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## The Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 and Philippine Aquaculture

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**Philippine Institute for Development Studies**  
*Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas*

## The Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 and Philippine Aquaculture

*Rolando R. Platon and Danilo C. Israel*

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# **The Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 and Philippine Aquaculture**

by

Rolando R. Platon  
and  
Danilo C. Israel

## **Abstract**

This paper reviews the Philippine aquaculture sector in light of the Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000, an internationally produced document that strongly encourages the incorporation of key strategy elements into the national aquaculture development programs. The purpose of the paper is to identify constraints to the full incorporation of the key strategy elements into the local aquaculture program and recommend measures for addressing them.

The paper found that the various key strategies mentioned in the Bangkok Declaration have already been implemented in the aquaculture sector to a significant extent. While so, however, much remains to be done to hasten the implementation of the strategies. In general, they will be better pursued if the Philippine Fisheries Code and the Agriculture and Fisheries Modernization Act are fully implemented. Adequate funding for the two laws must be provided to allow the establishment and operations of the different aquaculture institutions, programs, projects and activities they envisioned.

Review of the contentious provisions of the two laws must also be conducted and amendments made at the appropriate time, if necessary. Streamlining of the different government institutions and functions involved in fisheries and aquaculture should be pursued to effect coordinated operations. Furthermore, Increased support for training and extension is needed. In particular, the strengthening of regional offices of the Bureau of Fisheries and Aquatic Resources and the offices of the Local Government Units involved in extension must be given priority.

# **The Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 and Philippine Aquaculture**

**Rolando R. Platon<sup>1</sup>**  
**and**  
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## **I. Introduction**

In 2000, participants from different countries and governmental and non-governmental organizations participated in the “Conference on Aquaculture in the Third Millennium” held in Bangkok, Thailand (NACA/FAO 2000a). Based on the deliberations at this conference, the Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000, hereunder referred to as the Bangkok Declaration, was adopted. This declaration strongly encourages States, the private sector and other concerned stakeholders to incorporate key strategy elements identified in the conference into their national aquaculture development programs.

Although recent, the Bangkok declaration is now fast gaining attention among policymakers in the aquaculture sector of the Philippines. It is a welcome document because many of the key strategy elements it is promoting is also already being practiced to some degree in the aquaculture sector of the country. In a way, therefore, the Bangkok Declaration is a strong affirmation of ongoing attempts to transform local aquaculture into an efficient but sustainable sector of the economy.

This paper reviews the Philippine aquaculture sector in light of the Bangkok Declaration. In particular, it looks into the present state of aquaculture development in the country in relation to the key strategy elements mentioned in the Bangkok declaration. The purpose is to identify constraints to the full incorporation of the key strategy elements into the national aquaculture program and recommend some measures for addressing them.

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## **II. Review of Philippine Aquaculture**

In terms of volume, aquaculture surpassed municipal and commercial fisheries in 1996 as the largest production contributor among the fisheries sectors in the Philippines (Table 1). Furthermore, on average during the 1991-2000 period, aquaculture was the fastest growing sector even though its growth rates were negative from 1997 to 1999 (Table 2). These emphasized the dominant role of aquaculture in the entire fisheries industry.

In terms of value, however, aquaculture production remains below municipal and commercial fisheries during the 1991-2000 period (Table 3). Its average annual growth rate was also relatively lower than those of the other sectors (Table 4), the main reason being its negative performance during the years 1995 to 1997.

Of the different aquaculture production systems, mariculture and brackishwater fishpond culture contributed most to volume of production in 2000 (Table 5). Seaweed was the most important product of mariculture (Table 6) while Milkfish (Bangus) and tiger prawns (Sugpo) were the most significant species in brackishwater aquaculture (Table 7).

The above data, particularly those on production value, show that although aquaculture has been an important sector, it and fisheries in general remain beset with serious problems that hinder their full development (e.g. Israel 1999, BAR 1991). The identified most important of the problems in aquaculture and fisheries are:

- a) resource depletion in coastal waters - fish stocks in coastal waters are already seriously depleted due to over-fishing and destructive fishing;
- b) environmental damage in marine waters - large portions of marine waters are already seriously damaged, as manifested by the destruction of coral reefs and mangroves and the pollution of marine waters;
- c) environmental damage in inland waters - numerous rivers, lakes and other inland waterways and bodies are either already dried-up, sediment-laden or highly polluted;

**Table 1. Volume of Fish Production in the Philippines, by Sector (MT), 1991-2000**

Year	Commercial	Municipal	Aquaculture	Total
2000	946,485	943,951	978,169	2,868,605 P
1999	948,754	924,693R	948,995	2,822,442 R
1998	940,533	891,146	954,656	2,786,335
1997	884,651	942,466	957,390	2,766,507
1996	879,073	909,248	980,829	2,769,150
1995	893,232	972,043	919,810	2,785,085
1994	859,328	992,578	869,083	2,720,989
1993	824,356	1,013,969	793,620	2,631,945
1992	804,866	1,084,360	736,381	2,625,607
1991	759,815	1,146,765	692,401	2,598,981

Source: 2000 Philippine Fisheries Profile

P-Preliminary

R- Revised

**Table 2. Annual Growth Rates of Volume of Fish Production in the Philippines, by Sector (%), 1992-2000**

Year	Commercial	Municipal	Aquaculture	Total
2000	(0.24)	2.08	3.07	1.64
1999	0.87	3.76	(0.59)	1.30
1998	6.32	(5.45)	(0.29)	0.72
1997	0.63	3.65	(2.39)	(0.10)
1996	(1.59)	(6.46)	6.63	(0.57)
1995	3.95	(2.07)	5.84	2.36
1994	4.24	(2.11)	9.51	3.38
1993	2.42	(6.49)	7.77	0.24
1992	5.93	(5.44)	6.35	1.02
Average	2.43	(2.71)	3.71	0.78

Source: Table 1

**Table 3. Value of Fish Production in the Philippines, by Sector (Million Pesos), 1991-2000**

Year	Commercial	Municipal	Aquaculture	Total
2000	33,878	32,515	29,078	95471 P
1999	32,242	30977 R	26,810	90029 R
1998	29,737	28,966	26,161	84,864
1997	25,935	27,393	27,383	80,711
1996	24,555	25,373	33,206	83,134
1995	23,065	26,464	33,555	83,084
1994	20,714	24,475	35,003	80,192
1993	18,021	22,031	30,163	70,215
1992	16,801	22,656	25,986	65,443
1991	15,245	22,133	22,656	60,034

Source: 2000 Philippine Fisheries Profile

P- Preliminary

R- Revised

**Table 4. Annual Growth Rates of Value of Fish Production in the Philippines, by Sector (Million Pesos), 1992-2000**

Year	Commercial	Municipal	Aquaculture	Total
2000	5.07	4.96	8.46	6.04
1999	8.42	6.94	2.48	6.09
1998	14.66	5.74	(4.46)	5.15
1997	5.62	7.96	(17.54)	(2.91)
1996	6.46	(4.12)	(1.04)	0.06
1995	11.35	8.13	(4.14)	3.61
1994	14.94	11.09	16.05	14.21
1993	7.26	(2.76)	16.07	7.29
1992	10.21	2.36	14.70	9.01
Average	9.33	4.48	3.40	5.39

Source: Table 3

**Table 5. Volume of Fish Production in the Philippines, by Aquaculture Systems (MT), 2000**

Region	Total Aquaculture	Brackishwater Fishpond	Freshwater Fishpond	Fresh and Marine water		Mariculture
				Fishpen	Fishcage	
NCR	1,050	372	0	622	56	0
CAR	1,581	0	470	0	1,111	0
I	30,258	17,530	1,610	5,549	2,308	3,261
II	3,380	872	1,721	0	779	8
III	112,922	71,987	37,873	101	51	2,910
IV	216,742	15,404	1,096	26,762	21,403	152,077
V	18,281	2,614	86	0	4,191	11,390
VI	91,574	62,162	205	0	15	29,192
VII	19,179	8,409	4	0	5	10,761
VIII	4,409	1,812	50	0	23	2,524
IX	117,240	10,417	58	43	63	106,659
X	2,364	2,099	203	2	23	37
XI	16,271	12,211	937	369	2,184	570
XII	10,152	8,651	589	0	805	107
XIII	5,014	2,984	39	26	37	1,928
ARMM	327,752	1,884	36	17	13	325802
<b>TOTAL</b>	<b>978,169</b>	<b>219,408</b>	<b>44,977</b>	<b>33,491</b>	<b>33,067</b>	<b>647,226</b>

Source: 2000 Philippine Fisheries Profile



**Table 6. Production from Mariculture in the Philippines, by Species (MT), 2000**

<b>Region</b>	<b>Total</b>	<b>Oyster</b>	<b>Mussels</b>	<b>Seaweeds</b>
NCR	0	0	0	0
CAR	0	0	0	0
I	3,261	3,261	0	0
II	8	8	0	0
III	2,910	2,910	0	0
IV	152,077	2,737	6,628	142,712
V	11,390	32	611	10,747
VI	29,192	3,050	7,054	19,088
VII	10,761	127	0	10,634
VIII	2,524	0	2,462	62
IX	106,659	238	13	106,408
X	37	0	0	37
XI	570	57	0	513
XII	107	0	0	107
XIII	1,928	0	0	1,928
ARMM	325,802	0	0	325,802
<b>TOTAL</b>	<b>647,226</b>	<b>12,420</b>	<b>16,768</b>	<b>618,038</b>

Source: 2000 Philippine Fisheries Profile

**Table 7. Production from Brackishwater Fishpond in the Philippines, by Species (MT), 2000**

<b>Region</b>	<b>Total</b>	<b>Bangus</b>	<b>Sugpo</b>	<b>Other Shrimp/Prawn</b>	<b>Others</b>
NCR	372	360	4	0	8
CAR	0	0	0	0	0
I	17,530	16,278	164	89	999
II	872	243	181	79	369
III	71,987	45,950	19,061	24	6,952
IV	15,404	13,460	1,639	174	131
V	2,614	1,234	346	42	992
VI	62,162	60,458	1,139	97	468
VII	8,409	6,316	2,063	0	30
VIII	1,812	1,573	212	0	27
IX	10,417	5,727	3,472	522	696
X	2,099	1,592	433	0	74
XI	12,211	11,391	453	34	333
XII	8,651	3,527	4,942	62	120
XIII	2,984	1,537	1,177	133	137
ARMM	1,884	1,313	178	29	364
<b>TOTAL</b>	<b>219,408</b>	<b>170,959</b>	<b>35,464</b>	<b>1,285</b>	<b>11,700</b>

Source: 2000 Philippine Fisheries Profile

- d) resource depletion in coastal waters - fish stocks in coastal waters are already seriously depleted due to over-fishing and destructive fishing;
- e) environmental damage in marine waters - large portions of marine waters are already seriously damaged, as manifested by the destruction of coral reefs and mangroves and the pollution of marine waters;
- f) environmental damage in inland waters - numerous rivers, lakes and other inland waterways and bodies are either already dried-up, sediment-laden or highly polluted;
- g) poverty among municipal fishermen - this group of fishermen are among the poorest of the poor and their ranks continue to swell because of the worsening economic situation;
- h) low productivity in aquaculture – the sector is hindered by various problems including environmental deterioration, the scarcity of fry, high cost of production inputs, diseases, red tide, and other problems;
- i) underutilization of offshore and exclusive economic zone (EEZ) – these areas are underutilized due to limitation in capital, fishing equipment and technology among commercial fishermen; and
- j) high post-harvest losses - it is estimated that losses amount to 20 percent to 40 percent of total output.

To address the various problems in aquaculture and fisheries, Republic Act (RA) 8550 or the PFC was passed in 1998 to properly develop, manage and conserve aquatic species and the fisheries sector. A broader and complementary law, RA 8435 or the Agriculture and Fisheries Modernization Act (AFMA) was also legislated earlier in 1997 to modernize and hasten the development of the agriculture and fisheries sectors. The two laws currently serve as the legal and policy bases for the development of the agriculture and fisheries sectors of the Philippines (see FRMP 2000).

From the time of their passing up to the present, however, the PFC and AFMA have been under-funded as a result of increasing budget deficits and economic difficulties faced by the country. In addition, there are also some

provisions in the PFC that until now have been contested by opposing parties, the most notable of which are the expansion of municipal waters from 7 to 15 kilometers from the coastline (Section 18) and the definition of the general coastline of municipalities to include offshore islands (Section 4, No. 58). Commercial fishermen generally challenged the two provisions because they extend the areas for municipal fishing and reduce the areas for commercial fishing. For their part, municipal fishermen questioned the first provision because under it, small and medium commercial fishermen are allowed to operate within 10 to 15 kilometers from the coastline under certain conditions. The under-funding and the contentious provisions greatly limited the implementation of the objectives of the two laws.

Institutionally, the Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture (DA) manages the aquaculture sector (BFAR also manages the commercial fisheries while the Local Government Units, or LGUs, run the municipal fisheries). Aside from this agency, some other government institutions are involved in aquaculture development. Those involved in fisheries and aquaculture Research and Development (R&D) are the Bureau of Agricultural Research (BAR) under DA and the fisheries-oriented State Colleges and Universities (SCUs), the most prominent of which are the Marine Science Institute (MSI) of the University of the Philippines in Diliman (UP-Diliman), Institute of Aquaculture (IA) of the University of the Philippines in the Visayas (UPV), Freshwater Aquaculture Center (FAC) Central Luzon State University (CLSU) and the Mindanao State University in Naawan (MSU-Naawan).

Overall, the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) under the Department of Science and Technology (DOST) manages and coordinates fisheries and aquaculture R&D in the country. The BFAR is also now in the process of organizing the National Fisheries Research and Development Institute (NFRDI) to served as its R&D arm, as mandated by the PFC. This institute forms part of the National Research and Development Network of the DOST.

The Philippine government also hosts the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC AQD), a regional treaty organization. This Department is the leading institution conducting R&D on aquaculture commodities of importance to the Southeast Asian (SEA) Region. Its program of work considers the priorities of the host government that is its main source of funding support.

As part of its management functions, BFAR conducts training and extension activities in fisheries and aquaculture through its regional offices. In addition, the LGUs have their Provincial Agricultural Offices (PAOs) and Municipal Agricultural Offices (MAOs) that are involved in the management of local agricultural concerns, including training and extension in aquaculture. As will be explained later, some other institutions involved in aquaculture also play a role in the dissemination of mature aquaculture technologies to local aquaculture practitioners and potential investors.

In addition to the above institutions, community-based coastal resources management (CBCRM) projects run by various government offices, Non-governmental Organizations (NGOs), and/or People's Organizations (POs) play important roles in fisheries and aquaculture development. The Fisheries Resources Management Project (FRMP 2001) provided a listing of these CBCRM activities. Among the most prominent of the CBCRM projects are the FRMP, Coastal Resource Management Project (CRMP) and the Coastal Environment Program (CEP).

Because of their great importance to overall fisheries and aquaculture development, the PFC and AFMA serve as starting points in the discussion done below on the key strategy elements mentioned in the Bangkok Declaration vis a vis Philippine aquaculture. The different institutions and projects involved in the development of the aquaculture and fisheries sectors will also be highlighted in the discussions whenever appropriate.

### **III. Key Strategy Elements and Philippine Aquaculture**

#### **3.1 *Investing in People Through Education and training***

The Philippines has been making numerous important advances in terms of education and training. For fisheries in general, among the various provisions of the PFC related to education are the professionalization of fisheries graduates (Section 115); upgrading of the state fisheries schools and colleges (Section 116); inclusion of fisheries conservation subjects in school curriculum (Section 117); and d) educational campaign at all levels (Section 118). In terms of training and also extension, the PFC furthermore specifically mandated the NFRDI to provide a venue and intensive training and development of human resources in the field of fisheries for the maximum utilization of technology (Section 85); provision of extension services (Section 120); and the development of a National Fisheries Extension Program (NFES).

In addition to the above-mentioned provisions of the PFC, the AFMA placed education and training as forefront strategies by dedicating an entire separate title (Title 2) on human resource development that put priority to education and training on science and technology in the agriculture and fisheries sector (refer to Sections 65-79).

At the level of institutions, some agencies involved in aquaculture development have been conducting technology-oriented training, as well as extension, in aquaculture for many years. SEAFDEC AQD, in particular, has a strong training and extension program through its Training and Information Division (TID) that has produced international and national graduates from both the public and private sectors of the aquaculture industry. Some of these trainees became trainers themselves in their own countries or in the other agencies involved in local aquaculture training. Recently, SEAFDEC AQD, in cooperation with the University of the Philippines Open University, also initiated the development of a distance-training course through the internet to reach out to more trainees from far away places.

As already mentioned, the regional agencies of BFAR and the LGUs through the PAOs and MAOs have been conducting aquaculture training and

extension, as well as some SCUs that conduct the same in their respective areas. Aside from coordinating fisheries R&D, PCAMRD also conducts training and other information dissemination related to different activities in fisheries, including aquaculture, through its Research Information and Utilization Division (RIUD).

The provisions of the PFC related to education have been slowly implemented. For instance, at present the Board of Examiners for Fisheries is already organized but the first actual examinations to professionalize fisheries graduates still have to be conducted due to organizational and operational constraints according to key informants at the PRC. Training and extension in fisheries and aquaculture have been constrained by many limitations also, aside from the general problem of slow implementation due to inadequate funding for the PFC and AFMA. One is the limited expertise among BFAR, PAO and MAO personnel involved in training and extension. The problem of limited expertise in BFAR can be traced to the transformation of the bureau in the early nineties from a line agency to a staff agency. The change dissolved the regional offices of BFAR and devolved its extension functions to the LGUs. When BFAR was reverted back to a line agency in the late nineties, it got back its extension function but had to develop again its personnel for such work. But with the limited budget and competing priorities, the agency is hindered from developing an effective extension program up to now.

In the case of the LGUs, the PAOs and the MAOs conduct extension work with the cooperation of BFAR. But they also have limited expertise because of the low budgets at the provincial and municipal levels for training the extension workers. These workers eventually end up as generalists without little specialist ability for particular extension needs in the field. In addition, extension work at the LGU level is a low priority in several cases due to the perception of local politicians that it is not a high profile government program that can generate significant votes for them during elections.

Another problem related to training and extension is the poor coordination among the different agencies. Among the underlying reasons for this problem is the lack of a central plan for training and extension activities. Another contributing

factor is the propensity of some administrators to treat their institutions as individual units conducting activities to attain separate objectives, with little regard for potential duplication of activities.

It is recommended that trainers and extension workers in the pertinent government agencies must be constantly trained and re-trained to keep them updated of new technologies and developments. In this regard, the Agricultural Training Institute (ATI) under the DA and SEAFDEC AQD, among others, can play the lead roles. Furthermore, investment must be made in new technologies, such as computers and the internet, that can be used for education and training purposes. Also, the NFEP must be immediately drafted and implemented to generate a cohesive and concerted training and extension effort and help reduce the potential duplication of efforts.

Following the provisions of the PFC, the schools in the country with aquaculture curriculum offerings should be upgraded by the national government to produce graduates not only for the requirement of the local aquaculture industry but also to meet the demand from other countries. Based on the development trends of aquaculture worldwide, this demand will increase in the years to come. Thus, similar to what it is doing for the maritime industry, the government could play an active role in negotiating with foreign governments or firms, for instance for the placement of aquaculture and fisheries graduates. This way, the government helps spread goodwill and at the same time earn foreign currency for itself and its citizens.

### **3.2 *Investing in Research and Development***

The serious commitment of the government to aquaculture R&D is manifested by its hosting of the SEAFDEC AQD which is mostly public funded since it commenced operations in 1973. In general, however, the problem of low budget for aquaculture and fisheries R&D remains (e.g. Israel 1999). Partly to address this problem, the PFC appropriated an initial one hundred million pesos as Special Fisheries Science and Appofishtech Fund (Section 112). The fund was intended to provide technical and financial support to the development of



appropriate technology in fisheries, including its ancillary industries. The PFC also dedicated its entire Chapter 5 to fisheries R&D that, among others, provided for the establishment of the NFRDI to serve as the primary research arm of BFAR. For its part, AFMA devoted Chapter 1 of Title 3 to Research and Development promoting science and technology as essential for national development. It details the roles of appropriate government agencies, research and academic institutions within the framework of National Research and Development System. It also mandated that the budget for agriculture and fisheries during the first year of the implementation must be realigned so that ten percent of it must be appropriated specifically for R&D activities in the agriculture and fisheries sectors.

Since the implementation of the two laws, government-funded R&D activities in agriculture and fisheries have peaked up under the BAR system. For aquaculture specifically, BAR has organized a National Aquaculture Research Network that manages the conduct of aquaculture-based R&D activities it is funding. However, in totality, R&D funds for fisheries and aquaculture may not have risen as much as intended because of the under-funding of the PFC and AFMA. The implementation of the NFRDI has been at a slow pace as well due to funding related and bureaucratic problems. The functional relationship between the NFRDI and other government fisheries R&D agencies, like the BAR and PCAMRD, are also not clear and need to be ironed out to prevent potential duplication of functions between agencies. Still another important problem is that the R&D agencies in aquaculture have not been collaborating as well as they should, thus, significantly limiting the total delivery of outputs.

To address the above problems, the R&D funds promised in the PFC and AFMA should be made available; a National Fisheries R&D Program must be developed and implemented to provide a clear direction to the currently fragmented activities done by competing institutions; the NFRDI must be operationalized and its role vis-a-vis the other R&D agencies be made clear; and R&D must be directed more toward downstream research and technologies that can readily meet the current demands.

Furthermore, a very important component of any R&D program is the professional staff. Although nationwide there is a large number of aquaculture-related trained Ph.D. and Masters degree holders, only a small number of these may actually produce quality research output. This deficiency is due largely to the lack of research facilities or lack of experience or guidance from senior researchers.

To improve on the abovementioned situation, team research where researchers from different institutions who have common research areas of interest work as a team must be encouraged by the R&D institutions. The members of the research team could be a good mix of senior and junior researchers. If some institutions lack research equipment, experiments may be conducted in the most equipped institution. In certain instances a researcher from one R&D institution may be seconded or detailed in another institution to allow this type of collaborative research. A most appropriate venue for research collaboration, for instance, is the aquaculture new biotechnology laboratory at SEAFDEC AQD where joint projects will be implemented by BFAR and SEAFDEC AQD. In the course of implementation of the biotechnology related activities and programs, other institutions must be strongly encouraged to collaborate with the activities conducted there.

A particularly encouraging development along the above line is the ongoing process of establishing a tie-up between SEAFDEC AQD and UPV initiated by the heads of the two institutions. At present, a Memorandum of Understanding (MOU) has been prepared to provide the basis for these institutions to work together in the various areas of research, training, extension and instruction. If these efforts actually produce tangible results, the collaboration can serve as a good model for institutions to follow.

In general, results of R&D done by the institutions should also be verified in various field conditions. Examples of these activities are the demonstration centers of BFAR established in different regions of the country. The verification exercise serves as a demonstration of technology and promotes effective dissemination to farmers.

### **3.3 *Improving Information Flow and Communication***

For this purpose, the PFC mandated BFAR to establish and maintain a Comprehensive Fishery Information System (Section 65); required the NFRDI to formally establish, strengthen and expand the network of fisheries-researching communities through effective communication linkages nationwide (Section 85); and stipulated that Filipino representatives abroad and foreign-based personnel may be required to assist in the collection of fisheries data and information (Section 121). For its part, the AFMA mandated the DA to set-up a National Information Network (NIN) at all levels taking into account existing information networks and systems (Section 41). This network was intended to provide information and marketing services related to the different aspects of the agriculture and fisheries (Section 42).

In actual implementation, the FRMP has been assisting BFAR attain its job on improving information flow and communication by continuing work on the Philippine Fisheries Information System (PHILFIS), a project originally developed under the Fisheries Sector Program (FSP), the predecessor of FRMP. An important thing that sets PHILFIS apart from other information systems is its use of the Geographic Information Systems (GIS), a relatively recent technology for mapping and overall information management. At present, PHILFIS is a bit behind schedule but is nearing operationalization. The establishment of the Data Management Center of FRMP, which will be the physical center of PHILFIS, has just been approved. Eventually, this center will become the Management Information System (MIS) of BFAR once FRMP ends and PHILFIS is turned over to the bureau for long-term management.

For a long time also, SEAFDEC-AQD has been maintaining at its main library in Tigbauan, Iloilo aquaculture related collection of monographs, SEAFDEC publications and international journals. The library, reputed to have the most extensive aquaculture collection in Southeast Asia, serves requests for online searching of databases like ASFA, Fish and Fisheries Wildlife and Life Sciences on CD-ROM. Just recently, the library launched its on-line public access catalog to provide searchers access to AQD's collection.

The other agencies and institutions involved in aquaculture maintain their own databases or information systems related to the fisheries and aquaculture. For instance, under its RIUD, PCAMRD has been maintaining library and information services that provide various publications, tri-media releases and other materials related to fisheries and aquaculture.

Because PHILFIS is internet-based, linking the system with the information systems of the other institutions involved in fisheries and aquaculture presents surmountable problems. The challenge over the long-term is for BFAR, the LGUs and other potential users away from the city centers to be able to equip their offices with the physical and manpower resources to run PHILFIS. Currently, this has been done by the FRMP for PHILFIS although the build up of the needed resources has been slow due to various financial and bureaucratic constraints faced by the project.

To improve information flow and communication, BFAR must further invest in PHILFIS to make it relevant to the regional and local areas and a true center to and from which the databases and information systems of other local and international institutions can be linked; PHILFIS and other local information systems must develop and contain the appropriate databases and information systems which are geared to serve the needs not only of researchers and technical personnel but also the potential industry users; and the relevant agencies must promote the use of their databases and information systems by making them more accessible to all users, including those coming from the industry and rural areas by providing relevant lectures and training as well as helping provide the necessary equipment and related physical requirements.

### **3.4 *Improving Food Security and Alleviating Poverty***

This strategy is of foremost importance because of rising population, decreasing productivity, and increasing incidence of poverty in the Philippines. Fittingly, the PFC (Section 2) and AFMA (Section 2) declared food security and poverty alleviation as major policies and objectives of the State. However, most of the sections in the PFC addressing poverty alleviation were only explicitly designed for the municipal fisheries sector where many of the poor coastal communities

belong. In terms of improving food security, many sections in both the PFC and AFMA relate to the commercial fisheries and aquaculture sectors where increasing production is a major thrust.

At the institutional level, food security has been served by various agencies and institutions whose technology-oriented R&D has been geared toward increasing productivity in the sector and promoting food security in the entire country. BFAR in particular has an ongoing effort called the Aquaculture for Rural Development Program in collaboration with SEAFDEC AQD and other agencies that vigorously disseminates mature technologies particularly to small and medium-scale practitioners in the rural areas. The proliferation of CBCRM projects in the countryside that promote small-scale aquaculture and sea-farming activities also meet the objectives of food security and poverty alleviation. In particular, the FRMP which covers the eighteen major bays in the country has poverty alleviation and income diversification activities promoted among the coastal population in some of these bays, including those that are aquaculture-based such as the farming of crabs, milkfish, tilapia and other species.

The actual economic impacts of the above activities, for instance in terms of employment and income generation among the local population, are not known at present as studies to determine these are still to be conducted. Certainly, at present these activities are limited in scope when compared to the total number of poor people living in the coastal areas. Also, whatever efforts to attain food security and poverty alleviation in the country will clearly fall short if over-population at the national level and particularly in the depressed coastal countryside is not forcefully addressed.

For purposes of food security and poverty alleviation, current efforts that address food security and poverty alleviation in the coastal countryside such as the BFAR and SEAFDEC AQD initiative and the CBCRM projects must continue to be supported and if possible expanded. The county must also conduct a serious, sustained and long-term effort to address population-related issues in the coastal rural areas as well as nationally, by pursuing its ongoing population control

programs vigorously and putting up strong political will in the face of opposition from various sectors.

At the micro level, efforts to increase fish food supply coming from aquaculture should focus on the productivity of different scales of farms. In general, large-scale farms have better access to capital, technology and resources and have better capability to mass-produce low-value fish species with small profit margins per unit weight, such as milkfish and tilapia. The growth of these farms must be encourage by offering attractive incentives so that they get into the production of low-value species and help increase supply for the consumption of the masses.

This is not to argue, however, that small, traditional farms should not be supported. On the contrary, the growth of these farms must be encouraged also, particularly if they can get into the culture of environment-friendly and high-value species not for consumption but for sale. This will greatly help raise the viability of small farms and improve the lot of their owners and workers. Along this line, the pertinent agencies should intensify the transfer of technologies for the culture of high-value ones to small-scale operators and provide institutional support through financing and marketing services. In addition, the culture of non-food fish, like ornamentals, can be a major form of livelihood for small-scale operators, if done in accordance with established standards. The government should then endeavor to disseminate appropriate information related to state-of-art practices and marketing channels for these species.

The use of small farm reservoirs (SFR) for fish production, an untapped potential in many agricultural locations, is another area that can help contribute to fish food security in the country. Although some of these SFRs are just holding facility for irrigation water---filled up during the rainy season and drained during the dry season---the period when there is ample water can allow one grow-out production cycle for tilapia or catfish. BFAR in particular should promote the establishment of demonstration and training centers related to this activity in strategic areas equipped with hatchery and nursery to supply the seed requirements of farmers.

### **3.5 *Improving Environmental Sustainability***

Like food security and poverty alleviation, environmental sustainability is a key strategy in fisheries and aquaculture development. The PFC listed the conservation, protection and sustained management of the country's fishery and aquatic resources as its number one objective (Section 2). For aquaculture, there are various provisions that pertain to environmental sustainability. Among others, the PFC required that environment-friendly practices be applied in publicly owned fishponds (Section 46), a code of practice for aquaculture be put up (Section 47), incentives and disincentives for sustainable aquaculture practices be established (Section 48), and reversion of all abandoned, underdeveloped or underutilized fishponds to their original mangrove state be done (Section 49). As a development principle, the AFMA for its part also explicitly stipulated that the State shall promote development that is compatible with the conservation of the ecosystem in areas where agriculture and fisheries activities are carried out (Section 2).

The trend toward environment-friendly aquaculture is not only evident in the laws but also in the activities of the various aquaculture agencies and institutions in recent years. The R&D program of SEAFDEC AQD is full of environment-related studies for various species and stages of culture. Some of its training and extension activities are also into sustainable resource management, such as those on environment-friendly intensive shrimp farming and mangrove friendly aquaculture. Furthermore, the institution is the lead agency in the ongoing effort to develop a Regional Implementing Guidelines of the FAO Code of Conduct for Responsible Fisheries-Aquaculture Development (RCCRF-AD) for the ASEAN region.

As to the other institutions, under its aquaculture improvement and development activities, BAR has activities geared specifically toward the reduction of environmental impacts of aquaculture. Over the years, PCAMRD also has been allotting a substantial part of its R&D resources to address various aspects with environmental importance, including those in the aquaculture sector. Because of the strong trend favoring the environment, the SCUs and other agencies are into the action and allotting some of their budgets on environmental problems and

concerns. The MSI is particularly strong on this regard although its concentration is more on issues related to the management of marine resources in general and not on aquaculture alone. For its part, as lead agency, BFAR has caused the publication of the Code of Practice for Responsible Shrimp Farming (2000) and the promulgation of the Code of Practice for Aquaculture in September 2001 as Fisheries Administrative Order (FAO) No. 214.

While activities with environmental implications are peaking up in aquaculture, they are still far below the desired level as serious environmental problems in the sector remain. Limited budgets and the overriding concern to produce more to meet the needs of the growing population impede the development of a totally environmentally responsible aquaculture sector. The limited adoption of environment friendly practices is also problem because of the profit motive orientation of the private sector in general, voluntary nature of the code of practice for aquaculture, and weak monitoring and enforcement capabilities of both the national and local governments. Another important cause of weak adoption of environment friendly practices is the apathy of many people brought about by a long tradition of careless attitude toward the environment and the ineffective existing legal and institutional mechanisms to fully penalize those who damage the environment. Still another obstacle is that even for some people who are prepared to adopt environment friendly practices, doing so may not be possible due to lack of financing, for instance in there-construction of their farms to suit these practices.

For environmental sustainability in aquaculture, R&D agencies such as SEAFDEC AQD should continue research on environment-friendly technologies such as those that reduce feed use and fertilization rate per unit area and the government must promote the use of these technologies among the private sector through effective training, extension and demonstration. The adoption by the private sector of the codes of conduct for fisheries and aquaculture should be hastened by developing economic incentives to improve environmental-friendly culture practices among them. A review of the existing system for penalizing environmental offenders in aquaculture must also be done to identify loopholes,



improve on the system and make it an effective deterrent for potential offenders as well as punishment for actual ones.

Furthermore, BFAR in collaboration with the DENR and other pertinent offices should pursue a zoning or resource-use plan nationwide. The zone for aquaculture should be defined by its environmental carrying capacity. If any zone to be designated by the plan would be found overcrowded with existing farms exceeding the carrying capacity of the zone, BFAR should stop the operation of some farms to reduce environmental load to within the carrying capacity. The government should also provide incentives to encourage farmers to locate their farms within designated zones through the provision of infrastructure, training on best management practices, access to credit and marketing support and other related forms of assistance.

The national government should further promote the establishment of land-based aquaculture parks or mariculture parks. The concept of these parks is akin to that of a subdivision with a specified number of lots that is leased and occupied. For a certain site the appropriate number and size of ponds (for aquaculture parks) or number and size of cages (for mariculture parks) are determined. The government or private entrepreneur provides the ponds or the mooring facilities and related infrastructure while the aquaculture operators pay the lease for the number of ponds or mooring spaces they occupy. The parks are designed in such a way that environmental deterioration at the farm level and negative environmental impact on adjoining areas are avoided.

### **3.6 *Integrating Aquaculture into Rural Development***

An important provision of the PFC related to this strategy is the formation of Fisheries and Aquatic Resources Management Councils (FARMCs) composed of fisherfolk organizations and other government and non-government stakeholders in the rural coastal areas assigned to develop and manage aquatic resources (Article II). At present, some of these FARMCs are already operating and perform various functions including the formulation of fishery development plans, sometimes

covering aquaculture and sea-farming activities, wherever appropriate, in the respective rural coastal areas.

In addition to the above provision of the PFC, the AFMA has a rural industrialization and industry dispersal program (Chapter 3) that provides incentives to agriculture and fisheries-based business and industries that locate in rural areas and employ the rural population. Under this program, the proliferation of industrial aquaculture farms in rural communities is to be aggressively promoted, leading to the faster integration of aquaculture into the rural economy.

Some aquaculture and sea-farming activities, such as village seaweed culture, rice-fish culture and fish cage culture have already been practiced in various CBCRM sites around the country. In non-CBCRM sites, various institutions involved in training and extension also help popularize production techniques in the villages. For instance, as already mentioned, SEAFDEC-AQD and BFAR have an ongoing collaborative effort to disseminate developed technologies at SEAFDEC-AQD around the country, through demonstration farms, particularly in the rural areas where they are needed to help uplift the economic plight of the rural population.

Some of the problems faced in the effort to integrate aquaculture into rural development are similar to those on training and extension. In addition, there is the usual limitation in infrastructure like roads, power and communications that are needed for a timely and accurate response to business opportunities and the lack of efficient trading services linking fish-farmers to profitable markets. Furthermore, the limited credit support for the rural population to start aquaculture ventures is a long-term issue that continues to crop up regardless of the various programs already initiated by the government to provide credit to rural entrepreneurs. In some cases, credit is actually available but not accessed by the intended rural beneficiaries because of collateral requirements that cannot be met. In other cases, credit is available but only under interest rates and terms that beneficiaries still consider as stiff given the small-scale nature of the enterprises they are planning to put up. Still in other cases, because of the generally low repayment rates in the fisheries sector and the perceived riskiness of aquaculture and

fisheries ventures, providers of credit are hesitant to supply it. Finally, credit may not be available in rural areas where the peace and order situation is highly unstable and volatile.

For integrating aquaculture into rural development, the government should materialize the Aquaculture Investment Fund it promised in the PFC, especially for infrastructure development; support the credit facilities for aquaculture provided by the other fund sources including the CBCRM projects; expand the capability of LGUs to promote aquaculture activities through formal and informal training and extension activities; establish fish hatcheries in the rural areas to provide the seed stocking needs of rural aquaculture; promote integrated agriculture-aquaculture systems wherever they are applicable; and provide needed marketing assistance to rural producers. In addition, if the government pursues the establishment of land-based aquaculture or mariculture parks nationwide already mentioned earlier, it would greatly enhance the integration of small-scale aquaculture into the rural economy.

### **3.7 *Investing in Aquaculture Development***

Being an important component of the fisheries sector, aquaculture has been receiving much attention in terms of financial investment from the government over the years. Continuing this trend, the PFC dedicated an entire article (Article III) and committed an Aquaculture Investment Fund funds (Section 113) to the sector. As already mentioned, the committed funds were not forthcoming in full because of the under-funding of the law. In the case of AFMA, There is no single specific reference in the law for investment in aquaculture in particular. In general, however, it provided for a large initial budget for the implementation of the law that, by itself, can already be taken as investment in agriculture and fisheries as a whole. Chapter 6 of AFMA also provided for infrastructure support, like farm-to-market roads, rural energy, communications infrastructure as priority investment areas, but this, like similar provisions in the PFC, is also greatly constrained by lack of funds coming from the government.

The operations of various government agencies like BFAR, BAR, PCAMRD and the SCUs and other research agencies like SEAFDEC AQD that are involved in aquaculture already indicate substantial government investment for aquaculture development. The creation of the NFRDI will mean additional investments favoring aquaculture and fisheries in general. It appears then that relative to the other fisheries and agriculture sectors and given the tight financial situation the country is in, aquaculture may be one of the sectors receiving firm government financial support.

Although public investment in aquaculture maybe at a relatively favorable level, private investment, particularly in R&D, can certainly stand some improvement. The low private investment in R&D is understandable given the long gestation periods of R&D efforts and the public good properties of R&D generated technologies. Still, strongly promoting additional private investment is necessary to fill in the gap created by limited public funding support for aquaculture due to the budgetary problems the national government has been facing for several years now.

For investing in aquaculture development, the government must provide economic incentives for the private sector to invest more in aquaculture R&D; continue to support aquaculture development by providing the necessary funds for aquaculture R&D and training and extension; support the credit schemes for aquaculture particularly those for micro-enterprises in rural areas; encourage foreign investment such as grants into aquaculture R&D; and promote investment in land-based aquaculture or mariculture parks.

### **3.8 *Strengthening Institutional Support***

For the agriculture and fisheries sectors, the PFC and AFMA are the strongest manifestations of institutional support that the government has provided. For fisheries alone, the creation by the PFC of the position of Undersecretary for Fisheries and Aquatic Resources (Section 63), reconstitution of BFAR from a mere staff agency to a line agency (Section 64), creation of FARMCs (Section 69), and the creation of the NFRDI (Section 82) are further indications of institutional support. In addition, the PFC provided for the provision of various economic

incentives in the aquaculture sector. These include among others the rationalization of the leasing of fishponds (Section 46), incentives and disincentives for sustainable aquaculture practices (Section 48), cancellation of the lease of absentee Fishpond Lease Agreement (FLA) holders (Section 50), licensing for the operation of fish pens, fish cages, cage traps and other structures for the culture of fish and other fishery products (Section 51), provision of pearl farm leases (Section 52), and the provision of insurance to fishponds, fish cages and fish pens (Section 54), the guidelines for which was the subject of FAO No. 125 issued in September 2001.

There are additional actions under institutional strengthening that need to be done for fisheries and aquaculture to move forward. The poor capability of the regional offices of the BFAR to conduct its functions, such as in training and extension, brought about by its being a mere staff agency for a long time before its conversion to line agency recently needs to be addressed. The unorganized FARMCs in many coastal communities also need to be put up as soon as possible. Furthermore, the poor cooperation and coordination between the different government agencies, caused by the lack of a clear national framework for research, development and extension is a long-standing problem in aquaculture and fisheries and thus must be addressed.

For strengthening institutional support, the government must move to decisively settle the contentious provisions in the PFC and AFMA, aggressively pursue the formation of FARMCs, especially at the barangay and municipal levels, encourage the participation of the private sector in the formulation of and public hearings for fisheries and aquaculture codes of conduct in order to improve their chances of compliance, encourage the formation of fishermen cooperatives and associations to pursue fisheries and aquaculture development in the rural areas, and strengthen BFAR as the lead agency for fisheries and aquaculture development.

### **3.9 *Applying Innovations in Aquaculture***

Both the PFC (Chapter 5) and AFMA (Title 3, Chapter 1) recognized the importance of technology innovations through R&D as important vehicles for faster agriculture and fisheries development. In aquaculture, the existence of several

R&D agencies indicates that technology innovations are given priority by the government. Many researches at SEAFDEC AQD deal on important innovations, such as the development of environment-friendly feeds that promote productivity and reduce environmental effects, stock enhancement and ranching that increase fish productivity in the wild, environment-friendly and water recirculating techniques for intensive prawn culture, and integrated systems such as mangrove friendly aquaculture for environmental improvement. At present, mature SEAFDEC AQD technologies are demonstrated in strategic areas of the country in collaboration with BFAR.

The problems on the application of innovations in aquaculture are similar to the problems faced under training and extension. An additional concern is that some of the technological innovations are highly risky and expensive ventures for potential practitioners to apply making them hesitant to do so. For applying innovations in aquaculture, the government should continue to support R&D in technology innovations, such as those done at SEAFDEC-AQD, to reduce financial risks and make them acceptable to aquaculture practitioners; conduct pilot-scale and full-scale testing of innovations before their dissemination; increase training and extension as well as education efforts to increase the application of innovations by the industry; and set codes of practice for the use of specific innovations, particularly those with significant potential environmental ramifications.

Research institutions should also undertake collaborative research with the private sector on technology innovations. Aquaculture technologies are products, not only of research-based information, but also of skills and experience developed through the years of industry practice. Collaboration with industry practitioners could take advantage of the “skills-of-the-trade” aspect hastening technology generation and innovation.

In the face of decreasing funding for extending innovations to practitioners, cheaper approaches must be developed in order to conduct extension effectively. A potential area is the more intensive use of the broadcast media, e.g. radio or television, or the print media, brochures, etc., in extension. This approach has economies of scale properties and can therefore reduce costs per unit. At present,

it is not that well exploit by the government since the emphasis in extension remains farm visitations, on-site extension and other man-to-man approaches. In more specific terms, for instance, government extension agencies can produce training and extension videos for specific mature technologies and innovations and provide these to the different aquaculture cooperatives and organizations that in turn show these to their members who are may adopt the technologies and innovations. The cost of the production of the videos can be recoup by selling them at full cost to the organized buyers so that the activity is sustainable over the long term.

In general, private sector sharing of the cost of government-led extension activities must be promoted. For instance, aquaculture cooperatives and organizations must be made to pay for at least some of the costs of extension, such as honoraria for speakers, etc. This will make the activity cheaper for the government to operate and at the same time diminish the granting of unnecessary training subsidy to aquaculture practitioners.

### ***3.10 Improving Culture-Based Fisheries and Enhancements***

The use of culture-based fisheries and enhancements in common pool fishery resources was also addressed by the PFC. Among others, the law required the LGUs concerned to identify municipal waters suitable for mariculture operations by fishery organizations and cooperatives and provide such organizations demarcated fishery rights (Section 22), required the licensing of fishing operations and culture structures in lakes, rivers and other inland waters (Section 50) and stipulated the creation of FARMCs for bays and other municipal waters, including inland waters like lakes and rivers. The AFMA has no provision on commonly owned resources although it stipulated the development of Strategic Agricultural and Fisheries Development Zones (SAFDZ) to ensure that land and water resources are efficiently and sustainably utilized (Section 6) for agriculture and fisheries development.

Mariculture in commonly owned coastal waters has been done in some areas already. The FRMP has a major program on mariculture development in some of its sites under its efforts for income diversification. No doubt, the other

CBCRM projects in fisheries that have poverty alleviation and income diversification objectives promote mariculture whenever it is applicable. Technologies for stock enhancement and sea ranching are also being developed, by SEAFDEC-AQD particularly for mollusks, abalone, seahorse and other species.

The challenges faced in the promotion of mariculture and other fisheries activities in commonly owned water resources include better extension and dissemination, improved credit access and related concerns. Continued R&D on the applicable technologies for commonly owned water resources, including freshwater, is also a must for a more expansive exploitation of these resources in the future. Furthermore, institutions for the management of common water resources, such as the bay FARMCs at the different management levels must be strengthened for the purpose.

For improving culture-based fisheries and enhancements, the institutions that can help pursue them like the FARMCs and CBCRM projects must continue to be established, strengthened and supported by the government; areas where culture-based fisheries and enhancement are done must be properly zoned, and integrated in a resource management plan, training and extension and credit facilities to organizations like cooperatives must be made available; proper and continuous monitoring must be conducted to assess not only the financial but also the environmental and other impacts, and continued R&D must be exerted to further develop and refine technologies.

The government should actively pursue capability building of LGU's on management of coastal resources through formal and informal training as this would be the key to any successful stock enhancement program. The successful experience of SEAFDEC AQD-initiated coastal resource management project in Malalison, Antique should serve as model for other sites in the country on the sharing of responsibility and authority between the government and local fishers/community. For inland waters, research and academic institutions should conduct studies on the breeding of endangered indigenous species such as the Manila catfish *Arius sp.*, the snakehead *Channa striata*, the goby *Glossogobius*



*giurus*. Availability of breeding technologies for such species would enable restocking of hatchery-reared seeds in rivers or lakes.

### **3.11 *Managing Aquatic Animal Health***

The PFC has some provisions related to the management of aquatic animal health. These include strict guidelines on the importation of foreign species (Section 10) and the importation and exportation of fishery products (Section 61). Also provided for is the establishment of the Fisheries Inspection and Quarantine Service (Section 67) whose functions include the quarantine of aquatic animals and other fishery products determined or suspected to be with fishery pests and diseases and the examination of fishery products coming in and out of the country that may be a source or medium of fish pests and fish diseases.

Over the years, SEAFDEC AQD has been conducting a strong R&D program on fish health that has produced solutions to various health-related problems. The agency has been instrumental in solving health issues in prawn culture that crop up in recent years and contributed to the revival of the prawn industry. It is also helping aquaculture practitioners by providing technical expertise in the detection of fish diseases and offering an internet-based training course in fish health management that will reach out to more participants who do not have to be physically present at SEAFDEC AQD.

It should be pointed out also that the recent move of BFAR in the establishment of diagnostic laboratories nationwide equipped with PCR to detect White Spot Syndrome Virus (WSSV) in shrimp is an important step in the efforts to fish health management. This project will certainly improve the awareness among shrimp farmers of the dreaded virus and its control measures leading to its containment. Another positive step in this direction is the ongoing conduct by BFAR in coordination with SEAFDEC AQD, the Bureau of Export and Trade Promotion of the Department of Trade and Industry (DTI) and the private sector of a series of regional shrimp industry for a in major shrimp producing areas nationwide. This undertaking was intended to generate a more comprehensive consultation with the different stakeholders of the industry and one of its major

objectives is to increase the awareness of the BFAR National Action Program to control WSSV in prawn.

The problem of fish diseases continues however due to various factors. There have been reports of excess dumping of trash fish from other countries that may carry diseases. Other problems are the poor information and dissemination efforts of the concerned agencies on fish diseases and the limited funding resources available for addressing the problem particularly related to R&D. It should also be pointed out that fish diseases and environmental degradation, particularly water pollution, are much related issues in aquaculture. Solving water pollution problems will therefore go a long way toward forcefully addressing the various fish health issues in aquaculture.

Another important issue related to fish diseases is the importation of fry. During the slump in shrimp grow-out production when most hatcheries stopped operation due to low fry demand, there had been a report of illegal importation of *P. monodon* fry. Although the country of origin was not confirmed, that particular shipment was blamed for the first documented occurrence of white spot virus in cultured shrimp in the country. This case highlighted the laxity in the implementation of quarantine regulations.

For managing aquatic animal health, the government must strictly monitor and enforce the trade laws which impacts on fish health, particularly those relating to the importation of fish species e.g. FAOs on the movement, importation, export of fish; set up and adequately finance the institutions provided by law to guard against the entry of foreign borne fish diseases; develop strong linkages between the government and private sector and the international aquaculture community to implement a coordinated approach toward fish diseases; and if possible develop some form of compensation mechanisms for those affected by fish diseases to motivate their cooperation and assistance in an effective fish diseases prevention program.

### **3.12 *Improving Nutrition in Aquaculture***

There are no specific provisions in the PFC and AFMA that deal directly on fish nutrition although it is implicit in the R&D-related provisions of the PFC (Chapter V) that fish nutrition is an important research component in fisheries and aquaculture. Like fish health, fish nutrition is a major R&D program at SEAFDEC-AQD. Over time, the agency has been successful in developing fish feeds that are efficient, cost-effective and utilize local materials as production inputs. In addition, it has promoted low-cost feeds that can be used by small-scale aquaculture production operations by the poor. Currently, among its important ongoing nutrition studies is the development of environment-friendly feeds that minimize the amount of fish meal through substitution with alternative protein source. As a research coordinating agency, PCAMRD has also been funding some researches that are related to nutrition over the years.

There are various concerns in fish nutrition research that remain and need further attention. One is the development of a feed and feeding technique that will allow the highest possible level of utilization of the feed for greater feed efficiency and better environmental management. Another is how to raise the involvement, particularly in funding, of the feed producing private sector that is a direct beneficiary of fish nutrition R&D. Still another issue is at what optimal levels of funding and effort and in what particular areas of work should public agencies commit and concentrate on in terms of nutrition R&D given that the private sector, particularly the large scale feed producers and aquaculture operators, are also into it on their own. This concern is important because of the tight resources available to R&D and the equity concerns in aquaculture development.

For improving nutrition in aquaculture, continued R&D on the various technical concerns related to fish nutrition must be done. These include the development of more efficient, environment-friendly and cost-effective feeds that are also nutritionally enhancing to fish consumers, development of feeds using alternative inputs to fish meal, and development of biotechnological approaches to improve protein contents of vegetable-based alternatives. In addition, the government must find ways to involve and integrate the R&D efforts of the private sector into the overall nutrition R&D program and determine the optimal level of

investment into the program given the integrated participation of the private sector to save on scarce financial resources.

### **3.13 *Applying Genetics to Aquaculture***

There are also no specific provisions in the PFC and AFMA that mention fish genetics although again it is implicit in the R&D program of the law (Chapter V) that fish genetics is a critical component in fisheries and aquaculture. The various R&D institutions considered fish genetics as an important component of aquaculture development. As in the case of fish health and nutrition, research on fish breeding and genetics has a long history at SEAFDEC AQD. The R&D program of this agency has been involved in developing technologies for the maintenance of broodstock for various fish species and the production of quality seeds in its own hatcheries, some of which were distributed to the industry. It has also resulted to the adoption of broodstock and hatchery technologies of various species by the private sector. Currently, it is conducting studies on genetic characterization of different generations of hatchery-bred tilapia and bighead carp, genetic analysis of other indigenous species, and genetic variation on wild population of prawns to serve as baseline information for the eventual captive broodstock development.

A major problem in fish breeding and genetics R&D is insufficient funds for the purpose. The maintenance of broodstocks, hatcheries and related facilities in particular has been taxing for SEAFDEC AQD. It should be mentioned that for some time in the past, BFAR also maintained its National Bangus Breeding Program (NBBP) but was forced to privatize it due to funding problems related to maintenance. There is also the need to account for the activities of the private sector in fish breeding, which are already significant for some species like milkfish, prawn and tilapia, and incorporate these into the planning of a national program for fish breeding and genetics.

For applying genetics in aquaculture, the government must take account of all the fish breeding activities of the private sector and include this into the overall fish breeding and genetics program in the country; strictly implement relevant laws related to the dumping of foreign species into the country and develop rules for the trans-border movements of non-indigenous species; design an equitable

dissemination program for the results of breeding and genetic activities, such as the establishment of hatcheries for low-value species like tilapia in Mindanao and other remote inland areas; provide focus and support for the development of captive broodstock for prawns, and develop an educational program for informing the public of the merits of genetics in aquaculture.

### **3.14 *Applying Biotechnology***

Biotechnology is now well accepted as a very promising avenue for attaining increased production in both agriculture and fisheries. As proof, AFMA mandated that 4% of the 10% allotted for R&D during the first year of implementation shall be used to support the Biotechnology Program. For aquaculture in particular, biotechnology is potentially useful in the search for new feeds and the improvement of the composition of feeds, improvement of the growth rates and control of reproductive cycles through use of hormones therapy, production of new vaccines and development of disease resistance and tolerance to low oxygen levels in fish to name some.

Biotechnology is only beginning to be applied in Philippine aquaculture. SEAFDEC-AQD has been pursuing a biotechnology R&D program and just lately, the National Economic and Development Authority (NEDA) approved a P431 million Japanese grant to modernize its laboratory and other facilities for the main purpose of starting a biotechnology program. This is a major milestone in aquaculture development that will keep the country at pace with the more developed countries in the application of modern technologies for increased production.

Being a new program, there are various problems in the application of biotechnology for aquaculture development and some are cost related. Personnel need to be further trained to fully exploit the full potentials of biotechnology research and this costs additional funding at this time when additional government money may not be forthcoming. Furthermore, intensive information drives are also needed to inform the public on various biotechnology-related concerns, such as Genetically Modified Organisms (GMOs), to increase their acceptability of biotechnology as an appropriate tool for development. At

present, resistance to biotechnology has been building up in the press and among the other sectors of the population and this could politically significantly hinder its application.

For applying biotechnology in aquaculture, the government must develop and implement a concerted biotechnology program in aquaculture building on what is already going on at SEAFDEC-AQD and other institutions; invest resources for the training of technical personnel to man the program; develop strong contacts and linkages in the international community for the financial and technical support of the program; implement an active effort to educate the public of the importance of biotechnology, including its safety and environmental aspects; and study deeply and explain to the public the potential impacts of serious biotechnology related issues, particularly of GMOs, on social welfare.

### **3.15 *Improving Food Quality and Safety***

The PFC addressed food quality and safety with the provision mandating the establishment of the Fisheries Inspection and Quarantine Service (Section 67). Along this line, the Implementing Rules and Regulations (IRR) of the law ordered the establishment and enforcement of safety and quality standards on aquatic organisms and fishery products for domestic consumption and international trade and consistent with international trade agreements. Furthermore, it also required the establishment and implementation of laboratories, Hazard Assessment Critical Control Points (HACCP)-based fish inspection system and Quarantine Inspection Unit for the purpose of maintaining food quality and safety standards in fishery products. On the part of AFMA, the law mandated the establishment of the Bureau of Agriculture and Fisheries Product Standards (BAFPS) to set and implement standards for fresh, primary-and-processed agricultural and fishery products (Section 61).

Despite the above, marketable fish and fry from foreign countries, some of which may be contaminated, continue to be dumped or illegally imported to the country. An obvious reason for this is the very slow establishment of the institutions mandated by law to improve food quality and safety and the weak implementation of the PFC. In general, the propensity of the consuming public to

purchase cheap fish regardless of quality has also contributed to the incidence of fish-related health problems. The poor maintenance and unhealthy conditions in fish markets, particularly the poor management of the disposal of solid wastes, and the non-availability of fish storing and post-harvest facilities in many areas aggravate the problem.

For improving food quality and safety, the government must immediately move for the faster establishment and operation of the institutions for food quality and safety and strongly implement the related laws and regulations; improve the quality and cleanliness in public wet markets to acceptable standards; exert serious efforts to conform with all international protocols related to food quality and safety; study the potential labeling of aquaculture products to ensure quality and safety and following internationally set agreements; and ensure through strict monitoring and enforcement of rules that the aquaculture industry at each stage in the market chain must conform to set rules and be responsible for the quality and safety of their products.

### **3.16 *Promoting Market Development and trade***

The PFC addressed market development and trade by specifically mandating as one of the functions of BFAR the provision of extensive development services in all aspects of fisheries, including processing and marketing (Section 65). It also dedicated an entire article on post-harvest facilities, activities and trades (Article IV). The AFMA mentioned as a principle global competitiveness and required the State to enhance the competitiveness of the agriculture and fisheries sectors in both domestic and foreign markets. It also required the installation of a market information system (Section 39) and a National Marketing Assistance Program that will immediately lead to the creation of a national marketing umbrella for agriculture and fisheries products (Section 40). Furthermore, it allotted a section on trade and fiscal incentives in the agriculture and fisheries sectors (Title 5).

Overall, the Philippines is implementing trade liberalization through the Tariff Reform Program (TRP) which aims to gradually reduce tariffs on all products, excluding sensitive agricultural products, by a target uniform rate of 5 percent by

2003 (de la Pena 1999). Fishery products are not defined as sensitive products, thus, are part of this program. The reduction of tariffs of fishery products should augur well in the importation of tuna fish for the canning industry and fish meal for the feed industry among others.

There are certain provisions in the PFC related to trade, however, which were problematic. One is the requirement that no person, shall import and/or export fishery products of whatever size, stage or form for any other purpose without securing a permit from the DA (Section 61). This is viewed by some as giving too much power to the DA that makes trade less transparent and can develop unwanted rent seeking among fish importers, fish producers and government officials (De La Pena 1999). Another problem is the prohibition in the exportation of fry of endemic species that may hinder the development of the local fry industry (Section 61). Some quarters further think that the fisheries sector at the moment is weak and cannot compete internationally and should be among the sensitive sectors to be protected. Thus, they proposed that the reduction in the tariffs in fishery products should be slowed down to make the sector adjust less painfully to the changes. The TRP, however, is already law and revising it will require a tedious and drawn-out effort through the legislature. Furthermore, since 2003 is already close when the uniform target rate of 5 percent is applied, any effort to revise the rates is now too late.

For promoting market development and trade, the government must seriously study the contentious provisions in the laws related to trade and have these amended in time if necessary; develop assistance schemes to the fisheries industry in order for it to wither the initial negative effects of tariff reduction and survive in the face of strong international competition; and strongly support the post-harvest component of the industry by implementing what has been planned under the PFC and AFMA.

### ***3.17 Supporting Strong Regional and Interregional Co-operation***

The PFC made no mention of regional and interregional co-operation as a strategy in fisheries development but it required BFAR to monitor and review international fishing agreements (Section 65). The AFMA also did not touch on the



issue but its recognition of its importance is implicit on its principle of global competitiveness (Section 2).

Being a treaty organization, the linkages of SEAFDEC AQD to other SEAFDEC institutions and other fishery and aquaculture agencies exist. It also has strong linkages with the Food and Aquaculture Organization (FAO), Network of Aquaculture Centers for Asia and the Pacific (NACA) and other international organizations. For instance, recently, it is implementing a Collaborative research under the Philippines-Australia cooperation funded by the Australian Center for International Agricultural Research (ACIAR) on crab aquaculture. In addition, its setting up of a biotechnology program financed by the Japanese government will help promote and improve the regional and inter-regional cooperation in the field of biotechnology R&D. In addition to these, through SEAFDEC-AQD, the Philippines has been an active participant in the ASEAN Fisheries Federation, particularly in its shrimp club, and more recently in the collaborative project of the ASEAN-SEAFDEC Fisheries Consultative Group.

PCAMRD, BFAR and the rest of the institutions in fisheries and aquaculture also have external linkages to various agriculture and fisheries institutions. The Philippines, however, lately lost out to Malaysia as the seat of the International Center for Living Aquatic Resources Management (ICLARM) and this is an important loss to the country. On the other hand, the relocation of ICLARM means that at least some of the manpower and expertise coming from said institution can now move and help develop the national programs. An example is that of some former management information staff of ICLARM working for the FRMP and helping develop the PHILFIS project.

For supporting strong regional and interregional cooperation, the government must continue to seek cooperation in the development of the aquaculture sector with other countries, at the bilateral, regional ASEAN and interregional levels and particularly for emerging issues like safety, quality and trade in aquaculture products. It must continue to support existing international aquaculture organizations housed in the country particularly SEAFDEC-AQD. While no longer located in the Philippines, ICLARM remains an important player in

the development of fisheries and aquaculture throughout the world and local institutions and researchers should maintain its linkages and networking with this institution as well as with FAO, NACA, ASEAN Fisheries Consultative Group, ACIAR and other important international organizations intensively involved in Philippine aquaculture. The government should also make use of Filipino aquaculture expertise to provide technical services as part of international commitment in any appropriate international cooperation.

#### **IV. Conclusions**

In retrospect, the Bangkok Declaration is a welcome development for the aquaculture sector of the Philippines as it further confirms the various key strategies already implemented in the sector. While so, much remains to be done to improve on the actual implementation of the individual strategies mentioned in the Declaration. Aside from the specific recommendations forwarded, in general, the PFC and AFMA must be fully supported and implemented. Funding for the two laws must be increased to at least allow the establishment and operations of the different important aquaculture institutions, programs, projects and activities. Review of the contentious provisions in the two laws must be conducted and amendments made at the appropriate time. This will help result to the settlement of the various issues and the better implementations of the laws. Streamlining of the different government institutions and functions involved in fisheries and aquaculture, particularly those involved in R&D, should be pursued. This will improve coordination among the agencies. Lastly, Increased support for training, extension and dissemination is needed. The strengthening of BFAR regional agencies and the PAOs and MAOs for extension purposes must be given priority.

In conclusion, the path to an efficient and sustainable aquaculture sector requires the serious commitment of the country to fully implement the key strategy elements mentioned in the Bangkok Declaration. It is also by doing things together as a team instead of individually that institutions can attain their goals in the sector in the least cost and time possible.

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