitor farm conditions		
11	Recognize signs of impending disasters and react immediately		
12	Organize fishfarmer communities		
13	Invest in collecting information for decision making		
14	Incorporate aquaculture activities in local plans		
15	Promote COOPERATIVE management schemes		

Aquaculture will continue to be the fastest growing sector in fisheries and it will be relied upon for food, income, and employment. Let us not jeopardize what aquaculture can contribute by wantonly disregarding its use of the environment. The environment is a gracious host but aquaculture must be a responsible guest. With proper management and by applying the policies already available to us, the LGUs, for whom this book is written, can strike a healthy balance between aquaculture development and environmental integrity.

# References

Acosta, B. O., and R. S. V. Pullin (eds.). 1991. Environmental impact of the golden snail (Pomacea sp.) on rice farming systems in the Philippines. Summary report of the Workshop held at the Fresh-water Aquaculture Center, Central Luzon State University, Nueva Ecija, Philippines. ICLARM Conference Proceedings 28. 34 p.

Armada, N.B. 2004. State of the demersal fisheries, pp.42-46. In: DA-BFAR (Department of Agriculture – Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resources Management Project, Cebu City, Philippines. 378 p.

Azanza, R.V., Y. Fukuyob, L.G. Yapa and H. Takayamac.2005. Prorocentrum minimum bloom and its possible link to a massive fish kill in Bolinao, Pangasinan, Northern Philippines. Harmful Algae4(3):519-524.

Barica, J. 1976. Nutrient dynamics in eutrophic inland waters used for aquaculture in some countries bordering the South China Sea, with particular reference to mass fish mortalities. FAO Working Paper SCS/76/WP/24. Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations, Rome, Italy.

Bureau of Agriculture Statistics (BAS). Undated. Fisheries statistics of the Philippines, 2003-2005. Bureau of Agriculture Statistics, Quezon City, Philippines, 138 p.

Burgonio, T.J. 2007. RP's mangrove cover slowly recovering, Philippine Daily Inquirer, October 22, 2007, p. 13.

Food and Agriculture Organization (FAO). 1990. Technical resource papers regional workshop on the culture and utilization of seaweeds. Volume II. Regional Seafarming Development and Demonstration Project Network of Aquaculture Centres in Asia, Bangkok, Thailand.

Food and Agriculture Organization (FAO). 2007. The state of world fisheries and aquaculture 2006. FAO Fisheries and Aquaculture Department, Rome, 2007.

Heinig, C. 2000. Overview of Maine Department of Marine Resources Finfish Aquaculture Monitoring Program: Eight Years of Monitoring, 1992-99. (Available from Jon Lewis), Maine Department of Marine Resources.

Helfrich, L.A. and S.A. Smith. 2000. Fishkills: their causes and prevention. Virginia Cooperative Extension Publication 420-252. Virginia Polytechnic Institute and State University and Virginia State University.

Jacinto, G. 2002. Bolinao fish kill – looking back. Aqua Beat 2:2.

San Diego-McGlone, M.L. and P. White. 2006. Aquaculture environmental impact on sensitive habitats (corals, seagrasses,mangroves). Paper presented at the PHILMINAQ Conference, 6-7 December 2006. University of the Philippines Marine Science Institute, Diliman, Quezon City, Philippines.

Primavera, J.H. 1995. Mangroves and brackishwater pond culture in the Philippines. Hydrobiologia 295, 303-309.

Querijero, B.V.L., C.R. Pagdilao, and S.V. ilagan. 2006. Guidelines for establishment of fish cages and other structures in lakes and coastal waters. Proceedings of the 1st Consultation

Workshop on Guidelines for Establishment of Fish Cages in Lakes and Coastal Waters, 25-26 Oct 2001, Los Banos, Laguna.

Sotelo-Fuertes, Y. 2007. Fish cages blocking flow of river, Philippine Daily Inquirer, June 21, 2007. www.newsinfo.inquirer.net.

Van Dolah, F.M. 2000. Marine Algal Toxins: Origins, Health Effects, and Their Increased Occurrence. Environmental Health Perspectives 108, Supplement 1: 133-141.Welcomme, R.L. 1988. International introductions of inland aquatic species. FAO Fish. Tech. Paper 294, Rome, 318 p.

White, A. T. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: why protection and management are critical. Coastal Resource Management Project, USAID, Philippines.

WorldFish and PRIMEX Final Report. 2007. Final Report Submitted to the Asian Development Bank (ADB) and Bureau of Fisheries and Aquatic Resources (BFAR). Strategy for Sustainable Aquaculture Development for Poverty Reduction (ADTA-4708-PHI).

www.bfar.da.gov.ph www.seafdec.org.ph www.wikipedia.org www.wwf.org

# Appendix 1 Structure, organization, and mandates of BFAR

BFAR has the following organizational subdivisions: divisions, centers, and regional offices. Divisions and units with primary role in aquaculture are marked appropriately in (Fig. A.1.1)

## 1. Inland Fisheries and Aquaculture Division (IFAD)

At the Central Office, the Inland Fisheries and Aquaculture Division (IFAD) is the main office in charge of aquaculture development. IFAD provides technical assistance and advisory services on aquaculture and inland water management and formulates and recommends policies and regulations on the proper management, protection, rehabilitation and utilization of inland water resources for live aquatic animals in coordination with LGUs and other concerned agencies. IFAD is also in charge of coordinating with the LGUs and other concerned agencies the establishment of fish hatcheries and pilot demonstration farms. Other functions of IFAD are as follows: i) develops appropriate guidelines on implementing the Code of Practice for Aquaculture; ii) provides standards, monitors, and coordinates aquaculture activities in the Philippines in coordination with other organizations such as NACA, etc.; and iii) recommends to the NFRDI researchable areas on aquaculture and inland water fisheries.

IFAD consists of three sections dealing with three major aquaculture environments: brackishwater, freshwater, and marine. These sections perform functions with respect to policy formulation, technical assistance, standard setting (mainly through the Code of Conduct for Responsible Aquaculture), linking with other agencies and LGUs, and extension. Specific functions of the Inland Fisheries and Freshwater Section include the inventory and assessment of inland waters (lakes, rivers, marshes, and reservoirs) and rehabilitation of the depleted inland waters without endemic species through regular fish stocking programs in collaboration with the other Divisions concerned. The Mariculture Fisheries Section develops linkages in sea farming to establish information exchange; verifies newly-developed technologies on finfish culture, shellfish, seaweeds and such other mariculture technologies; and recommends establishment of mariculture projects in areas with high potentials for development. Lastly, the Brackishwater Fisheries Section undertakes inventories and assessments of existing brackishwater fishponds and hatcheries for proper disposition and registration, and formulates incentives to fishpond operators complying with environmental standards and promoting sustainable technologies and management practices.

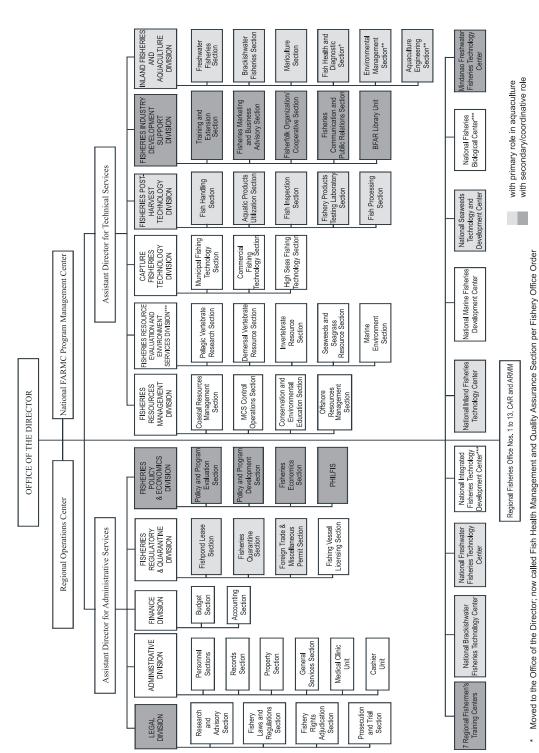
## 2. The Fish Health Section (FHS)

The Fish Health Section (FHS) is administratively part of IFAD but due to the nature of its work, covering both culture and capture, it is maintained as an independent unit under the Office of the BFAR Director<sup>1</sup>. The following are functions of the Fish Health Section:

1

Renamed as Fish Health Management and Quality Assurance Section by virtue of a Fisheries Office Order.

Fig. A.1.1 Organizational Chart of Bureau of Fisheries and Aquatic Resources



- Assists in the implementation of the National Diagnostic and Quarantine System for the movement of living aquatic animals;
- Formulates guidelines to strengthen the National Program in Aquatic Animal Health Certification and Quarantine Procedures;
- to the Fisheries Regulatory and Quarantine Division policies and procedures, in coordination with the concerned Divisions, regulations on aquatic animal health certifications and quarantine procedures;
- Renders emergency diagnostic and technical assistance on fish disease diagnoses and recommends prevention, control, and treatment measures;
- Monitors/assesses health status of stocks in selected fish and other aquatic resource farms in the Philippines;
- Provides standards and sets directions to different regional fish health satellite laboratories;
- Serves as the repository of all information on fish diseases;
- Establishes centralized quarantine facilities for imported live aquatic animals;
- Develops expertise in the field of disease diagnosis specifically on parasitology, bacteriology, histopathology, and immunology, in support to diagnostic undertakings; and
- Conducts national specialized training programs, such as fish health management, for government fishery biologists, extension workers, fish farmers and other interested individuals.

## 3. The Fisheries Regulatory and Quarantine Division (FRQD)

The Fisheries Regulatory and Quarantine Division (FRQD) has four (4) sections - the Fishpond Lease Section, the Fishing Vessel Policy and Licensing Section, Quarantine Section, and the Foreign Trade Section. Three of the sections have functions directly relating to aquaculture (Fig. Al.1). The functions of the division with reference to aquaculture are:

- a. Conducts quarantine activities of all imported and exported fish and fishery/ aquatic products, including those for domestic trade;
- b. Quarantines fish and other aquatic animals suspected to be inflicted with harmful pests and diseases;
- c. Documents and authorizes the movement or trading of fish and fishery/aquatic products;
- d. Issues fishpond lease agreements;
- e. Issues permits/licenses for the construction and operation of fish pens, fish cages, and such other structures outside of the municipal waters;
- f. Formulates and implements policies and procedures on the issuances, conversions, transfers and renewals of fishpond lease agreements, issuances of permits and clearances for fishery trade, and issuances of special/gratuitous permits for the exploitation of fishery resources for experimental or research purposes; and

g. Performs such other related functions as may be assigned from time to time by the Assistant Directors and/or the Bureau Director.

The Fishpond Lease Section, aside from issuing fishpond lease agreements, also conducts ocular inspection and verification of areas covered by fishpond applications/ permits and Fishpond Lease Agreements and monitors compliance to agreement. They are also in charge of coordinating with private and other government agencies and/or financing institutions in all matters pertaining to Fishpond Lease Agreements.

The Foreign Trade Section, in collaboration with the FHU, inspects shipments of import/export for live fish and assigns them to quarantine if warranted; provides samples for research on fish parasites and diseases; monitors permits/commodity clearance and auxiliary invoices.

#### 4. Fisheries Post-Harvest Technology Division (FPHTD)

Another division with critical functions with respect to aquaculture is the Fisheries Post-Harvest Technology Division (FPHTD). This division is in charge of developing value-added products for local and export markets; development of a national fish and fishery products quality standards; undertakes pilot approach to Hazard Analysis Critical Control Point (HACCP) for developed fish/fishery products; provides lab services for fish quality management; establishes and implements an inspection system for import and export of fish/fishery aquatic products and fish processing establishments consistent with international standards to ensure product quality and safety; Implements international agreements/commitments on the improvement of trading of fishery products and fish processing establishments consistent with international standards to ensure product quality and safety; and implements international agreements/commitments on the improvement of trading of fishery products under the regulation of the World Trade Organization-General agreements on tariff and trade on sanitary certificates for fish and fishery products. Formerly consisting of five (5) sections, the functions were merged intro three sections as follows: Aquatic Products Utilization and Standardization Section; Fish Inspection and Quality Control Section; and Fishery Products Testing Laboratory Section.

Two divisions at the Central Office perform support functions to aquaculture. These are the Fisheries Policy and Economics Division (FPED) and the Fisheries Industry Development Support Division (FIDSD). The FPED is in charge of formulation, review, and updating of appropriate policies, plans, and programs for the utilization, management, development, conservation and allocation system of fisheries and aquatic resources including the National Fisheries Industry Management and Development Plan (NFIMDP) and the Comprehensive Fishery Research and Development Program (CFRDP), in consultation with other BFAR units and other agencies. FIDSD is in charge of extension, cooperative strengthening, and marketing assistance. The National FARMC Program management Center, which is under the Office of the Director and functions as the secretariat of the National FARMC, is in charge of organizing, strengthening, and monitoring the performance of FARMCs.

#### 5. Regional Fisheries Units

There are sixteen Regional Offices (Regions I to XIII, CAR, and ARMM) which are administrative alteregos of BFAR. They are in charge of extension, they implement plans,

policies and programs, and they conduct routine inspection of fishery demonstration farms, nurseries, stations and other instrumentalities of BFAR within the Region. Basic services provided by all regional offices are categorized as follows: i) Production support; ii) Market development; iii) Extension, Training and Education; iv) Research and Development; and v) Regulatory. There are also Regional Outreach Stations (ROS) for specific commodities run by the Regional Fisheries Units depending on the commodity focus, such as the ROS for tilapia in Bay, Laguna and the Mobo Fishfarm in Mobo, Masbate for brackishwater technologies.

#### 6. Regional Fisheries Training Centers (RFTC)

BFAR has seven Regional Fisheries Training Centers (RFTC) located in 1) Aparri, Cagayan; 2) Puerto Princesa City, Palawan; 3) Tabaco, Albay; 4) Carmen, Cebu; 5) Catbalogan, Samar; 6) Zamboanga City, Zamboanga; and 7) Panabo City, Davao del Norte. RFTCs provide multi-level training and extension services, capacity building programs, and advisory services to fisherfolk, the private sector, and local government units at the regional and local levels. These centers aim to develop and upgrade individual skills and competencies of technical fisheries staff of the LGUs and other agencies involved in fisheries implementation and, more specifically, of small scale fisherfolks/ organizations/cooperatives. The centers transfer relevant and appropriate technology to improve present practices and increase individual productivity and income. Each of the training centers are also expected to establish and operate feasible sectoral fishery projects to serve as support/demonstration facilities in the target fishing communities for replication as source of fisherfolk's income or alternative livelihood.

#### 7. National Technology Centers

There are eight National Technology Centers which are operated and maintained for technology generation, field testing of technologies, extension services, demonstration and training / seminars in support of policy formulation and project implementation on fisheries development and conservation in coordination with concerned agencies and organizations. All centers are also production centers of quality fry and fingerlings and distribution centers for Regional Outreach Stations as well as Satellite Stations. Of the eight centers, only one, the National Marine Fisheries Development Center, is not relevant to aquaculture. Two centers have been transferred to the NFRDI, namely: National Fisheries Biological Station in Taal, Batangas, and the National Integrated Fisheries Technology Development Center in Dagupan, Pangasinan. Areas of expertise identified for the centers are shown in Table A.1.1.

Technology Centers	Area of expertise	
Fisheries Biological Station Complex Center	Selective and induced spawning of freshwater and marine ornamental fish	
	Breeding of indigenous fish like <i>maliputo</i>	
	Resource assessment of Taal Lake and Pansipit River	
National Inland Freshwater Fisheries Technology Center	<ul> <li>Serve as the Philippine germplasm center for common carp and major carp species and other freshwater fishes;</li> </ul>	
	<ul> <li>Conduct stock assessment and limnological studies of Laguna de Bay and other major lakes / reservoir;</li> </ul>	
National Brackishwater Fisheries Technology Center	<ul> <li>Conduct research and development studies on saltwater aquaculture species (e.g., milkfish, grouper, salt-tolerant tilapia hybrid, mudcrab);</li> </ul>	
National Freshwater Fisheries Technology Center	Improvement and maintenance of good quality strain of tilapia brood stocks and fingerlings	
	Undertake studies for other freshwater species	
National Integrated Fisheries Technology Development Center	<ul> <li>Commercial milkfish fry and fingerling production;</li> <li>Culture and breeding of green grouper, milkfish, rabbit fishes, seabass, Caranx sp., etc.;</li> </ul>	
	<ul> <li>Commercial production of sampi (Marobrachium rosenbergii);</li> </ul>	
	Development of saline tilapia (Oreochromis molobicus);	
	Broodstock development of various marine fish species;	
	Fishery products development; and	
	<ul> <li>Special Projects such as Environmental monitoring and modelling of aquaculture areas; Dissemination and adoption of milkfish aquaculture technology in the Philippines; Genetic selection for salinity-tolerant tilapia through hybridization; and Genetic improvement of Macrobrachium rosenbergii</li> </ul>	
National Seaweeds Technology Center	<ul> <li>Conduct Applied research in seaweeds and seaweed products</li> </ul>	
Mindanao Freshwater Fisheries Technology Center	Freshwater aquaculture species	

Table A.1.1. Area of expertise of BFAR Fishery Technology Centers

# Appendix 2

# Location of BFAR Fish Health Laboratories, contact persons & numbers, as of October 2007

Region	Location	Contact Person	Contact Number
1	West Dagupan, Pangasinan	Ms. Rosario Gaerlan	(075) 523 085
2	Tuguegarao, Cagayan	Ms. Evelyn Ame	(078) 844 4261
3	San Fernando, Pampanga	Ms. Carmencita Agustin	(045) 961 2784
4	FFRS, Los Banos, Laguna	Ms. Ligaya Cabrera	(049) 536 0705
NCR	Central Fish Health Laboratory, 860 Quezon Avenue, Quezon City	Ms. Simeona Regidor Dr. Sonia Somga	(02) 372 5055
5	Mercedes, Camarines Sur	Ms. Edna Tud	(054) 477 3948
6	Muelle Loney St., Iloilo City	Ms. Evelyn Abad	(033) 336 9878
7	Arellano Blvd, Cebu City	Ms. Carolina Lopez	(032) 253 0661
8	Avenida Veteranos, Tacloban City	Ms. Remedios Lequin	(053) 321 3152
9	RT Lim Blvd, Zamboanga City	Ms. Carolina Moron	(088) 856 9610
10	Macabalan, Cagayan de Oro City	Ms. Evie Lumingkit	(062) 991 8192
11	Magsaysay Avenue, Davao City	Mr. Raul Millana	(064) 421 1213
12	General Santos City	Ms. Sarah Mae Mamalangkap	(082) 224 5085
13	Bungao City, Surigao del Norte	Ms. Ana Melissa Talavera	(085) 343 5255
14	Autonomous Region of Muslim Mindanao ORG Complex, Cotabato City	Ms. Cheryl Dimacisil	(064) 421 1234
CAR	Cordillera Autonomous Region (CAR), Guisad, Baguio City	Ms. Petra Gayagay	(074) 443 6716

# **Appendix 3**

FISHERIES ADMINISTRATIVE) ORDER NO. 214 : Series of 2001 .....)

# **SUBJECT: Code of Practice for Aquaculture**

Pursuant to Section 47 of R.A. No. 8550, this code of practice for aquaculture outlining the general principles and guidelines for environmentally-sound design and operation for the sustainable development of the industry is hereby promulgated for the information and guidance of all concerned.

**SECTION 1.** *Definition.* – The terms and used in this order shall be construed as follows:

- a. *Aquaculture* Fishery operation involving the breeding and farming of fish and other fishery species in fresh, marine and brackishwater areas.
- b. *Aquaculture project* shall refer to fish cages, fishpens, fishponds, fish hatcheries, seaweeds farms, mollusk (pearls, mussels, oysters) farms and other related projects.
- c. *Biofilter* Organisms which ingest impurities from the water making the ponds meet the required optimum physical and microbiological parameters for the cultured species such as mussels, seaweeds and oysters.
- d. *Brackishwater aquaculture* refers to a fishery operation involving the culture of fish in a mixture of seawater and freshwater with salinity less than 30 parts per thousand.
- e. *Carrying capacity* The size of population of a given species that can be supported in a given area or volume of a body of water which will not lead to the deterioration thereof.
- f. *Closed recirculating system* A system where the pondwater, instead of being discharged to the outside environment, is reused after undergoing filtration in a settling pond or water treatment process.
- g. *Code of practice* A code prescribing principles and standards for responsible practices with the end in view of ensuring the effective conservation, management and development of aquaculture.
- h. *Drugs* Chemical substances used to alter the state or condition of the fish and/or the culture medium.
- i. *Effluent* A general term denoting any wastewater, partially or completely treated, or in its natural state flowing out of a manufacturing plant, industrial plant or treatment plant and from ponds and hatcheries.
- j. Endemic species Species restricted or native to a particular region.
- k. Exotic species Species that are introduced or non-native; foreign.
- 1. Environmental Impact Assessment (or EIA) The process of predicting the likely environmental consequences of implementing projects or undertakings and designing appropriate preventive, mitigating and enhancement measures.

- m. Fish cage refers to an enclosure which is either stationary or floating, made up of nets, or screen sewn or fastened together and installed in the water with opening at the surface or covered and held in a place by a wooden/bamboo posts or various types of anchors and floats.
- n. *Fishpen* An artificial enclosure constructed within a body of water for culturing fish, and fishery/aquatic resources made up of poles closely arranged in an enclosure with wooden materials, screen or nylon netting to prevent escape of fish.
- o. *Fishpond* A land-based facility enclosed with earthen or stone materials to impound water for growing fish.
- p. *Fishpond Lease Agreement (or FLA)* A contract entered into by and between the Secretary of Agriculture and a qualified fishpond applicant for the use of public land for fishpond development purpose for a period of twenty-five (25) years.
- q. Freshwater aquaculture Fishery operation involving the raising and culturing of fish in a water body originating from lakes, reservoirs, streams and rivers having a salinity from 0 to 0.5 parts per thousand.
- r. *Genetically Modified Organism (GMO)* refers to organism whose genes are manipulated to produce certain desired characteristics and be propagated for experimental purposes.
- s. *Hatchery* refers to a lake-based or land-based structure growing or culturing fish for breeding and fish seed production.
- t. *Lake* An inland body of water, an extended part of a river, a reservoir formed by a dam, or a lake basin intermittently or formerly covered with water.
- u. Mariculture refers to seafarming of aquatic plants and fishes.
- v. Outfall refers to the outlet of a river, stream or lake.
- w. *Quarantine* Enforced isolation of organisms which are or which may be infectious to prevent the transmission of disease to other organisms or the environment.
- x. *Reservoir* An artificial impoundment where water is kept for future use. The use of pond reservoir is to allow the settling of organic matter from the water source before use in the ponds.
- y. Settling pond refers to a pond specially designed for the settling of heavily loaded particles and other organic matter in the water before disposal to the surrounding environment.
- *z. Zonation plan* A plan defining the boundaries of specific areas for fishery utilization and development purposes.

## A. General Principles and Guidelines

**SECTION 2.** *Site selection/evaluation.* – Potential sites for aquaculture shall be thoroughly evaluated by BFAR in consultation with DENR, LGUs, and NFARMC to ensure that ecological and social conditions are sustained and protected. The following practices shall ensure that the sites selected are appropriate for aquaculture farms:

- a. Water source in the area shall be evaluated as to its quality and quantity;
- b. Tidal patterns, freshwater influences and flood levels, offshore currents and existing water uses shall be determined;
- c. Sustainability of topography, soil and ecosystem for siting and construction of ponds shall be ascertained;
- d. Long-term climatological records for the last five (5) years shall be acquired to determine the occurrence of floods, droughts, storms and other calamities in the area;
- e. Existing flora and fauna shall be determined relative to ecologically sensitive areas such as migration routes, nesting grounds, etc.;
- f. Alternatives to mitigate potential negative environmental and social impacts shall be considered;
- g. Regulatory requirements for the site shall be documented and possible alternatives shall be considered for compliance with regulations; and
- h. Availability of work force in the area shall be surveyed.

**SECTION 3.** *Farm design and construction.* – Proven and accepted designs and construction procedures shall be adopted to overcome problems related to flood levels, storms, erosion, seepage, water intake and discharge points and encroachment on mangroves and wetlands as well as social impacts. The following practices shall assure this goal:

- a. An EIS shall be required to be submitted to the DENR for review and evaluation before initiating any development activity or construction;
- b. Embankments shall be so designed as to prevent erosion and reduce seepage;
- c. Farm shall be properly designed in such a way that the arrangement of the pond compartments, water control structures and all other facilities shall mutually harmonize with each other giving the most efficient water management and manipulation of stocks;
- d. An ideal farm shall have wastewater treatment and settling pond areas which are necessary for conditioning intake water as well as settling wastewater before discharging to the environment;
- e. Structural design shall consider storms and flood levels;
- f. Required buffer zones shall be maintained as well as vegetative cover for exposed earthwork:

- For brackishwater, a buffer zone of at least 100 meters from the sea to the main peripheral dike and 50 meters along the river banks (for typhoon prone areas) and 50 meters from the sea and 20 meters along the river banks (for non-typhoon prone areas), shall be left undisturbed for ecological reasons and physical protection from flooding and wave action.
- 2) For freshwater, a distance of 20 meters (for non-typhoon prone areas) away from the embankment and 50 meters (for typhoon prone areas) shall be maintained to serve as buffer zone to minimize flood risk and related environmental hazards.
- g. Permit for the construction of deep wells for freshwater supply shall be obtained from the National Water Resources Board;
- h. Fish cages, floating or stationary, shall be installed and kept at least one (1) meter between units and at 20 meters apart between clusters to provide water exchange.
- i. Fishpens shall be spaced 200 meters apart; and
- j. Marine cage farming shall be operated in definite zones established by the LGU concerned in consultation with the M/CFARMC.

**SEC. 4.** *Water usage.* – A good environment within the pond system shall be influenced by the following practices on water usage as well as the pondwater quality management:

- a. The construction and operation of deep wells for freshwater supply shall be based on a design which prevents salt intrusion into freshwater aquifers and subsidence of ground level;
- b. Closed recirculating water system shall be considered in the intensive and semiintensive farming systems;
- c. Water exchange shall be minimized by maintaining good water quality through moderate stocking densities and feeding rates, using high quality feeds and good feeding practices.

**SECTION 5.** *Water discharge and sludge/effluent management.* – There shall be emphasized increased awareness of proper waste management in the aquaculture industry that shall enhance the protection of coastal land and water resources through the following practices:

- a. Effluents, sediments and other wastes shall be properly disposed of through the use of wastewater treatment and settling ponds;
- b. Outfall shall be so designed that no significant impact of effluents on natural waters occurs beyond the mixing zone;
- c. Sediment from ponds, canals or settling basins shall be put back into the area from which it was eroded, used as earthfill or disposed on some other environmentally-responsible way; and
- d. Discharged water shall meet water quality standards (determined qualitatively and quantitatively). Qualitative standards shall include prohibition of the release of turbid and odorous water to the receiving water while quantitative standards shall include the maximum and/or minimum levels of suspended solid, measure of acidity (pH), dissolved oxygen, ammonia and other nitrogenous compounds, phosphorus, carbon dioxide and the Biochemical Oxygen Demand (BOD).

**SECTION 6.** Use of drugs, chemicals, potentially toxic pesticides and fertilizers. – The following shall be practiced to foster awareness on the proper use of therapeutic agents and other chemicals without endangering food safety or threaten the environment.

- a. Drugs, chemicals, pesticides and fertilizers including lime shall be used only when clearly justified to treat specific problems;
- b. If chemicals are used, pondwater shall not be discharged until they have degraded/ dissipated or until the compound have naturally decomposed to non-toxic form;
- c. Records shall be maintained regarding the use of chemicals in ponds as suggested by the Hazard Analysis and Critical Control Points (or HACCP) method;
- d. Banned chemicals shall not be used for any purpose;
- e. Drugs, antibiotics and other chemical treatments shall be in accordance with recommended practices and comply with the national and international regulations;
- f. Aquaculture producers shall follow the information on product labels regarding dosage, withdrawal period, proper use, storage, disposal and other uses of the chemicals to safeguard environmental and human safety;
- g. Therapeutants shall be stored in a cool place and in a secure manner and unused compounds shall be disposed of by methods preventing environmental contamination;
- h. Biodegradable indigenous material such as derris roots, teaseed and tobacco dust shall be used to eliminate unwanted species in ponds instead of non-biodegrable compounds; and
- i. Regulations on labeling the contents and percentage of active ingredients in all chemicals including fertilizers and liming material shall be developed.

**SECTION 7.** *Stock selection, stocking practices.* – The following practices shall assure increased production of good quality and disease-free stocks promoting profitable fish farming:

- a. Moderate and appropriate stocking density by species shall be employed;
- b. Indigenous species shall be cultured whenever feasible;
- c. Stock only healthy fry and fingerlings. Genetically improved fish species for stocking shall be sourced from government and accredited non-government hatcheries; and
- d. Hatchery fry and fingerlings shall be encouraged for use rather than those caught from the wild.

**SECTION 8.** *Introduction of exotic and GMOs.* – The introduction of exotic and GMOs shall be made after a sound ecological, biological and environmental justification based on scientific studies and subject to the bio-safety standard as provided for by existing laws and regulations.

**SECTION 9.** *Feed, feed use and management.* – The following practices shall be adopted to improve the efficiency of supplemental feeds and feed management in aquaculture and reduce the amount of waste entering the ponds:

- a. Feeds shall be selected as to their high utilization rates to reduce nutrient pollution from uneaten feeds and excretory products;
- b. Feed characteristics shall include balanced levels of amino acids and other nutrients appropriate for the age of the fish, high palatability to stimulate rapid consumption, and high stability to prevent rapid nutrient release;
- c. Ideally, extruded feeds shall be used;
- d. Feeds shall be stored in cool, dry areas to prevent mold and other contaminants from forming;
- e. Medicated feeds shall be used only if and when necessary for the control of specific disease;
- f. Feeding management in lake-based aquaculture shall be in conformity with the carrying capacity of the lake as specified in Chapter B of this order;
- g. Good feeding practices shall include frequent feeding in small quantities of feed several times through the day, using feeding trays and even distribution of feeds in the pond;
- h. DA Administrative Order No. 16 on the "Nutrient Standard for Aquaculture Feeds" and other regulations of the Bureau of Animal Industry shall be complied with; and
- i. Records of daily feed application rates shall be kept to assess feed conversion ratio (or FCR).

**SECTION 10.** *Fish health management.* – The following practices shall be complied with to provide effective management of fish health focusing on disease prevention rather than disease treatment, eventually reducing the incidence of diseases and protecting the natural fisheries.

- a. Sustainable farming practices shall be promoted;
- b. Appropriate quarantine procedures, handling, transport and proper acclimatization of healthy fry and fingerlings prior to stocking shall be strictly observed;
- c. Good water quality shall be maintained by using appropriate stocking and feeding practices;
- d. For non-infectious diseases related to pond condition, specific corrective management measures shall be carried out;
- e. For mild infectious diseases with potential to spread within a farm, the pond shall be quarantined and remedial measures shall be applied;
- f. For serious infectious diseases that may spread widely, the pond shall be isolated and the remaining fish shall be harvested by net and the pond shall be disinfected without discharging the water;
- g. Treatment shall be done only when necessary;
- h. Dead, diseased fish shall be disposed of in a sanitary manner to prevent the spread of the disease;
- i. When disease occurs, transfer of fish, equipment and pondwater shall be avoided;

- j. Fishfarmers shall participate in the BFAR's national program on disease information, surveillance and reporting system; and
- k. On-site disease monitoring shall be conducted only by a competent Aquatic Animal Health Officer

**SECTION 11.** *Aquaculture Data Management.* – Data management shall be properly coordinated with all agencies concerned to come up with a networking system to access aquaculture information. This shall be attained through the following:

- a. Database shall be created out of environmental, social and land use impacts including collection and publication of statistics on aquaculture;
- b. Newsletters and other informative papers on aquaculture shall be published;
- c. Linkages with local and international government and non-government organizations for information networking shall be pursued;
- d. Information from relevant agencies and organizations relating to aquaculture shall be requested regularly; and
- e. All aquaculture operators shall submit annual reports of their production as requirement for renewal of the corresponding permits to the municipal or city government concerned, copy furnished the BFAR regional offices.

#### **B.** Incentives

The formulation of incentives shall encourage compliance with the environment standards and shall promote sustainable management practices on aquaculture.

**SECTION 12.** *Incentives.* – The following incentives may be granted for consistent compliance with the rules and regulations of this Code.

- a. Eco-labeling.
- b. Technical and market assistance.
- c. Gawad Saka nominee
- d. Training on aquaculture technologies

#### C. Carrying Capacity (Lake-based Aquaculture)

The measurement of carrying capacity in lakes and rivers is essential in rationalizing management and utilization of fishery resources in these areas.

**SECTION 13.** The criteria for the determination of the carrying capacity of lakes to control stocking density and feeding requirements are the following:

- a. The carrying capacity of a lake shall be determined through the conduct of physicochemical and biological study to determine plankton/algae density, nutrients and transparency and fish biomass and composition;
- b. The carrying capacity of fishpens, cages in the lake shall be based on the physicochemical and biological productivity measured in terms of biomass (g/m3) and nutrient uptake (gm/C/m3); and

c. The level of primary productivity in inland water that could support the good growth of planktivorous species like tilapia, carp, milkfish shall be less than 10 g/cu.3.

**SECTION 14.** This Order shall be subject to the existing laws, rules and regulations and local ordinance on these matters.

**SECTION 15.** *Effectivity.* – This order shall take effect fifteen (15) days after its publication in the Official Gazette and/or in two (2) newspapers of general circulation and fifteen (15) days after its registration with the Office of the National Administrative Register.

ISSUED this 17th day of September 2001 at Quezon City, Metropolitan Manila, Philippines.

(SIGNED) LEONARDO Q. MONTEMAYOR Secretary

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Director, Bureau of Fisheries & Aquatic Resources

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