

SEAFDEC/AQD

Highlights 2007

AQUACULTURE DEPARTMENT
Southeast Asian Fisheries Development Center
Tigbauan, Iloilo, Philippines





Acronyms / abbreviations commonly used in this report

ABW	Average body weight (of fish in culture)
ACIAR	Australian Centre for International Agricultural Research
AQD	Aquaculture Department (of SEAFDEC in the Philippines)
ASEAN	Association of Southeast Asian Nations
DA-BFAR	Bureau of Fisheries and Aquatic Resources of the Department of Agriculture (DA) (Philippines)
DOST	Department of Science and Technology (Philippines)
FCG	Fisheries Consultative Group (of ASEAN-SEAFDEC)
IAMSLIC	International Association of Marine Science Libraries & Information Centers
ICD-SA	Institutional capacity development for sustainable aquaculture (project)
IHHNV	Infectious hypodermal and hematopoietic necrosis virus
GIS	Geographic information system
GOJ or GOJ-TF	Government of Japan or GOJ Trust Fund
LGU	Local government units (in the Philippines)
m or m³	Meter or cubic meter
NACA	Network of Aquaculture Centres in Asia-Pacific
NGO	Non-government organization
OJT	On-the-job training / trainee
PCR	Polymerase chain reaction (a process)
R&D	Research and development
PTAC	Philippine Technical and Administrative Committee (under the Department of Agriculture, overseeing AQD programs and activities)
SEAFDEC	Southeast Asian Fisheries Development Center
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
WSSV	White spot syndrome virus

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Department officers

Chief	Dr. Joebert Toledo	Program leaders	Mr. Armando Fermin (Mollusc) Dr. Emilia Quintio (Mudcrab and shrimp) Dr. Felix Ayson / Dr. Relicardo Coloso (Marine fish) (January to June) (July to December) Dr. Anicia Hurtado (Seaweeds) Dr. Ma. Lourdes Aralar (Small-holder freshwater) Dr. Hiroshi Ogata (GOJ-TF) Dr. Gilda Lio-Po (Fish health) Dr. Relicardo Coloso (Nutrition & feed development)
Deputy Chief	Dr. Koichi Okuzawa / Dr. Hiroshi Ogata (January to March) (April to December)	Section heads : RD	Dr. Relicardo Coloso (Nutrition & feed development)
Head, RD	Dr. Evelyn Grace DJ Ayson	: TID	Ms. Kaylin Corre (Training) Ms. Milagros Castanos (Development communication) Ms. Amelia Arisola (Library & databanking services)
Head, TVDD	Dr. Neila Chavoso / Dr. Clarissa Marte (January to July) (August to December)	: AFD	Engr. Salvador Rex Tillo (Engineering) Ms. Didi Baticados (Human resource management) Mr. Juan Garin Jr (Budget-cashiering) Ms. Renee Valencia (Accounting)
Head, TID	Mr. Renato Agbayani		
Head, AFD	Atty. Jerry Opinion		
Head, BFS	Dr. Ma. Lourdes Aralar / Mr. Emiliano Aralar (January to July) (August to December)		
Head, DBS	Ms. Jocelyn Ladja / Mr. Hanani Torilla (January to June) (July to December)		
Head, IMS	Mr. Albert Gaitan		
Head, Manila Office	Dr. Nerissa Salayo		



AQD's abalone hatchery in 2007 produced over 260,000 pieces of early juveniles from 1,292 breeders



Signing of the agreement on an abalone program for the Philippines
Seated L-R: DA Undersecretary Jesus Emmanuel Paras, BFAR Director Malcolm Sarmiento, DA Secretary Arthur Yap, AQD Chief Joebert Toledo, AQD Deputy Chief Hiroshi Ogata
Standing L-R: Guimbal town mayor Christine Garin, 1st District of Iloilo Congressional Representative Janette Garin, Tigbauan town mayor James Excelsior Torres



The tropical abalone *Haliotis asinina* is a sought-after seafood all over the world. It is a delicacy in Japan and an irreplaceable ingredient in Chinese gourmet dishes. Shells can be used as jewelry and furniture inlay

A 5-year program on abalone breeding and culture

Upon recognizing that abalone technologies developed by AQD are now ready for dissemination and adoption, AQD and DA-BFAR signed a 5-year collaborative *National breeding and culture program of abalone* for strategic areas in the Philippines. The agreement was made 13 July 2007 during AQD's 34th year anniversary celebration. The program is expected to:

- (i) provide tropical breeding and culture technology in suitable regions or provinces;
- (ii) introduce and demonstrate abalone farming as an alternative means of livelihood for coastal communities; and
- (iii) increase production and export earnings from the tropical abalone.

Under the terms of agreement, BFAR will provide funds ~ P15 million ~ for the construction and operation of abalone culture and breeding sites. AQD, on its part, will, among other things, provide the necessary technical expertise.

A declaration of core values, vision and mission

Following instructions at the SEAFDEC Department Chiefs' Meeting held October 2006, AQD conducted a series of strategic planning workshops in April and June 2007 and set-out to redefine AQD's core values, vision and mission. The exercises were aimed at honing AQD's competitiveness given the increasing scarcity of resources available to it.

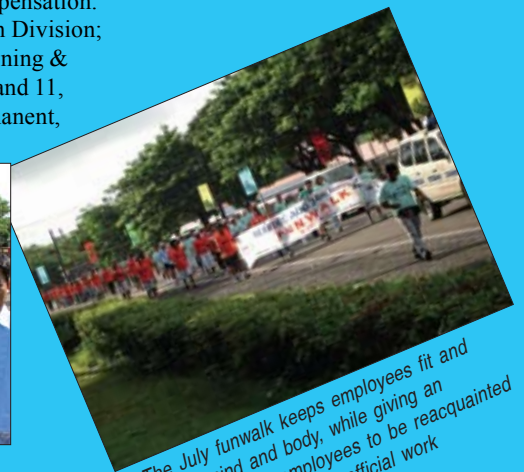
AQD also reorganized its structure and put into place a new employee position classification scheme that rationalizes job responsibilities and compensation. As of 31 December, 108 employees are working under the Research Division; 29, Technology Verification & Demonstration Division; 21, Training & Information Division; 46, Administration & Finance Division; and 11, Management Group. Of the total 215 employees, 36% is permanent, the rest has fixed-term appointments.



Strategic planning workshop in April 2007

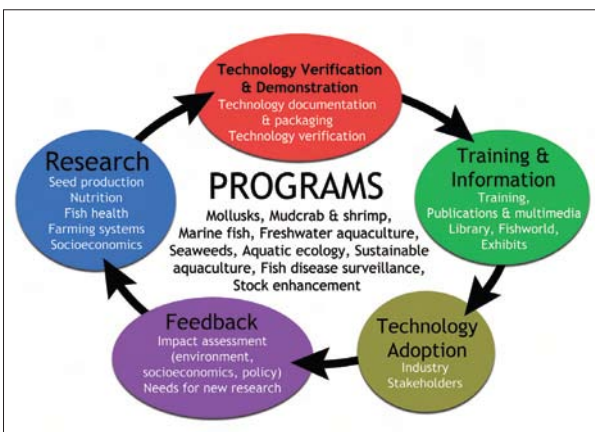


AQD's senior research staff



The July funwalk keeps employees fit and trim in mind and body, while giving an opportunity for employees to be reacquainted outside the bounds of official work

The Chief reports



Dr. Joebert Toledo and AQD's framework for research and development which was put into practice when Dr. Toledo first came to office in 2006

2007 may be considered the year when SEAFDEC Aquaculture Department (AQD) institutionalized its technology transfer mechanism for the private sector while continuing to demonstrate technologies for people's cooperatives and local governments.

Two newly launched projects cover these: (1) the *Agree-build-operate-transfer aquaculture business packages* (ABOT AquaNegosyo) and the *Institutional capacity development for sustainable aquaculture* (ICD-SA). These two are open to clients and stakeholders from all the SEAFDEC member countries. For this year, however, only nationals of AQD's host country, the Philippines, have formally signed up for ABOT (two clients) while preliminary consultations are being done in six more provinces for ICD-SA (four are already onboard).

These ventures are necessary inputs to AQD's R&D framework (above box) as they provide feedback to AQD's programs, and are sources of ideas for technology innovation and new research direction. For what is aquaculture technology if it can not mean improved livelihood? Or food security for fisherfolk and small-holder fish farmers?

Abalone, mudcrab, grouper, milkfish, seabass, native catfish, bighead carp, tilapia, freshwater prawn, and seaweeds are the priority commodities. Technology transfer of these species is not only through the new ventures above, but also through our innovative training courses. This year, we exceeded by 50% the number of people who trained with us in 2006. There were 300 stakeholders who attended our 23 training courses. Perhaps nationals of SEAFDEC member countries coming to learn is a given, but not those from Spain, India, Canada, Nigeria, France, Germany, the Netherlands, the USA, and the United Kingdom. This representation can only speak of confidence in AQD's science-based technologies.

With the more vigorous and institutionalized focus to reach out to stakeholders, rich and poor, AQD nonetheless has not forgotten its primary mandate of research which is the backbone of technology generation.

In 2007, around 80 research studies and technology generation projects were approved, some with external funding provided by GOJ Trust Fund, ASEAN, Kagoshima University and Fisheries Research Agency in Japan, ACIAR, UP Visayas, DOST, and various private companies.

THE NEW VISION OF AQD

To be a global leader in the generation and transfer of appropriate and sustainable tropical aquaculture technologies for food security and holistic human development

These studies are organized as either departmental or regional programs which have been approved for implementation by the SEAFDEC Council.

DEPARTMENTAL PROGRAMS

Integrated mollusc production
Mudcrab & shrimp domestication
Marine fish
Small-holder freshwater aquaculture
Seaweed strain improvement
Aquatic ecology

Activities under these programs included research and verification of aquaculture technologies in the priority areas of broodstock development & management, seed production, nursery & grow-out culture.

To further promote these technologies in the ASEAN region and also address the specific needs of the member countries in terms of aquaculture development, AQD, in collaboration with partners, and with the support of the GOJ-TF, also worked on the following:

REGIONAL PROGRAMS

Aquaculture component of the special 5-year program on sustainable fisheries for food security in the ASEAN region
Development of fish disease surveillance system
Research & development on stock enhancement for threatened species of international concern

We report the progress of each study in this *Highlights*. Full reports of previously completed ones are published in journals or in proceedings.

In 2007, 44 scientific papers were written by AQD researchers ~ 30 papers in journals indexed by the Institute for Scientific Information and covered in their *Current Contents*, 2 in other journals, and 12 in conference proceedings or as book chapters.

AQD also published 5 new manuals, 8 flyers, and 15 large-format posters. Updates on AQD activities are posted regularly in its website www.seafdec.org.ph and news are released to and utilized by the mass media.

Stakeholders also get to hear of research results first-hand through seminars and workshops. Of note is the first *SEAFDEC International workshop on emerging fish diseases* that AQD organized and convened in December 2007 in Bangkok with the support of the GOJ-TF.

Another accomplishment in 2007 was the effort made in expanding and enhancing collaborations. To make sure that many will benefit from R&D activities, new collaborative arrangements were made with various stakeholder groups (i.e., government agencies, LGUs, international organizations, private companies, private sector entrepreneurs; see overleaf). For 2007, AQD signed 17 new formal agreements with various partners.

We would like to thank our stakeholder-cooperators, our funding partners and collaborators, and the Philippine government for their continued support to AQD.

As a final note, most of the activities conducted in 2007 will be continued in 2008.

Among the 17 new partners welcomed by AQD in 2007 are (CLOCKWISE FROM LEFT): Petron Foundation Inc, here with President Gloria Arroyo; Chinese Academy of Fishery Sciences in Wuxi, China; DA-BFAR, here with US Ambassador Kristie Kenney at the multi-species hatchery in Tawi-tawi, southern Philippines; and the Palawan Aquaculture Corporation in western Philippines



PARTNERSHIPS WITH AQD

International organizations

- SEAMEO-SEARCHA: institutional cooperation in a number of areas to pursue education, training, and research objectives of mutual interest, as well as exchange scientific information, publications and execution of separate agreements for any particular undertaking that will be jointly implemented : April 2007 to April 2010
- NACA's Regional Lead Centre in China (Freshwater Fisheries Research Center of the Chinese Academy of Fishery Sciences) : collaboration on these areas of common interest - (1) feed development and disease control, particularly on the use of herbal extracts as feed additives or as immunostimulants, (2) breeding of freshwater prawn and tilapia, (3) manipulation of the water environment through the use of probiotics, (4) socio-economic impact of aquaculture in the lakes of both countries, (5) training of one or two nominees by AQD in China, and (6) exchange visit of staff : April 2007 - April 2009
- United Nations Educational Scientific & Cultural Organization (UNESCO) : Preparation and production of guidebook to Philippine mangrove associates : April – Dec 2007
- Australian Center for International Agricultural Research (ACIAR) : Integrated fisheries resource management (Rinconada Lakes, Philippines and New South Wales, Australia): aquaculture and water quality component : Jan – Dec 2007

Philippine government agencies

- DA - Bureau of Fisheries and Aquatic Resources : Joint collaboration in the conduct of research programs and dissemination of science-based technologies : May 2007 to May 2012; National abalone breeding & culture program : 2007 to 2012
- BFAR-National Fisheries Research and Development Institute: Capacity-building of BFAR-NFRDI in fish health management through training and collaborative research : July 2007 – July 2008; Aquaculture biotechnology program : June 2007 – July 2009

Provincial and municipal LGUs

- Misamis Occidental : Strengthening research & training capabilities of Misamis Occidental LGU: July 2007 to July 2012
- Municipal Government of Anini-y, Antique : Abalone searanching : July 2007 to July 2009
- ICD-SA partners (listed under separate section, page 26)

Consortiums, foundations, schools, NGOs

- Western Mindanao Seaweed Industry Development Foundation Inc (WMSIDFI), MSU Tawi-Tawi, BFAR Autonomous Region of Muslim Mindanao, Tawi-Tawi Chamber of Commerce & Industry, Philippine Development Assistance Programme, and Growth-for-Equity in Mindanao : Establishment of a land-based seaweed seedling nursery and seaweed cultivars bank in Tawi-Tawi : beginning May 2007
- WMSIDFI, Zamboanga State College of Marine Science & Technology, BFAR Region 9, Zamboanga City LGU, DOST Region 9 : Establishment of a land-based seaweed seedling nursery and seaweed cultivars bank at Zamboanga City : beginning Oct 2007
- Datingbayan Foundation Inc, Cebu : Polyculture of abalone and seaweeds : Jan 2007 to Jan 2012
- Polytechnic State College of Antique : Sustainable freshwater aquaculture development projects [broodstock development&management-hatchery-nursery-grow-out culture operations; on-site training courses on native catfish, freshwater prawn, tilapia, carp, seabass & mudcrab; training on research methodologies] : Oct 2007 to Oct 2010
- Learning-By-Doing Specialist School in Agriculture, Sulu : Abalone hatchery and culture demo-farm : April 2007 to April 2009
- ICD-SA partners (listed under separate section, page 26)
- Sagay Municipal Government's Protected Area Management Board-Sagay Marine Reserve (Negros Occidental) : Development of strategies for stock enhancement : Jan 2006 to Jan 2011
- Philippine Institute of Development Studies (Makati City) and Central Philippine University (Iloilo City) : for the technical services respectively of Dr. Danilo Israel and Dr. Ilda Borlongan : Feb 2006 to Feb 2008 and Aug 2006 to Aug 2007

Private corporations and individuals

- Palawan Aquaculture Corporation, Manila : Seed production of the humphead or Napoleon wrasse : Sept 2007 to Sept 2009
- Bluebay Aquaculture, Quezon City : Collaborative research & training on freshwater aquaculture, marketing of research by- products, and information dissemination : Dec 2007 to Dec 2009
- Mr. Manchan Ang of Cotabato City : Integrated mollusc production at AQD's Mariculture Park : June 2007 to June 2010
- Philmarine Technology Group Inc, Manila: Integrated mollusc production at AQD's Mariculture Park : July 2007 to July 2010
- ABOT Aquanegosyo clients (listed under separate section, page 25)
- Jamandre Industries Inc and Mr. Leonil Iguiz, both from Iloilo City : as locators in AQD's Mariculture Park in Igang : Aug 06 to Aug 07
- Mr. Reynaldo Acap of Oton, Iloilo : pilot hatchery and nursery of abalone : Aug 06 to Aug 07

Research & development projects, 2007

STUDY TITLE	STUDY LEADER	PERCENT COMPLETION	B U D G E T		COLLABORATING UNIT	
			SEAFDEC	EXTERNAL		
Departmental programs						
MOLLUSC						
1	Improvement of hatchery production techniques for the donkey's ear abalone <i>Haliotis asinina</i>	AC Fermin	50%	800,270		
2	The effect of light intensity and photoperiodicity on the settlement rate, feeding behavior, growth and survival of abalone (<i>Haliotis asinina</i>) postlarvae	MR de la Peña	70%	284,398		
3	Lipid and essential fatty acid requirements of juvenile abalone, <i>Haliotis asinina</i> , Linne	MB Teruel	10%	124,550		
4	Verification of some hatchery techniques for donkey-ear abalone, <i>Haliotis asinina</i>	AC Fermin	40%	612,920		
5	A modular system of culturing the tropical abalone, <i>Haliotis asinina</i> L. 1758, in mesh cages	VC Encena II	40%	569,090		
MUDCRAB AND SHRIMP						
6	Refinement of broodstock management and seed production techniques (mudcrab)	ET Qunitio	85%	995,206		
7	<i>Penaeus indicus</i> / <i>P. merguensis</i> broodstock development: I. Refinement of broodstock management and larval rearing	FDP Estepa	75%	493,352		
8	Nursery culture of mudcrab, <i>Scylla serrata</i> , in net cages fed formulated diet	MEM Rodriguez	60%	503,644		
9	Cost-effective culture, harvesting and preservation techniques of green microalgae for crab and fish seed production	MR de la Peña	100%	162,110		
10	Studies on the nutritional quality assessment of feeds and feedstuffs and their effects on growth, health conditions, immune response, aquaculture production, and environmental degradation of marine invertebrates commonly cultured in the Philippines: New aquaculture technology for various penaeid species: <i>Penaeus monodon</i> (PhD Thesis)	MB Teruel	20%	88,000	275,000	GOJ-Kagoshima University
11	Vermimeal (<i>Eudrilus euginae</i>) as fish meal substitute in diets of shrimp and milkfish	MR Catacutan	75%	60,600		
12	Enabling aquatic animal health capacity through geographic information system (GIS): Diseases of crustaceans	CL Pitogo	70%	317,820		
13	Mud crab <i>Scylla serrata</i> culture using formulated diet in brackishwater ponds	ET Qunitio	80%	155,692		
14	Grow-out production of the mudcrab, <i>Scylla serrata</i> in pond and mangrove pens at Dumangas Brackishwater Station	JM Ladjá	100%	64,000		
15	Verification of <i>Penaeus indicus</i> grow-out diets in ponds using environment-friendly scheme	NV Golez	60%	1,731,627		
16	Enhancing adoption of mud crab production technologies in Northern Samar	ET Qunitio	15%	62,000	807,452	CATP (IIRR), ACIAR, ACE
17	Production of juvenile mudcrab, <i>Scylla serrata</i> in brackishwater ponds	MEM Rodriguez	60%	874,928		
MARINE FISH						
18	Reproductive biology of pompano <i>Trachinotus blochii</i>	JT Fermin	20%	385,840		
19	Use of PUFA-rich thraustochytrids as enrichment diets for live foods (rotifers and Artemia) in the larviculture of the seabass, <i>Lates calcarifer</i>	DG Estenor	20%	307,642		
20	Studies on the seed production techniques of milkfish and rabbitfish	EGT de Jesus-Ayson	80%	2,289,858		
21	Verification studies on the seed production techniques of high value marine fish species such as grouper, red snapper and sea bass	EGT de Jesus-Ayson	50%	2,425,292		
22	Identification of molecular markers for egg quality in cultured marine species	J Bangcaya-Gonzaga	80%	638,208		

STUDY TITLE	STUDY LEADER	PERCENT COMPLETION	B U D G E T		COLLABORATING UNIT
			SEAFDEC	EXTERNAL	
23 Improvement of the nutritional value of locally available feed resources for practical aquatic feeds by submerged fermentation and solid substrate fermentation using milkfish gut bacteria and/or selected fungi	RM Coloso	30%	1,003,000		
24 Assessment of the potential of mysid shrimps (Crustacea: Mysidacea) as live food in marine fish culture 2: Nutritional evaluation of the mysid shrimps	PS Eusebio	25%	477,850		
25 Evaluation of some nutritional and microbial derivatives as immunostimulants in grouper, <i>Epinephelus coioides</i> . I. Influence of environmental stress on innate immunity and resistance to bacteria in grouper fed various immunostimulants	EC Amar	65%	132,000	150,000	UP Visayas
26 Use of SEAFDEC-formulated diet for milkfish cultured in marine cages (verification study)	NS Chavoso	70%	319,000		
27 Milkfish fingerlings production in ponds	EB Coniza	60%	393,400		
28 Effect of molluscicide and pesticide on snail population in milkfish grow-out production pond	JM Ladja	95%	437,000		
29 Verification of grouper and snapper grow-out diets in cages in pond	EB Coniza	50%	776,924		
30 Verification of seabass grow-out diets in ponds	EB Coniza	50%	561,394		
31 Improvement of cage nursery rearing techniques for sea bass (<i>Lates calcarifer</i>), grouper (<i>Epinephelus</i> spp.), and mangrove red snapper (<i>Lutjanus argentimaculatus</i>) in earthen ponds	RSJ Gapasin	70%	496,260		
32-34 Production of marine fishes in brackishwater ponds					
<u>Substudy I:</u> Nursery cage fingerling production of seabass (<i>Lates calcarifer</i>), grouper (<i>Epinephelus</i> spp.), and mangrove red snapper (<i>Lutjanus argentimaculatus</i>)	RSJ Gapasin	75%	103,000		
<u>Substudy II:</u> Grow-out culture of grouper	JM Ladja	95%	626,556		
35 Culture of high value fish in floating cages	RE Mamauag	15%	714,200		
36 White cowpea meal as alternative source of protein for grouper, <i>Epinephelus coioides</i>	RE Mamauag	10%	531,860		
SEAWEED STRAIN IMPROVEMENT					
37 Determination of ammonium uptake of <i>Gracilariopsis bailinae</i> and its impact on the co-culture of abalone, <i>Haliotis asinina</i> , and <i>G. bailinae</i> in a recirculating system	TR Mallare	15%	105,000		
38 Propagation of <i>Kappaphycus</i> plantlets from callus-like structures by tissue culture	AQD Hurtado	40%	639,642		
39 Seed production of <i>Kappaphycus</i> : A protoplast isolation and sporulation of <i>Kappaphycus</i>	MRJ Luhan	35%	726,842		
AQUATIC ECOLOGY					
40 Environmental capacity of Humaraon Cave, Igang, Guimaras and Bugang River, Pandan, Antique for aquaculture activities	NS Chavoso	100%	976,332		
41 The <i>tangab</i> fishery in Iloilo Strait: operations, catch volume and species composition, economic importance, and ecological impact	TU Bagarinao	40%	60,000		
42 A comprehensive socio cultural and economic baseline assessment of the fishing communities of Anini-y and Tibiao for coastal resources stock enhancement and sustainable aquaculture in the Province of Antique	ET Aldon	65%	60,000		

STUDY TITLE	STUDY LEADER	PERCENT COMPLETION	B U D G E T		COLLABORATING UNIT	
			SEAFDEC	EXTERNAL		
SMALL-HOLDER FRESHWATER AQUACULTURE						
43	Improvement of fillet yield in Nile tilapia (<i>Oreochromis</i> spp.) through farm-based mass selection	RV Eguia	75%	75,120		
44-45	Refinement of broodstock and hatchery management methods for the commercial production of freshwater prawn <i>Macrobrachium rosenbergii</i> seedstock					
	I. Production of <i>M. rosenbergii</i> larvae tolerant to reduced salinities	RV Eguia	80%	93,040		
	II. Bioeconomics of freshwater prawn hatchery production in different larval rearing system	MA Laron	75%	100,000		
46	Refinement of broodstock and nursery technology for the commercial production of bighead carp <i>Aristichthys nobilis</i> (Richardson) fingerlings in cages in Laguna de Bay 1. Reproductive performance and fry production of bighead carp on different feeding regime	MA Laron	65%	180,680		
47	Growth and survival of Asian catfish fry reared in net cages with and without supplemental feeding in Laguna de Bay, Philippines	AD Evangelista	100%	236,000		
48	Farming of the <i>Macrobrachium rosenbergii</i> in modular cages in Laguna de Bay	MLC Aralar	95%	210,120		
49	Economic impacts of aquaculture development in Laguna lake	DC Israel	90%	731,570		
50	Hatchery seed production of the native catfish, <i>Clarias macrocephalus</i>	AC Fermin	50%	656,725		
Regional programs						
PROMOTION OF SUSTAINABLE AQUACULTURE IN ASEAN						
51	Domestication of mud crab <i>Scylla serrata</i>	ET Quinitio	25%	190,353	410,000	ASEAN-GOJ-TF
52	Genetic characterization of commercially important Philippine stocks of freshwater prawn, <i>Macrobrachium</i> sp., using DNA markers	MRR Eguia	85%	290,400	220,000	ASEAN-GOJ-TF
53-55	Development of specific pathogen free (SPF) shrimp (<i>Penaeus monodon</i> , <i>P. vannamei</i>) broodstock					
	Information exchange on status of <i>P. monodon</i> captive broodstock development in the Southeast Asian region and the possible impact of the introduction of <i>P. vannamei</i> in the region	ET Quinitio	75%	a	100,000	ASEAN-GOJ-TF
	Genetic characterization of <i>P. monodon</i> broodstock	MRR Eguia	40%	a	485,000	ASEAN-GOJ-TF
	<i>Penaeus monodon</i> broodstock development: Studies on improvement of maturation of pond-reared <i>Penaeus monodon</i> broodstock	FDP Estepa	20%	a	600,000	ASEAN-GOJ-TF
56	Morphometric characterization and performance evaluation of <i>Macrobrachium rosenbergii</i> stocks and other commercially important freshwater prawns in the Philippines	MRR Eguia	100%	61,050	161,700	
	I. Collection, identification, and validation of <i>Macrobrachium</i> samples					
	II. Reproductive efficiency of two <i>Macrobrachium</i> stocks at different protein levels					
57	III. Performance of different strains of <i>Macrobrachium</i> in grow-out culture in lake-based cages and ponds	MLC Aralar	95%	30,000	240,000	ASEAN-GOJ-TF
58	Development of strategies to extend the spawning season of Asian sea bass (<i>Lates calcarifer</i>)	EGT de Jesus-Ayson	40%	a	400,000	ASEAN-GOJ-TF
DISEASE SURVEILLANCE SYSTEM FOR AQUATIC ANIMALS						
59	Parasite fauna of bivalves and gastropods in the Philippines	GE Pagador	40%	183,750	160,000	GOJ-TF
60	Pilot testing of the SEAFDEC "indigenous probiotic" in grow-out shrimp ponds	GL Po	10%	a	450,000	GOJ-TF
61	Development of a vaccine against viral nervous necrosis (VNN) in economically important marine fish	RV Pakingking Jr	25%	663,800	150,000	GOJ-TF

a = AQD's counterpart contribution is compensation of staff

STUDY TITLE	STUDY LEADER	PERCENT COMPLETION	B U D G E T		COLLABORATING UNIT
			SEAFDEC	EXTERNAL	
62 Epidemiology of the white spot syndrome virus (WSSV) in different shrimp (<i>Penaeus monodon</i>) culture techniques in the Philippines	EA Tendencia	13%	a	400,000	GOJ-TF
63 Surveillance of emerging fish viral pathogens in some Southeast Asian countries	GL Po	70%	a	1,000,000	GOJ-TF
64 Monitoring and surveillance of transboundary pathogens in cultured shrimps and freshwater prawns	CL Pitogo	70%	a	700,000	GOJ-TF
65 Development of control methods for viral nervous necrosis (VNN) of marine fish	LD de la Peña	45%	a	400,000	GOJ-TF
66 Development of immunological preventive methods for shrimp. I. Immunostimulation and vaccination strategies for WSSV prevention	EC Amar	80%	a	500,000	GOJ-TF
67 Studies on the withdrawal period and residues of antibiotics used in aquaculture	MT Arnaiz	85%	111,296		
68 Survey of pesticide residues in fish and prawns in Western Visayas	MT Arnaiz	85%	293,386		
R&D ON STOCK ENHANCEMENT FOR THREATENED SPECIES OF INTERNATIONAL CONCERN					
69 Aquaculture and conservation of seahorses <i>Hippocampus barbouri</i> , <i>H. comes</i> , <i>H. kuda</i>	JDT Fermin	15%	49,000	250,000	GOJ-TF
70 Pilot hatchery production of sea cucumbers for stock enhancement program	MFJ Nievaes	75%	144,000	150,040	GOJ-TF
71 Fisheries and seed production of the angelwing clam <i>Pholas orientalis</i> Gmelin 1790 for the rehabilitation of depleted wild stock	MJH Lebata-Ramos	30%	267,416	250,000	GOJ-TF
72 Development of sea ranching techniques for the donkey-ear abalone <i>Haliotis asinina</i> and other economically important mollusks I. Bio-physical factors limiting growth and survival of seeded abalone	AC Fermin	30%	30,000	250,000	GOJ-TF
73 Growth and survival of hatchery-reared giant clams <i>Tridacna gigas</i> in ocean nurseries in Negros and Panay Island	MJH Lebata-Ramos	75%	243,114	250,000	GOJ-TF
74 Stock enhancement of abalone <i>Haliotis asinina</i> in Sagay Marine Reserve	MJH Lebata-Ramos	60%	339,596	250,000	GOJ-TF
75 Behavioral studies of the donkey's ear abalone, <i>Haliotis asinina</i> , under laboratory conditions: implications to stock enhancement	SM Buen-Ursua	100%	215,680	250,000	GOJ-TF
76 Socioeconomic analysis of stock enhancement of abalone and giant clams in Sagay Marine Reserve in the Philippines	ND Salayo	40%	108,360	250,000	GOJ-TF
77 Seed production of the humphead wrasse, <i>Cheilinus undulatus</i>	H Ogata	5%	122,000	247,540	GOJ-TF
Other studies					
78 Comparison of characteristics of KHV isolates from Asia	GL Po	100%	a	860,000	Fisheries Research Agency (Japan)
79 Pilot project on milkfish cage culture as livelihood option for affective Guimaras fisherfolk	AG Gaitan	35%	a	3,528,845	Petron Foundation
80 Integrated fisheries resource management (Rinconada Lakes, Philippines and New South Wales, Australia): Aquaculture and water component	MLC Aralar	30%	95,200	287,296	ACIAR
81 The USS Albatross expedition in the Philippines, 1907-1910: Biodiversity collections, research publications, and exploration history	TU Bagarinao	50%	a		Fulbright Program, USA
82 Initial assessment of the bacterial flora of Guimaras waters and soil after the Petron Solar I oil spill	GL Po	90%	a		UP Visayas
83 Capacity building of BFAR-NFRDI in fish health management through training and collaborative research	CL Pitogo	15%	a		BFAR-NFRDI

a = AQD's counterpart contribution is compensation of staff

Mollusc program

Mollusc program has conducted experiments aimed at improving the techniques for broodstock maturation, larval management and transport protocols of donkey's ear abalone, *Haliotis asinina*.

The hatchery techniques for the donkey's ear abalone *H. asinina* were verified and tested. From January to November, 1,016 spontaneous spawnings (average=92 per month) occurred in tank-held broodstocks with intervals of 13-15 days between spawning periods. A total of 112.5 million veligers with monthly average of 10.2 million were produced (survival from trocophore to veliger stage was about 46%). A total of 274,120 juveniles were harvested during the period.

Delaying the stocking or holding the larvae for 12-24 h after retrieval from incubation induced higher mortalities ranging from 20-40%, respectively. Larvae held for 6 hours in the

incubation tanks had higher settlement and survival rates than those larvae held for 12 or 18 hours. In another experiment, survival rate of veligers stocked directly upon retrieval from incubators or delayed stocking for 6 hours was higher when crustose coralline algae plus diatoms were present on settlement plates (1.46-2.1%) than when plates were devoid of algal food (0.94-1.24%).

Simulated larval transport experiments showed that survival was better when trocophore larvae were loaded at 50,000 per liter and transported within 6 hours in oxygenated plastic bags at 20-22°C. For bigger juveniles, 24-25 °C during transport was more favorable. Transporting juveniles at 3-3.5 cm shell length and within 24 hours with UV-treated seawater gave a 100% survival.

The effects of light intensity and photoperiodicity on the settlement rate, feeding behaviour, growth and survival of abalone larvae were assessed. In two experiments, increasing the light intensity (increased number of bulbs) did not significantly affect the number of settled larvae either at day 3, day 4, day 5, day 10, or day 15. The presence of food in the gut was detected starting at day 3.

The lipid and essential fatty acid requirements of juvenile abalone were assessed. Proximate analysis showed abalone meat to contain in dry basis: 67% protein, 3% crude fat, 16% nitrogen-free extract and 11.4% crude ash.

A modular floating cage system (regular decrease of stocking densities in mesh cages as the animals grow) was employed to determine the growth, survival and feed conversion ratios of cultured tropical abalone. This system is now used in commercial scale culture at AQD's Igang Marine Station.

CLOCKWISE FROM LEFT: Abalone breeders and broodstock are tagged and conditioned in round, suspended netcages in indoor tanks. Juveniles are allowed to settle on corrugated plates where diatoms are already attached to serve as food. Once grown, the juveniles can be harvested from the hatchery and brought to the sea where they can be raised in net-protected drums. A production cycle from hatching to grow-out can take about a year



Mudcrab and shrimp program

The program aims to develop a technology for sustainable production of quality seeds and captive broodstocks of mudcrab (*Scylla serrata*) and native shrimp species, particularly *Penaeus monodon*, *P. indicus*, and *P. merguensis*, that can be genetically selected for desired heritable characteristics.

MUDCRAB

Activities focused on domestication, refinement of broodstock management and seed production techniques, and improving the culture techniques during nursery and grow-out phases and in different production systems.

Scylla serrata stocks from Cagayan, Camarines Norte, Northern Samar and Surigao (Philippines) were screened for the presence of viral diseases. Stocks from all sites were negative for viruses, except for two crabs from Cagayan which were found to be positive for IHNV. First generation families were produced from stocks obtained from these sites.

The reproductive performance of broodstock maintained in outdoor and indoor maturation tanks with sand substrate was compared. Results showed that the interval from spawning to hatching was 10-11 days in outdoor tanks and 10 days in indoor tanks. Of the four crabs that spawned, two hatched their eggs in outdoor tanks while only one female hatched its eggs in indoor tanks.

Two experimental larviculture runs were conducted to compare commercial probiotic with SEAFDEC-developed probiotic. Antibiotic served as control. Mass larval mortality occurred in both treatments. Survival from zoea to megalopa was 3.8% in the control.

The use of several levels of formulated feed in nursery culture of mudcrab in net cages was evaluated. After 30 days, highest survival was noted in crabs fed 6 g per ton per day. Highest survival was obtained in crabs fed mussel + formulated diet and lowest in crabs fed trash fish + formulated diet.

The production of mudcrab juveniles in different nursery systems was evaluated. Highest production was found in megalopae stocked in net cages provided with ribbon-like zigzag net substrates hung in water column compared to those stocked in cages with net substrates positioned on the bottom.

The use of formulated diet in grow-out rearing of *S. serrata* juveniles in brackishwater ponds was tested. After 5 months, specific growth rate of crabs fed fish alone was higher than those fed fish plus formulated diet. Preliminary results of a separate run being conducted also showed better growth performance in crabs fed fish alone.

Comparison of culture systems in AQD's Dumagas Brackishwater Station showed that *S. serrata* juveniles grew better in ponds than in mangrove pen.

As part of the initiative to disseminate and facilitate adoption of AQD technologies on mud crab, the following have been identified for implementation in Northern Samar: (i) capacity building, (ii) refinement of mud crab culture practices, (iii) stock assessment and policy issues, (iv) monitoring & evaluation, and (v) marketing. [See also the section on ICD-SA]

NATIVE SHRIMPS

The activities on shrimp focus on: (i) developing the technology to produce viable *P. monodon* and *P. indicus/P. merguensis* broodstock in captivity and determining the economic viability of such activity; (ii) maintaining the family lines of these three species; (iii) refining the techniques for broodstock management of *P. monodon* and *P. indicus/P. merguensis*; and (iv) refining the techniques and evaluating the commercial viability of *P. indicus* and *P. merguensis* hatchery and grow-out culture.

Studies on improvement of maturation of pond-reared *P. monodon* broodstock. A total of three batches of F1 generation have been produced, but the fecundity and hatching rates were low. Separation of males and females was done for

In Samar, eastern Philippines [clockwise]: demonstration of mudcrab nursery in the mangroves of Pambujan; retrieval of mudcrab from a bamboo trap; children operating a small net gear and their catch of fly-sized crablets



the first batch to observe its effect on percent mating. Males and females previously separated then mixed had 50-60 % mating and those that were mixed from the start of culture had 67-100%.

Refinement of broodstock management and larval rearing of *P. indicus* / *P. merguensis*.

Two runs were conducted to compare the effects of SEAFDEC-developed probiotics with antibiotics and other commercial water treatment products for shrimp larval rearing. The first run showed that survival until day 15 of postlarvae was similar for all treatments; however, survival rates were low. In the second run, two more treatments were included (commercial probiotic and a probiotic from France). Luminescent bacteria were found in all stocks except in those treated with the SEAFDEC-developed probiotic.

The immunostimulant beta-glucan, used in Vietnam and Thailand to lessen mortalities during handling, was tested during a simulated transport trial of *P. indicus* postlarvae. Survival was highest in postlarvae treated with 2 ppm a day before transport and lowest in untreated; but no significant difference was detected due to the high variability in their

response.

Economic assessment of the viability of *P. indicus* hatchery using present zoea production (50,000 per female), survival (20%) and other input values shows a cost of production of P0.12 per fry. If sold at P0.15 each, return-on-investment will be 85% and payback period will be 0.89 years.

Monitoring diseases. To help monitor the incidence of diseases of crustaceans, GIS mapping of target diseases has been a regular activity. Data have been grouped to show maps by species, disease, and period of occurrence. A draft webpage has also been constructed for fish and crustacean diseases.

Developing specific pathogen-free *P. monodon* and *P. vannamei* broodstock.

The status of *P. monodon* captive broodstock development in Southeast Asian region and the possible impact of the introduction of *P. vannamei* in the region have been monitored.

P. monodon breeding program. Multiplication centers were established in Thailand, Vietnam and India for SPF *P. monodon* fry produced in the USA. In Malaysia, the performance of SPF *P. monodon* improved 50-80% in grow-out pond. In the Philippines, maturation in captivity was achieved even without ablation but spawning was



Penaeus indicus juvenile



Penaeus merguensis juvenile



Penaeus monodon broodstock

attained only after ablation. Two batches of F_1 have been produced. Indonesia has not gone into breeding program.

P. vannamei and other exotic shrimps. Various countries in Southeast Asia have already gone into the breeding and culture of white shrimp as an alternative to *P. monodon*. In Indonesia, fry were produced from imported stocks, grown in ponds, and used as broodstocks by private hatcheries. In Thailand, legal importation of *P. vannamei* has been allowed since mid 2002 on the condition that stocks are free of viruses. In Brunei Darussalam, after the successful verification trials on *P. stylirostris*, farmers had started growing this species in their ponds in 2000. In Singapore, biosecure facility has been established, postlarvae are grown to broodstock size and sold to operators in Malaysia, Indonesia and Myanmar. Vietnam has also joined the league of white shrimp producers.

In the Philippines, postlarvae of specific pathogen-free *P. vannamei* broodstocks have been distributed to accredited shrimp farmers. An increase in the demand for postlarvae has been noted. This has led to selection of market size stocks from ponds by private sectors which are then used as broodstock in hatcheries.

This could start the spread of exotic diseases if proper screening is not implemented. There are already reports of *P. vannamei*

occurrence and catch in local waters due to mass release of stock by scared growers before the lifting of the ban and floods.

Interview with pond operators in the Luzon area revealed that those from Zambales preferred to culture *P. vannamei* while those from Pampanga and Bulacan preferred *P. monodon*.

Genetic characterization of *P. monodon* broodstock. Pleopod samples from *P. monodon* collected from Bohol, Roxas and Bacolod are being processed for genetic variability. Genetic differences were observed between stocks based on restriction morphs obtained after digestion with restriction enzymes: *MspI*, and *EcoRI*. Restriction morphs obtained from RFLP analysis using *RsaI* and *HaeIII* show monomorphic patterns in all the three stocks.

Verification of *P. indicus* grow-out diets in ponds using environment-friendly scheme.

Due to lack of enough white shrimp *P. indicus* postlarvae, *P. vannamei* postlarvae were used in trial that compared their production performance using SEAFDEC shrimp diet and commercial *P. vannamei* feed. After 90 days of culture, those fed SEAFDEC shrimp diet had relatively lower average body weight than those fed commercial *P. vannamei* diet, primarily due to lower crude protein content of SEAFDEC diet used.

Marine fish program

In 2007, the marine fish program continued to improve the technologies for broodstock management, seed production, nursery, and grow-out culture of groupers (*Epinephelus coioides* and *E. fuscoguttatus*), the Asian sea bass (*Lates calcarifer*), mangrove red snapper (*Lutjanus argentimaculatus*), rabbitfish (*Siganus guttatus*) and milkfish (*Chanos chanos*). The development of breeding and seed production technologies for pompano (*Trachinotus blochii*) was also added as a new activity for 2007.

SEED PRODUCTION

Work on seed production focused on improving the larval production and reducing the cost of production using SEAFDEC-formulated larval feeds. For this year, a new larval feed formulation for the hatchery production of carnivorous species such as groupers, red snappers, and sea bass was tested. Larval diet was used from day 15 in all larval rearing runs and larvae were successfully weaned to artificial feed at day 45.

SEAFDEC-formulated diet was also used to feed milkfish and other marine fish broodstock to make them mature and spawn spontaneously in broodstock tanks and in floating marine net cages. As in previous year, “off-season” spawning was again recorded in November and December. Mature males and

females in sea bass broodstock were also observed and these were successfully induced to spawn. The continued presence of mature fish beyond the spawning season may be due to still relatively warm water temperature during the rearing period. With regard to pompano, no spontaneous spawning was observed.

NURSERY CULTURE

The SEAFDEC-formulated feed developed for nursery culture of grouper was tested and was found to promote good growth and survival.

The nursery rearing systems in net cages in ponds were also tried for sea bass, grouper, and red snapper, to make use of the presence of zooplankton in the ponds as the main food of the fry and thus replace the use of brine shrimp and trash fish during nursery rearing. For seabass, two experimental runs showed that zooplankton-fed fry had better growth and survival than those fed trash fish. In the case of grouper fry, two runs also showed significantly higher survival for those fed zooplankton. In terms of growth, during the 1st run, no significant difference was observed in two treatments; however, during the second run, growth was significantly better in those fish fed zooplankton.

Samples of wild mysids from earthen brackish water ponds were evaluated for its nutritional quality. Results showed important concentrations of fatty acids such as

icosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are essential for the development of marine fishes.

GROW-OUT CULTURE

Verification on the use of SEAFDEC-formulated diets for the grow-out culture of milkfish, sea bass, groupers, snappers and rabbit fish in brackish water ponds and net cages in the pond, and in floating marine net cages was continued.

SEAFDEC-formulated diets are tested in commercial scale, yielding good results for grouper raised in cages at Igang, Guimaras (bottom); and for milkfish grown in commercial cages (at left) in Pangasinan, Philippines



The trial to verify the new milkfish grow-out feed formulated by AQD and specific for milkfish culture in sea cages was completed. Milkfish given SEAFDEC diet consistently gave higher final weight, specific growth rate, overall production and better FCR than milkfish fed commercial diet. Lipid content was higher in SEAFDEC diet (8-9%) than in commercial diet (<7%) and this may have had a positive effect on milkfish grown in seawater.

Verification trials were conducted to test AQD's grow-out feeds along side a commercial feed for growing groupers and red snappers in cages in ponds and for seabass, in ponds. Preliminary evaluation on the use of white cowpea diet as an alternative source of protein for grouper showed that this is comparable with fish meal diet in terms of performance parameters and proximate body composition of groupers.

Trials were conducted to determine the effective control of snails (*Cerithidea cingulata*) in milkfish ponds. The efficacy of molluscicides to eliminate pest snails in ponds depends on weather conditions. Nicotinamine sulfate showed its best effect during rainy days, while Terminator (saponin component), 75% metaldehyde, tobacco dust and 1:5 mixture of ammonium sulfate and lime were effective during dry conditions. Among these products, Terminator, Nicotinamine sulfate and mixture of ammonium sulfate and lime seemed economically viable.

PRODUCTION IN BRACKISHWATER PONDS AND FLOATING CAGES

Nursery rearing. *E. fuscoguttatus* juveniles were fed SEAFDEC-formulated diet and reared for 36 days in two stocking densities, 600 and 1000 fish per cage measuring 2 x 3 x 1 m³. No significant difference in growth was observed in two stocking densities.

Grow-out in brackish water ponds.

E. fuscoguttatus stocked in pond and fed SEAFDEC-formulated diet (45-47% CP) at rate of 3.5-5% of biomass per day indicated wastage of feeds as animals did not convert them into biomass. Results suggest the need for improving the feed quality (slow sinking type) and feeding technique for greater efficiency of this feed.

Grow-out in floating net cages. Grouper (80 g) grown in floating sea cages using SEAFDEC-formulated diet for 120 days attained average body weight of 260 g, specific growth rate of 1.1 and food conversion ratio of 2.3.

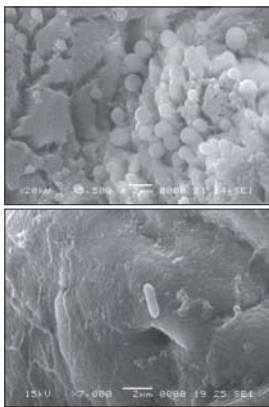
OTHER STUDIES

Other equally important studies under the program dealt on finding biochemical markers for egg quality in marine fishes using biotechnological approaches, cheaper and cost effective alternatives to fish meal in practical feeds, and good immunostimulants against microbial and viral infections.

The work to establish molecular markers to assess egg quality in marine fish is on-going. Primers for IGF-II and GH are being tested to quantify the expression of IGF-II and GH mRNA by real time PCR. Spawning batches of grouper, snigid, and sea bass were sampled.

The improvement of the nutritional value of locally available ingredients for practical aquatic feeds is being done. Milkfish fed different natural food bases and diet have different microflora composition which could be used for future fermentation studies involving various feed ingredients for the improvement of milkfish diet formulations and possibly as probiotics to promote fish health and nutrition.

The evaluation of nutritional factors and microbial derivatives as immunostimulants in grouper is on-going. Results showed that onion and ginger compared favorably with vitamin C and alpha-glucan as immunostimulants. Experimental infection was conducted to see if the observed increases in immunity indices would translate to resistance to pathogenic challenge.



Magnified 5,500x and 7,000x by a scanning electron microscope, these cocci (round-shaped bacteria) and Bacillus (rod-shaped) have been found in the intestinal walls of lumot-fed milkfish. These bacteria and other fish microflora can be used in future fermentation studies to improve milkfish diet formulations and possibly as probiotics to promote fish health and nutrition

Small-holder freshwater aquaculture

The program aims to improve the seed production and grow-out technologies for commercially important freshwater commodities (tilapia, catfishes, carps, and freshwater prawn) and promote freshwater aquaculture for livelihood, particularly among the landless in inland rural areas. The following describes the activities and accomplishments in 2007:

The experiment that evaluated the growth and survival of native catfish (*Clarias macrocephalus*) fry in net cages with and without supplemental feeding in Laguna de Bay was completed. After 6 weeks rearing, growth of fry that received artificial diet was higher than those fed exclusively with natural food available in the lake.

Another activity on native catfish was seed production where six induced spawning trials were conducted using *C. macrocephalus* females and a mixture of *C. macrocephalus* & *C. gariepinus* males. Survival of about 86 percent of hybrid fingerlings was observed.

In pond grow-out demonstration, growth of catfish fingerlings was better when fed SEAFDEC-formulated diet after 60 days of rearing than those fed commercially formulated diet.

An experiment aimed at improving the carcass traits in Nile tilapia (*Oreochromis* spp.) through farm-based mass selection and interspecific hybridization was continued. Preliminary analysis showed improvement in terms of body girth especially in the selected group.

The reproductive performance and fry production of bighead carp *Aristichthys nobilis* in net cages installed in Laguna de Bay and using different feeding regimes have been assessed. Highest gonadal maturity for both males and females was observed among broodstock fed for 3 months before spawning. Growth and survival of fry from broodstock fed a month before spawning were highest among the different treatments.

A study aimed at producing larvae of the freshwater prawn *Macrobrachium rosenbergii* which is tolerant to reduced salinities was continued. Results indicated consistent production of postlarvae in 12 and 6 ppt salinity levels. Another study which evaluated the effect of horizontally oriented shelters on growth and survival of freshwater prawn showed that those reared in cages provided with shelters had significantly better growth. However, differences in survival were not statistically significant.

The bioeconomics of freshwater prawn hatchery production using either green water and clear water was assessed. Larvae reared in green water had higher survival and shorter time to reach the post larval stage.

The survey to assess the economic impacts of aquaculture development in Laguna Lake over time has been completed. Data from interviews of key informants, 60 fish pen operators and 120 fish cage operators, as well as from secondary sources, are being consolidated.

PAIRED PHOTOS, TOP TO BOTTOM
Stocking of catfish fingerlings in ponds and 6-week catfish; berried females and blue-clawed males of freshwater prawn; tilapia being harvest from Lake Buhi and interview of fishfarmers around Laguna de Bay

BELOW Harvest of Nile tilapia from Lake Bato in Camarines Sur, eastern Philippines



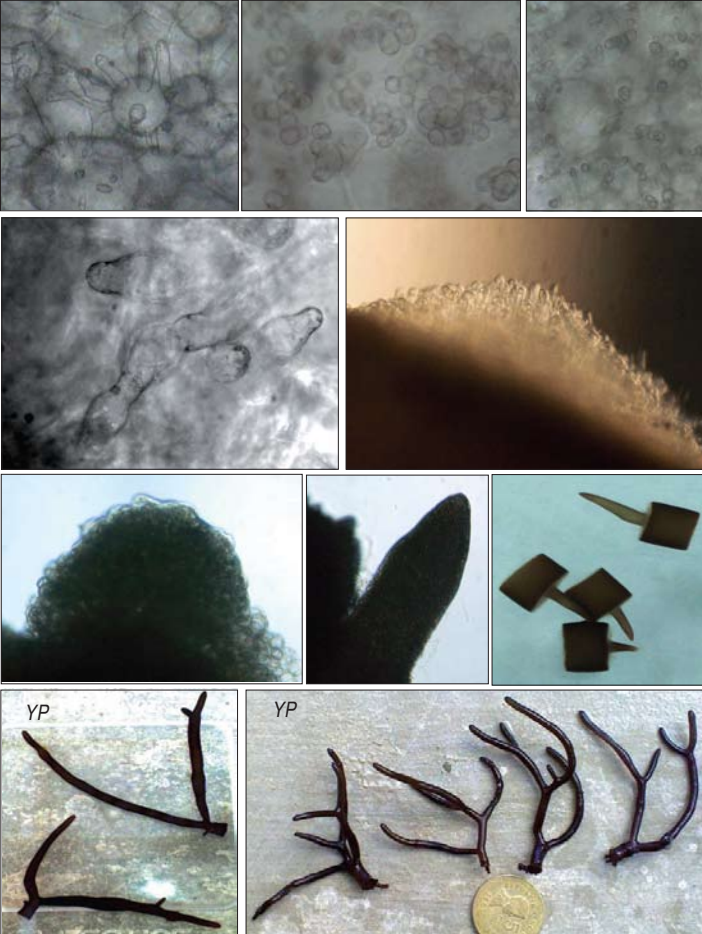
Seaweed program

The program focuses on production of 'new' and improved varieties of *Kappaphycus* through tissue culture, sporulation, and protoplast fusion techniques. Sufficient biomass from these techniques will be obtained and used as possible sources of cultivars for land-based and sea-based nursery systems, and for pilot-scale outplanting.

The following studies were continued in 2007: (a) propagation of *Kappaphycus* plantlets from callus-like structures by tissue culture; (b) seed production of *Kappaphycus* and *Gracilaria* from spores; and (c) determination of ammonium uptake of *Gracilariopsis bailinae* and its impact on the culture of abalone *H. asinina*, and *G. bailinae* in a recirculating system.

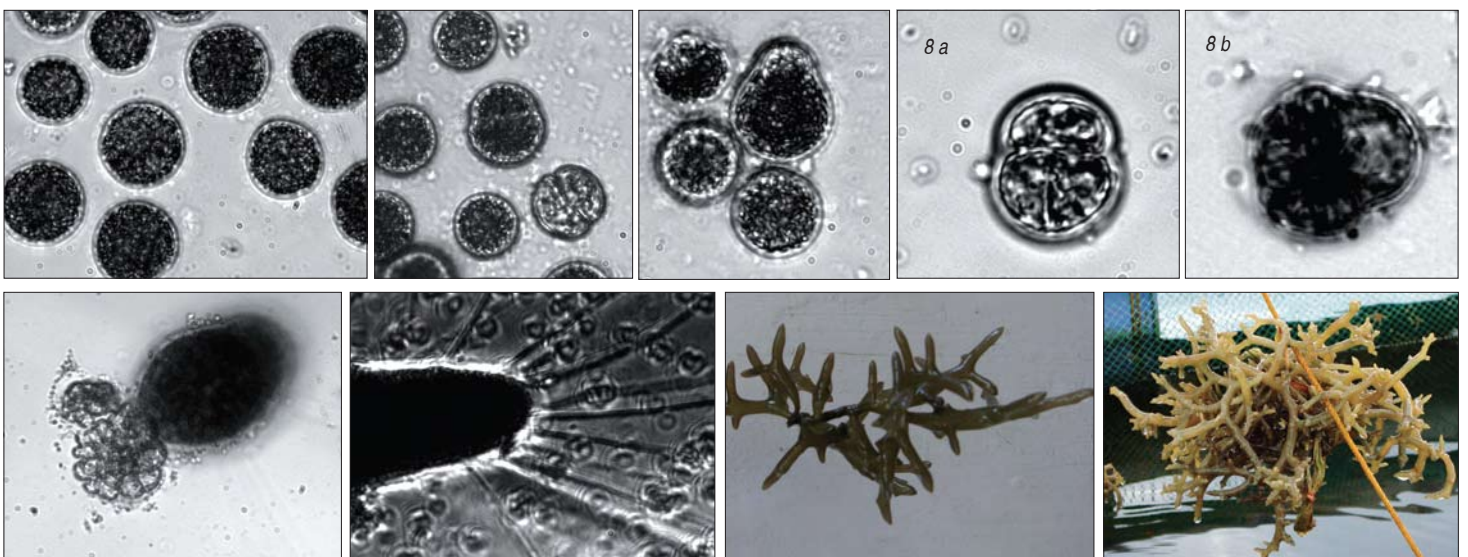
To propagate *Kappaphycus* plantlets by tissue culture, six varieties were made to produce shoots in ASL media with or without plant growth regulator (PGR). Emergence of secondary branches was only observed in cultures with PGR. Plantlets are now being grown in tanks.

Significant progress was made on seed production of seaweeds from spores. Plantlets of *Kappaphycus* generated from spores are now being grown in tanks while plantlets of *Gracilaria* generated from spores are now being grown in aquaria and being adapted to different salinities (15, 20, 25 ppt). Protoplast isolation was also attempted in *Kappaphycus*. More trials will be done to standardize and optimize the techniques. Bacteria associated with the "ice-ice" disease were also isolated from four strains of *Kappaphycus* from Zamboanga (southern Philippines).



Growing seaweed by tissue culture (L-R, top-bottom): filamentous cells, bubbly cells, budding & filamentous cells, filamentous cells, filamentous dome, bubbly callus, shoot primordium, young shoots, young plants (YP)

Growing seaweed from spores (L-R, top-bottom): at day 0, 1, 2, 8 (a and b), 18, 23; at 5 and 12 months



Aquatic ecology program

The program focuses on (a) Institutional arrangement in local governance in selected municipalities in western Visayas, Philippines, (b) Determination of environmental capacity of Igang Bay and other aquaculture sites, and (c) ecological studies for sustainable aquaculture. Technologies developed from other AQD programs will be adapted in the studies under this program. For instance, results of nutrition studies from marine fish and crustacean programs will be considered in estimating the environmental capacity of the sites.

In 2007, two studies were initiated: (i) *Environmental capacity of Humaron Cove, Igang, Guimaras and Bugang River, Pandan, Antique*; and (ii) *The tangab fishery in Iloilo Strait: operations, catch volume and species composition, economic importance and ecological impact*.

The sites selected were Humaron Cove, Igang, Guimaras and Bugang River, Pandan, Antique, covering areas of 29 and 8.8 hectares, respectively. High levels of water quality variables (phosphate, ammonia, chlorophyll-a, total suspended solids, dissolved oxygen, salinity and temperature) were observed but were not persistent, suggesting that the environmental capacity of the sites may not have been reached yet.

The other study gathered information to enable appropriate regulation of the *tangab* fishery in Iloilo Strait. [Tangab is a large fixed filter net; see also section on FishWorld.] Survey showed that *tangab* operations were concentrated on and the catch landed at four sites in Iloilo Strait namely: Morobuan, Guimaras; Calumpang, Iloilo City; Arevalo, Iloilo City; and Atabayan, Tigbauan. About 200 species of various sizes of fishes, crustaceans, mollusks and other invertebrates have been identified in the tangab catch at the four sites.

A fisher pulls in the tangab net at sunset while women and children go through the catch afterwards



This is Bugang River where periodic water monitoring and sampling are done to determine environmental capacity. AQD is providing technical assistance to a people's cooperative which raises seabass in cages at the river mouth



AQUACULTURE COMPONENT of the SPECIAL 5-YEAR PROGRAM on SUSTAINABLE FISHERIES for FOOD SECURITY in the ASEAN REGION (2006-2010)

GOAL: The program addresses the need for relevant technologies for sustainable aquaculture in the region. It focuses on problem areas such as broodstock development, genetic improvement, seed production, and culture systems of priority species for aquaculture, through research and human capacity building

In 2007, a new project entitled *Development of technologies and human capacity building for sustainable aquaculture* has been implemented by merging two former projects on the same topics. The new project now covers:

- **freshwater aquaculture of indigenous species;**
- **integrated aquaculture system**, which has a newly implemented subproject on rice-fish culture in Cambodia;
- **coastal aquaculture and mariculture**, with a new subproject on developing strategies to extend the spawning season of sea bass *Lates calcarifer* under captivity;
- **captive broodstock development and seed production**, with a new subproject on domestication of mud crab *Scylla serrata*

Freshwater aquaculture of indigenous species. Growth performance of the freshwater prawn *Macrobrachium rosenbergii* post-larvae from local broodstock (Calumpit, Bulacan, Philippines) was assessed by a feeding trial (3 types of feed, 2 sizes of mesh for cages, and the use or non-use of shelter). Use of heap-cage resulted in significantly higher growth and survival than b-net, although feed type and presence or absence of shelter failed to affect growth performance. The genetic characterization of *M. rosenbergii* has been done using DNA markers.

A program report on *Recent developments in the genetic improvement of the giant freshwater prawn (Macrobrachium sp.)* was published in 2007.

Integrated aquaculture systems.

Dissemination of rice-fish (silver barb, silver carp and common carp) aquaculture system with selected farmers is ongoing in Cambodia. Lecture, training and pond inspection have been done. The rice-fish system will be useful not only in increasing rice production but also in providing fish as food and in generating income to poor households in rural areas.

Coastal aquaculture and mariculture.

As part of the activity to promote seed production of commercially important aquatic species in the coastal areas, the year-round fry production technologies of sea bass (*Lates calcarifer*) by water temperature manipulation especially during the period of low water temperature is being developed.

This program component also supported two international training courses (see also pages xx) organized by and held at AQD which were attended by fisheries officers of SEAFDEC member countries:

- **Marine fish hatchery**, a 37-day course aiming to provide participants with basic technical knowledge and skills in operating marine fish hatcheries. The 9 participants, 4 with GOJ fellowships, were very much satisfied with their training as they were able to experience the larval rearing of milkfish, grouper, snapper, sea bass and rabbitfish
- **Abalone hatchery and grow-out**, a 20-day course aiming to provide participants with technical knowledge and skills to enable them to operate and manage an abalone hatchery and grow-out. Successfully completing the course were 18 participants, 4 with GOJ fellowships

Captive broodstock development. With regard to the studies on development of domestication technologies of specific pathogen-free *Penaeus monodon* and mud crab *Scylla serrata*, batches of offspring (F1) from wild or virus-free broodstock have been produced. Likewise, a study on genetic

variation of the shrimp and crab populations from various sources is being undertaken.

Information on the status of *P. monodon* captive broodstock development and the possible impact of the introduction of *P. vannamei* in the region has been collected from SEAFDEC member countries, India and Australia.

The international training courses and the publication of books have facilitated the packaging and sharing of successful experiences between institutions and countries in Southeast Asia on viable aquaculture technologies



The on-site, hands-on courses in Myanmar and Vietnam on health management

DEVELOPMENT OF FISH DISEASE SURVEILLANCE SYSTEM

GOAL: To develop a surveillance system for economically-important and emerging diseases of aquatic animals in Southeast Asia through establishment of resources and facilities for fish health diagnosis and human capacity building

The activities in 2007 focused on R&D of new preventive methods for aquatic animal diseases that are suitable to the region.

Refinement of diagnostic methods and development of new prevention methods for aquatic animal diseases.

White spot syndrome virus (WSSV) continues to be a big problem to the shrimp industry. AQD has developed immunological preventive methods for WSSV of *Penaeus monodon* via immersion techniques with immunostimulants

and vaccine. To determine how pond management affects the disease prevalence, the relationship between the prevalence of WSSV-positive shrimp in ponds and environmental factors has been epidemiologically assessed, suggesting that exposure to more stress factors in the presence of WSSV contamination could lead to an outbreak.

Preventive measures against viral nervous necrosis (VNN), the most serious infectious disease of marine fish, have progressed by studying the mechanism of transmission and vaccination techniques.

Research Institute for Aquaculture No.2 (Vietnam) identified pathogenic agents of a new emerging haemorrhage disease in freshwater catfish (*Pangasianodon hypophthalmus*). Some infectious bacteria ~ *Aeromonas*, *Edwardsiella* and *Clostridium* ~ were detected from diseased catfish.

Surveillance for important viral diseases of fish and shrimps in the region, and mobile clinics.

With regards to the surveillance activities of shrimps and crabs, samples of *Penaeus monodon*, *P. indicus*, *P. merguensis*, *P. vannamei*, freshwater prawn *Macrobrachium rosenbergii*, *Scylla serrata* were collected from various sites in the Philippines, Myanmar, Indonesia and Thailand.

WSSV, IHHNV, TSV, GAV, YHV, IMNV, IMNV, and MBV were monitored by PCR or histopathology among marine shrimps/mud crab samples from the Philippines and Myanmar.

In the Philippines, WSSV infection is still widespread in shrimp culture facilities affecting *P. monodon*, *P. indicus* and *P. vannamei*. The most significant disease of crustaceans that has been found so far in the Philippines is IHHNV, infecting 23% of total samples. Of the 8 viruses in the surveillance list, TSV, IMNV and WTD are still presumed exotic to the Philippines because all samples obtained from surveillance activities tested negative for them. IHHNV was also detected in one of the 12 shrimp samples from Myanmar.

The prevalence of TSV, WSSV, IHHNV and IMNV were surveyed in *P. vannamei* cultured in Indonesia. TSV, WSSV and IHHNV were found in cultured white shrimp and more likely to be widespread in all of the surveyed areas. Meanwhile, the spread of IMNV remains limited.

Freshwater prawn samples collected in the Philippines were monitored for WTD and WSSV, and all samples were so far negative for both viruses. The causative agents, *M. rosenbergii* nodavirus (MrNV) and extra small virus (XSV) of WTD were tested in wild/cultured freshwater prawn samples in Thailand. These two viruses were negative in wild prawn samples except those from Ubonrachathani province. In contrast, the viruses were detected in cultured prawn samples.

Surveillance of emerging fish viral pathogens of KHV, SVCV and GCHV was conducted by cell culture, infection assay in naïve fish and PCR/RT-PCR tests for samples of koi carp, common carp, grass carp and silver carp collected in Cambodia, Lao PDR,

Myanmar, Philippines and Vietnam. To date, these fish viruses were not detected from the samples.

As part of the mobile clinic service of this activity, epizootics in two farms in Myanmar among tilapia (*Oreochromis niloticus*) and rohu were investigated during sampling. No significant bacterial or parasitic diseases were detected.

In connection with the surveillance activity, a flyer on spring viremia of carp was published.

On-site and hands-on training.

AQD conducted training courses focused on basic and advanced (eg. DNA/RNA-based) diagnostic methods for shrimp and fish diseases in Myanmar and Vietnam. [See also pages xxx] The participants with sufficient skills were expected to act as national trainers or core persons in the diagnosis of important diseases in their respective countries.

- **On-site training courses in Myanmar** on fish (10 participants) and shrimp & prawn (23 participants) health management
- **Hands-on training in Vietnam** on health management & disease diagnosis of shrimp & prawn (19 participants) and detection of koi herpes virus (KHV) & spring viremia of carp virus (SVCV) (16 participants)

An international workshop, and annual progress and planning meetings.

AQD organized and convened the first *SEAFDEC international workshop on emerging fish diseases in Asia* in Bangkok, Thailand on 6-7 December 2007 to (1) get updated information on emerging fish and shellfish microbial diseases in Southeast and East Asia; (2) keep abreast of advances in the pathogenesis, diagnosis, epidemiology and surveillance techniques; and (3) identify research gaps.

The workshop was attended by 71 participants from 17 countries including all SEAFDEC member countries. The results of the discussion will be reflected in future research thrust under the Regional Fish Disease Project of SEAFDEC.

The *Annual progress and planning meetings* of 2006 and 2007 were respectively convened at AQD in Iloilo, Philippines on 16 March 2007 and in Bangkok, Thailand on 5 December 2007 with study leaders from Thailand, Indonesia, Vietnam and AQD and representatives from National Research Institute of Aquaculture (Vietnam), Fisheries Research Agency (Japan) and SEAFDEC Secretariat in attendance.



The abalone drop sites are marked by flags attached to floats and anchored



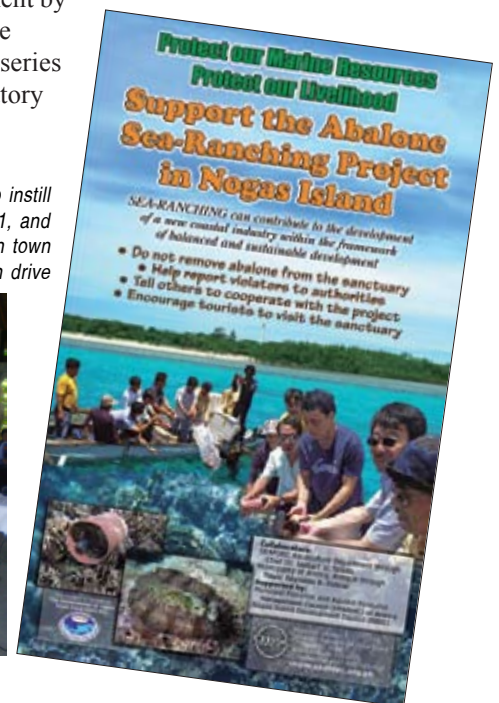
STOCK ENHANCEMENT OF THREATENED SPECIES OF INTERNATIONAL CONCERN

GOALS: (1) To develop ecologically sound strategies for stock enhancement including hatchery production and release of genetically diverse and disease-free juveniles; (2) encourage participation of local communities in stock enhancement; (3) develop methods and criteria for monitoring and evaluation of stock enhancement and conservation success; (4) transfer the stock enhancement technologies and social strategies to the countries in the region; and (5) review past and present stock enhancement programs to conserve threatened species in Southeast Asia

Into the waters of the Nogas Island Marine Sanctuary, AQD released more than 15,000 abalone juveniles in three batches as part of a searanching experiment jointly undertaken with the Anini-y municipal government (Antique, Philippines). The sawed-off PVC pipes which serve as shelters for abalone in the hatchery are removed from the reef after all abalone crawl out

In 2007, AQD took a significant step in stock enhancement by releasing SEAFDEC-bred abalone juveniles into a marine sanctuary in west central Philippines. This came after a series of studies on behavior of juvenile abalone under laboratory

An agreement with the LGU is made on July 24, a people's consultation to instill awareness regarding the benefits of abalone searanching is held on August 21, and tarpaulin posters in two languages (Kinaray-a and English) are installed in town as part of the information drive



conditions have been conducted for the purpose of developing release techniques. A result of the experiment on bottom-substrate preference of juvenile abalone (a combination of sand, gravel, coralline rubbles and coral skeletons was used) showed that juveniles tend to move to and stay on coral skeletons after release.

Hand-in-hand with the laboratory study, the reef benthic characteristics of Carbin Reef, Sagay Marine Reserve (Negros Island, west central Philippines) were surveyed, and wild abalones were regularly monitored. The field study revealed that wild abalones were mostly found in transects rich in dead corals covered with epiphytic algae. These results of the laboratory and field studies will be useful for assessment of potential sites for releasing hatchery-bred abalone juveniles.

In addition to Carbin Reef, sea ranching of abalone started in 2007 in Nogas Island, Anini-y (Antique) with the cooperation of the municipal government. Prior to release, a resource survey was conducted to determine the available food sources and bottom

characteristics of the reef which will serve as abalone habitat.

The release site covers around 30,000 m² that lie between Nogas Island and the main land. The marked abalones produced at the AQD hatchery were released in the coralline portion of the island. The release site has a depth of 0.6 – 3.0 meters during low tide.

On July 23, 2007, the first release of 5,800 hatchery-bred *Haliotis asinina* juveniles, 3.5-4.5 cm shell length, was made. Subsequent releases were done on October 2 with 3,800 juveniles of 3-3.5 cm shell length and on December 5 with 5,936 juveniles of 2-3.5 cm shell length. However, quite a few number of the released abalone were recaptured during the survey after release. This result indicates that AQD has to further improve release strategies by using more suitable sizes, time or season of release, among other factors. Moreover, during the stocking activity, the AQD team found the social aspects of the project needing more emphasis. The municipal residents need more information on the concept of stock enhancement, which could be conveyed by the conduct of lectures and seminars, and poster campaigns.

In addition to abalone activities, AQD has refined technologies on seed production and hatchery operation of seahorse (*Hippocampus barbouri*, *H. comes*, *H. kuda*), angelwing clam *Pholas orientalis*, and sea cucumber *Holothuria scabra*.

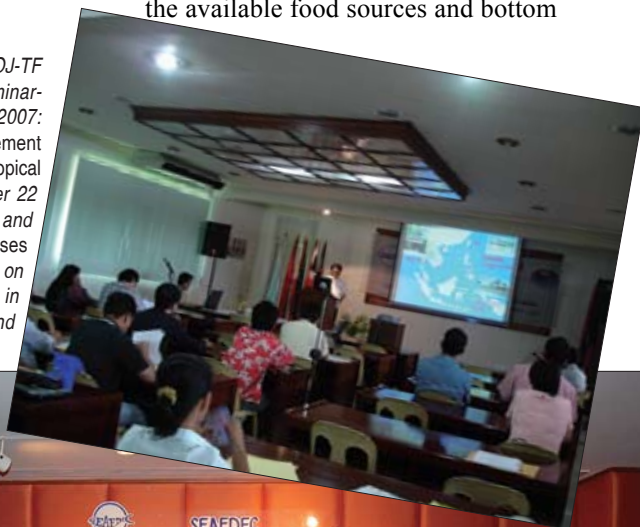
With regards to sea cucumber, AQD started the collaborative activity with the Research Institute for Aquaculture, No. 3 (Vietnam), where 300 broodstock have been collected and 55,000 juveniles (2-5 g) were produced, and 3,000 of them were released into a marine protected area (Nha Trang Bay) in 2007. In the Philippines, AQD has produced sea cucumber juveniles.

As an activity of verification of developed and established technologies, monitoring of the survival and growth of giant clam *Tridacna gigas* was continued at the three stocking sites in Sagay Marine Reserve (Negros), Malalison Island (Panay) and AQD's Igang Marine Station (IMS, Guimaras). A significantly higher growth rate was observed in clams grown in IMS than in Sagay and Malalison. There were no significant differences in temperature, salinity and total suspended solids between sites. Depth is the only factor that differs, with the IMS ocean nursery situated shallowest.

AQD released the manual on *Giant clam hatchery, ocean nursery and stock enhancement* in 2007.

Two of the GOJ-TF sponsored seminar-workshops in 2007:

- (1) Stock enhancement and aquaculture of tropical species on November 22 in Iloilo, Philippines; and
- (2) Emerging diseases in Southeast Asia on December 6-7 in Bangkok, Thailand



ABOT AquaNegosyo

technology packages for adoption by private entrepreneurs

The ABOT AquaNegosyo (Agree-Build-Operate-Transfer Aquabusiness) project prepares aquaculture business packages and provides technical assistance to interested aquaculture farmers and investors in the Philippines. It showcases complete packages of sustainable aquaculture technologies that are basic inputs to businesses in hatchery, nursery and grow-out of various economically important aquatic species.

The project also intends to develop entrepreneurial skills among scientists by actively transforming their discoveries into operational businesses and directly obtain economic benefits from such entrepreneurial engagements.

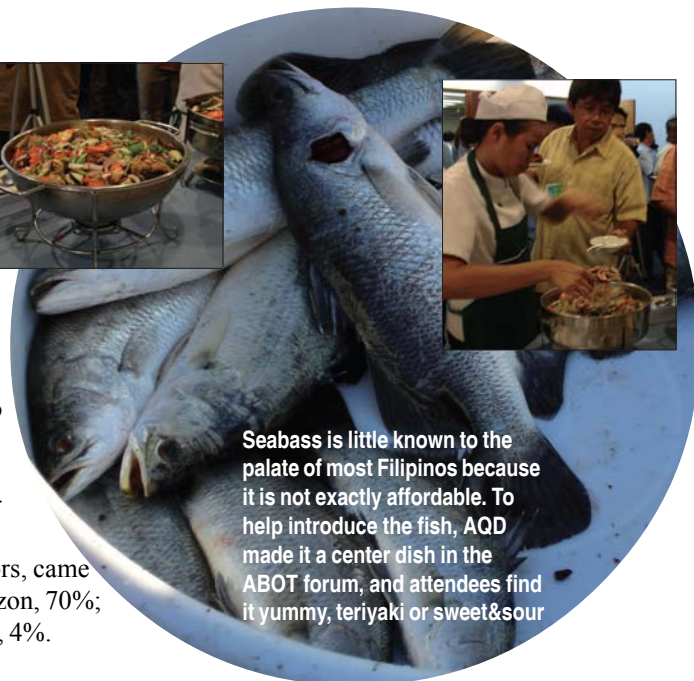
The project has conducted aquaculture farm sites assessment for ten (10) clients in the provinces of Cagayan, Pangasinan, Zambales, Tarlac, Pampanga, Quezon, Cebu, Masbate, and Aklan in the Philippines. Most clients are into or interested in either freshwater tilapia pond grow-out and hatchery (3) or brackishwater multi-species pond grow-out (6). One client is interested in tank culture of freshwater prawn and eel. Two (2) of these ten clients have signed formal agreements to avail of aquaculture business packages for freshwater tilapia and prawn pond grow-out in Tarlac and for a multi-species grow-out in brackishwater ponds in Cebu, respectively.

The project has organized an *Aquaculture technology forum* on 16-17 October 2007 in Diliman, Quezon City. The forum presented the latest technologies and business opportunities in aquaculture through 27 multidisciplinary lectures by AQD scientists, award-winning aquaculture entrepreneurs, and invited experts from various agencies with support systems for fish farmers. AQD publications and aquaculture feeds and larval feeds from two sponsors (Tateh Aqua Feeds and Spectrum Biosolutions, respectively) were displayed during the forum. Sea bass dishes were served during lunch and t-shirts featuring sea bass were sold to promote its market. About 200 persons attended the forum as participant, guest, speaker, or staff organizer. Attendees, including two foreign investors, came from all over the country: Luzon, 70%; Visayas, 26%; and Mindanao, 4%.



To acquaint entrepreneurs regarding the ABOT technology packages, AQD held an Aquaculture forum on October 16-17 in Quezon City. About 200 attended. TOP PHOTO FROM LEFT: AQD's Dr. Nerissa Salayo who conceived ABOT, AQD Chief Dr. Joebert Toledo, and BFAR Director Atty. Malcolm Sarmiento

Two clients sign up in 2007: the first on May 8, even before the official launch, and the second on November 23



Seabass is little known to the palate of most Filipinos because it is not exactly affordable. To help introduce the fish, AQD made it a center dish in the ABOT forum, and attendees find it yummy, teriyaki or sweet&sour

ICD-SA project

technology demonstration for coastal & upland villagers and their local governments

ICD-SA is the *Institutional capacity development for sustainable aquaculture* project launched in 2006 to hasten the transfer to and adoption by coastal villagers of appropriate technologies that would enhance the productivity of aquatic resources and at the same time safeguard the fragile balance of the aquatic ecology.

Training, technology demonstration and research are the three main activities of ICD-SA projects. The ICDSA projects, in effect, become: (1) an R&D platform for demonstrating the technical and economic feasibility of aquaculture technologies; (2) a laboratory for assessing socioeconomic and environmental impacts of aquaculture technologies; and, (3) on-site training ground for beneficiary communities.

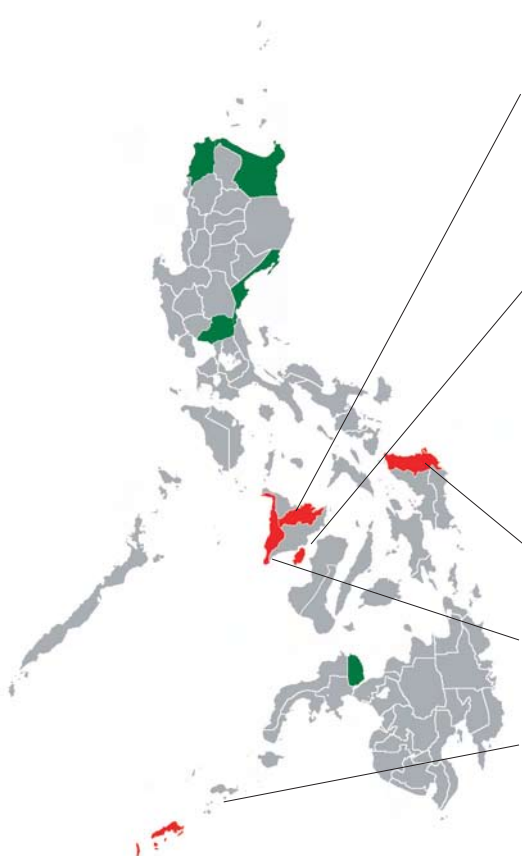
In 2007, AQD implemented ICD-SA projects in four provinces – Antique, Capiz, Guimaras and

Northern Samar – in central Philippines (shaded red in map). In the pipeline are similar projects for other provinces (shaded green).

TRAINING

Season-long training courses are conducted on-site. Each course consists of a series of modules conducted throughout the production cycle of a cultured commodity. Each module is usually 2-3 days and is composed of lectures and hands-on practical sessions.

The purpose of season-long training courses – which can go from 4 to 6 months or longer – is to enable participants to learn technical knowledge and skills through actual production activities such as pond/pen preparation, stocking, feeding, water quality



Capiz ICD-SA: The three-year (2007-2009) project is funded by the Capiz Provincial Government, amounting to US\$59,000. The project has three components: brackishwater aquaculture, freshwater aquaculture and coastal resources management

Guimaras ICD-SA: This *Pilot project on milkfish cage culture as livelihood option for Guimaras fisherfolk affected by oil spill* is funded by Petron Corporation, the oil company that chartered an oil carrier that sank and leaked oil in the seawaters of Guimaras in October 2006. The project site is in the mariculture park situated at AQD's Igang Marine Station. Started in October 2007, the one-year project is estimated to cost US\$78,000. Two fisherfolk organizations from four barangays (Igang, Rosario, San Antonio and Santo Domingo) are participating in the project. They are represented by 30 persons or households

Northern Samar ICD-SA: Started in July 2007, the two-and-a-half year project called *Enhancing adoption of mud crab production technologies in Northern Samar* is funded by the Australian Center for International Agricultural Research (ACIAR) and Community Agricultural Technologies Project. Funds are channelled through Action in Community Empowerment, an NGO that implements Australian development projects in the Philippines. Estimated to cost US\$73,000, the project's beneficiaries are 325 fishing households from four municipalities (Rosario, Lavasares, Lao-ang and Pambujan). These households derive their income mainly from the sale of crabs caught from the wild

Antique ICD-SA: The 3-year (2006-2008) project is funded mainly by the Community Development Fund of the province's congressional representative (US\$10,000). The municipality of Pandan, one of the project sites, contributed US\$2,000

Bongao, Tawi-Tawi: Multi-species marine fish hatchery

Ilocos Norte, Cagayan, Aurora, Quezon, Negros Occidental, Misamis Occidental (shaded green): Preliminary consultation and initial site assessments

CLOCKWISE In Roxas City, trainees try their hands at water quality monitoring after a demonstration on instrument use; in Dumarao, a trainee lifts up a bag of tilapia fry that will be stocked in the netcages which he and his co-trainees made; in Catarman, AQD scientist-trainer discusses feed formulation; and in Igang, trainees turn their attention to the basics of cage culture in a lecture

management, fish health management, harvesting and marketing. The extended period allotted gives participants more time to absorb and understand the topics. Camaraderie among the trainees and familiarity with their trainers may develop over time; this friendly atmosphere is conducive to sharing observations and solving production problems collegially.

In 2007, four season-long courses were started, with one completed (see table below).



Year 2007's COMPLETED MODULES of the SEASON-LONG COURSES under the ICD-SA project

Province	Season-long course; venue	Number of participants	Module 1; date	Module 2; date	Module 3; date	Module 4; date	Module 5 and up; date
CAPIZ Phase I <i>Roxas City</i>	Brackishwater aquaculture of grouper and mudcrab ^a	58: 17 LGU staff, 14 pond/hatchery operators, 9 students, 13 school staff, 5 private sector	Aquaculture production systems; 14-15 February	Soil/water quality and fish health management; 12-13 March	Feed formulation & preparation; 10-11 April	Business planning & management; 29-30 May	Harvest & post-harvest handling; 5-6 July
	Phase 2 <i>Dumarao</i>	Freshwater aquaculture of tilapia, catfish and prawn ^b	36: farmers from 3 barangays in Dumarao who have been displaced by a mini-dam construction	Freshwater aquaculture systems; 14-15 November	Feed formulation & preparation and soil/water quality; 4-5 December	Fish health management and economics; February 2008	Harvest and postharvest; March 2008
GUIMARAS	Milkfish cage culture ^c	30: fisherfolk from 4 barangays in Nueva Valencia affected by an oil spill	Aquaculture production systems; 8-9 October	Feed formulation & preparation and soil/water quality 16-17 November	Fish health management and cage maintenance; 19-20 December	Harvest, postharvest, and marketing; January 2008	Economics and business planning; March 2008
NORTHERN SAMAR	Mudcrab culture ^d	33: fisherfolk and NGO workers from 4 municipalities in Catarman	Mudcrab culture; 24-26 July	Stock enhancement & site assessment; 6-9 November	In 2008	In 2008	In 2008

^a Held at the Roxas City campus of the Capiz State University; ^b NIA Bunkhouse in Dumarao; ^c AQD's Igang Marine Station in Guimaras; ^d Catarman campus of the University of Eastern Philippines

TECHNOLOGY DEMONSTRATION & PRODUCTION RUNS

The selection of species and culture systems that are demonstrated on-site is determined by community consultation, expert observation and analysis, and economic viability. The community consultation helps determine the appropriateness of a technology based on the resources and capabilities of the beneficiaries. AQD scientists analyze the techno-bio-physical characteristics of the local resources and design the aquaculture farm in consultation with the clients/beneficiaries/donors. Construction of farm facilities is done with selected beneficiaries before the start of or during the “training-run” production, whichever is more practical and do-able.

Preliminary financial feasibility analysis is prepared by AQD researchers and economists using costs-and-returns and discounted financial projections. Financial indicators used are return-on-investments and payback period, net present value, internal rate of return, and

benefit-cost ratio. The indicators are used as budgeting instruments in the production run.

The first production run is a “training run,” closely supervised by AQD trainers. In the course of the season-long training, participants do the actual production operations like stocking, feeding, sampling and monitoring, disease surveillance and prevention, cage/pond repair and maintenance, harvesting, and marketing. The succeeding production runs are operated and managed by the beneficiaries, if they are evaluated as ready and capable, with minimum supervision by AQD.

ICDSA project duration is usually three years - long enough for the beneficiaries to learn and be confident in operating and managing aquaculture farms.

See table for the technologies demonstrated in the ICD-SA sites.

RESEARCH STUDIES

Baseline socioeconomic data are gathered through surveys and from secondary sources prior to or in the early months of the project implementation. At the start of the project, selected areas are studied to determine their carrying capacity as potential sites for aquaculture projects. And at the end, assessments will be conducted to measure, quantitatively and qualitatively, the project impact on the socioeconomic condition of the beneficiaries and on the aquatic environment. The information will be packaged into policy briefs and presented to LGUs to encourage legislations in support of sustainable aquaculture and fisheries development.

The 2007-2008 studies are presented next page.

The people's cooperative in Pandan makes its first harvest of cage-cultured seabass on June 8 (top, right), while the first stocking of 24,000 milkfish fingerlings from AQD is witnessed by project recipients, among others, on August 17 in Ilang (bottom, right)

The consultation in Nueva Valencia, Guimaras on September 2 (top, left); and the initial reseedling of bighead carp in Dumarao on August 23 (bottom, left). The latter was requested by the Dumarao LGU and highlighted the agreement signing with AQD



ICD-SA SITE TECHNOLOGIES DEMONSTRATED BY AQD**RESEARCH STUDIES****Capiz**

Grouper and mudcrab culture in brackishwater ponds in Roxas City. Renovation and preparation of three ponds started in November 2006. Grouper fingerlings and crablets from AQD hatcheries were stocked in February 2007, right after the first training module. Stock sampling was done at 15-day interval to monitor fish/crab growth. Water quality was monitored regularly to determine dissolved oxygen, water temperature and salinity. Mudcrabs were harvested after a four-month culture period.

For grouper culture, stock sampling showed encouraging results with fish attaining a 295g ABW after 6.5-month culture period. Fish growth is within the acceptable range. Harvest was completed at the end of September 2007. Results showed a 300g ABW and 89% survival rate.

The mudcrab harvest, however, showed a very low 12% survival due to the adverse effect of high salinity-high temperature combination from March to May. Another run is planned during the rainy season (June-October 2008) and is expected to show better results and demonstrate the economic viability of mudcrab culture.

Freshwater cage culture of tilapia, catfish and freshwater prawn in Badbaran River, Dumarao. As part of the second training module on freshwater aquaculture, net cages (8 units of 4 x 4 x 1.5 m) were installed and stocked with tilapia, catfish and freshwater prawn (*ulang*) in November 2007. This phase continues in 2008.

Socioeconomic survey of 20 rice farmer-trainees in Dumarao (to start 2008)

Ecological studies of Badbaran River in Dumarao (to start 2008)

Guimaras**Milkfish cage culture at AQD's Mariculture Park, Igang, Nueva Valencia**

Three floating net cages were constructed and installed in October 2007. The cages serve both as training and production facilities to demonstrate milkfish culture as an alternative livelihood for oil spill affected families. Each cage has a capacity of 600 m³ and was stocked with 24,000 milkfish fingerlings per cage. Estimated culture period is five months. Commercial brands and SEAFDEC-formulated feeds are used. After 75 days of culture, fish ABW was 135g; estimated survival rate was 95%. The estimated profit of US\$1,000 per cage will be equitably shared by the participating fisherfolk organizations. The money will be used to construct and operate fish cages in their respective areas.

Socioeconomic survey of participating barangays in Nueva Valencia (started November 2007)

Ecological studies of AQD's Mariculture Park in Igang (which hosts private firms in addition to the Petron project; ongoing in 2007 and to continue in 2008)

Antique**Cage culture of seabass in Bugang River, Pandan**

For the nursery phase, three units of nursery cages (3 x 2.5 x 1 m) were set up to grow 1,600 fry (2-3 cm long) up to 10-15 cm long. Fry were stocked at 100 fish per m³. After 30-45 days, 5-10 cm-long seabass fingerlings were transferred to grow-out net cages.

For the grow-out phase, 10-15 cm-long fingerlings from the nursery cages were stocked in 8 units of stationary net cages (4 x 2.5 x 1 m) at 20 fish per m³. The fish were given feeds formulated by AQD.

Selected harvesting was done starting on the 6th month, when the fish reached 400 g. Harvest was completed on the 8th month. Survival was 60%.

Seabass cage culture in ponds in the municipality of Hamtik

For the nursery operation, four net cages (3 x 2 x 1 m; mesh size, 0.5 cm) were installed inside a pond. Hatchery-bred seabass fry were stocked in the first 2 cages at 130 per m³ (780 per cage). After 30-45 days, 20-g seabass fingerlings were transferred to grow-out compartments.

For the grow-out phase, a 1.25 ha-pond was divided by nets into six compartments (2,080 m² per compartment). Seabass juveniles (20 g) were released from the first set of 4 units nursery cages to grow-out compartments at 5,000 fish per ha (1,040 fish per compartment). The second batch of fingerlings from the second set of 4 units nursery cages was released into 3 compartments two months later.

A strong typhoon hit the province midway the production cycle and caused the overflow of water and escape of fish from the ponds. Harvest was done after eight months, when fish were 350-400 g. The low survival (less than 50%) was attributed to *force majeure*.

Abalone searanching in the municipality of Anini-y (started October 2006 to determine the technical and financial viability of searanching which can be adopted by organized fisherfolk)

Socioeconomic survey of Anini-y (started late September 2007)

Northern Samar**Mudcrab nursery, grow-out, fattening and feed formulation** (to start 2008)

Mudcrab stock assessment [started in November 2007 in two sites – Rosario and Pambujan – to determine the seasonal trends in relative abundance of mud crab by size, sex, catch, stage of maturity, and condition of habitat]

Mudrab market survey (started in November 2007 to determine the supply and market chains of crabs from Northern Samar to crab farms all over the country)

Training and information dissemination

regular programs and activities to serve all stakeholders

AQD trained 50% more people over the previous year's (2006) record. A total of 300 government officers, fish farmers, fisherfolks, students and private sector practitioners attended AQD's 23 courses, and they ranged in age from 16 to 74 years. About 37% was female.

The training program is classified into four types:

- international courses with funding support from the Government of Japan in the form of fellowships for SEAFDEC member-countries
- on-site season-long courses as part of the ICD-SA project in collaboration with LGUs, NGOs, people's organizations, and other collaborating institutions [see previous section]
- specialized or client-driven courses tailored to the needs of requesting participants
- internships and OJT training for students and out-of-school youths

INTERNATIONAL TRAINING

Fish health management. This was conducted from 29 January to 4 February 2007 in Yangon, Union of Myanmar with funding support from the GOJ-TF's Fish Disease Project in collaboration with Myanmar Department of Fisheries (DOF). Ten (10) participants consisting of 5 technical staff of the DOF and 5 from the private sector (fish farmers, a hatchery operator, feed company staff), and 4 observers (3 from DOF and 1 a university assistant professor) attended the course.

Shrimp and prawn health management. The training-workshop was conducted 5-9 February in Yangon in cooperation with Myanmar DOF, the Marine Shrimp Association (MSA) of Myanmar, and AQD on a cost-sharing scheme. The 5-day on-site course had 23 participants ~ 11 fishery officers from DOF and 12 directors & technicians from MSA.

Marine fish hatchery. This GOJ-TF funded course was conducted 22 May to 8 June at AQD in Iloilo, Philippines for nine participants from Thailand (2), Cambodia (1), Singapore (1) and Philippines (5). Four of the participants had GOJ fellowship grants, one was sponsored by the Thai government, two were self-funded, and the others had special arrangement with AQD.

As trainees of the international course on marine hatchery (top) find out, handling broodstock is the first critical job in a successful hatchery



Health management and disease diagnosis of shrimps and prawn. In response to the request of Vietnam's National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED), this 5-day training was held 20-25 August at Southern Monitoring Center for Aquaculture No. 2 (RIA-2) in Ho Chi Minh City for 19 participants and 6 observers. Eight of the participants were from NAFIQAVED, nine from the various provincial stations of Vietnam's DOF, and two from RIA-2. This training was a collaboration between Vietnam's Ministry of Fisheries and GOJ-TF Fish Disease Project on a cost-sharing scheme, with the latter providing travel funds of the two lecturers from AQD.



The course in Vietnam on detection of KHV and SVCV



AQD researchers train staff of Myanmar's Department of Fisheries on fish (top) and shrimp health in early 2007 in Yangon



Detecting viral diseases of koi and carp is the topic of the second training for Vietnam's NAFIQAVED staff (top); the international participants of the abalone course take to the tanks for their practicals on abalone broodstock management

Detection of koi herpesvirus and spring viremia of carp.

This hands-on training was conducted from 27 August to 5 September in Ho Chi Minh City for 18 technical staff of NAFIQAVED and RIA-2 including two observers from RIA-2. The course was a cost-sharing agreement among AQD, NAFIQAVED and GOJ-TF Fish Disease Project.

Abalone hatchery and grow-out.

From 6 to 25 September, AQD conducted a 20-day training for 18 participants from Indonesia (1), Malaysia (2), Myanmar (1), and the Philippines (14). Of the 18 participants, four had GOJ-TF Fellowship Grants, three were private practitioners, 11 were personnel of BFAR, and two were AQD staff.



A landmark course for AQD in 2007 is the training on Seaweed tissue culture & sporulation, the first one ever held in the Philippines. Taught by AQD researchers, six trainees from the government and academe were able to grow 60- μ m seaweed plantlets from spores. It is to be noted that what ails the seaweed industry in the Philippines and the Southeast Asian region is deteriorating seedstock

SPECIALIZED TRAINING

Production of farm-based feeds for freshwater fishes.

This is for two officers of the Lingap Kabuhayan Foundation in Bustos, Bulacan who trained for 2 days, 15-16 February.

Seaweed tissue culture and sporulation.

This 5-week course was conducted from 19 February to 23 March for four BFAR personnel and two college instructors from Zamboanga State College of Marine Sciences and Technology and Mindanao State University – Tawi-Tawi College of Technology and Oceanography. This training was sponsored by BFAR, the Western Mindanao Seaweed Industry Development Foundation Inc (WMSIDF) in Zamboanga City and the Growth-for-Equity in Mindanao (GEM).

Pond management with emphasis on soil and water quality.

At the request of the GenoMar Inc, a company which develops genetic mapping and breeding programs of tilapia, this 3-day course was held 1-4 May for two of their staff from Indonesia and Spain.

Crab seed production. In response to a number of requests from foreign private enthusiasts, this course was conducted from 17 May to 7 June. Four participants from Singapore, India, Canada, and the Philippines attended.

Microalgae culture and production.

Two researchers from the Philippine Department of Science and Technology in Manila underwent this 12-day training which was conducted 13-25 June.

Familiarization with WSSV. Two staff of the Capiz Agri-Aqua Laboratory in Roxas City, Capiz attended this familiarization course on the detection of white spot syndrome virus (WSSV) using PCR, 19-20 July. The training was sponsored by the Provincial Government of Capiz.

Another two employees of Aqua CARDS, Inc. based in Siquijor trained in two separate 4-day sessions held 25-28 October and 20-23 November.



Milkfish feed formulation and preparation. This was conducted in Jordan, Guimaras 2-3 August for 20 participants comprising pond owners/technicians, LGU & NGO staff, and BFAR personnel. BFAR-Region 6 funded the course.

Abalone hatchery and diatom culture. This is for one staff of Ezotomi Seafood Inc, and was conducted 18 August to 26 September.

Tilapia hatchery and grow-out operations. The first batch had 1 participant from the Kingdom of Saudi Arabia, 1 from Sudan, and 5 from the Philippines; this was conducted 24-28 April.

The second session for three personnel of Harvest Moon Farm in Candaba, Pampanga was held 17-21 September.

Catfish breeding and farming. At the request of one Nigerian national, this course ran for a month (1 – 29 October), and held in two AQD stations.

Freshwater prawn hatchery and grow-out operations. This was conducted in Tabuk, Kalinga for 20 participants of the BFAR-CAR region from 27 to 29 November

Breeding and culture of selected freshwater species. This is for 1 participant, from 4 to 12 December.

Natural food culture and feed formulation. Conducted 5-9 November for two employees of BSJ Fishing and Trading Inc, a company based in Manila.

INTERNSHIPS

To cater to the needs of local and international fishery schools and other academic institutions in training their students on aquaculture operations, AQD accepts interns and OJTs. The interns and students are assigned different tasks in AQD hatcheries, grow-out culture systems, laboratories, and other offices and are closely supervised. Their performance is assessed afterwards.

In 2007, there were 203 students completing the program, including 6 foreign students from France (1), USA (1), Germany (1), UK (3), and Netherlands.

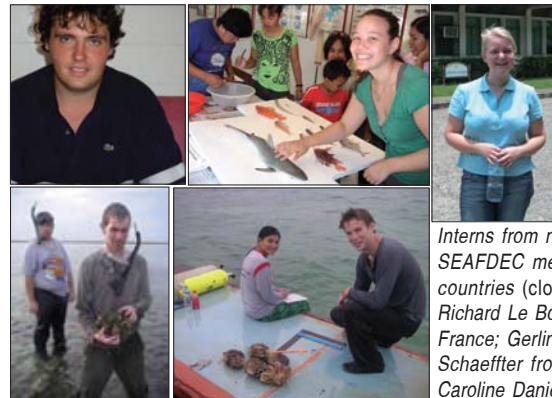


Special trainees from Indonesia and Spain learn pond management from an AQD visiting scientist, go on a field trip, and learn laboratory skills

Trainees from Singapore, India, Canada and the Philippines are introduced to mudcrab broodstock by an AQD researcher. The trainees also construct & install nursery cages, and culture natural food in the hatchery



A Nigerian national learns catfish breeding & farming



Interns from non-SEAFDEC member-countries (clockwise): Richard Le Boucher from France; Gerlinde Schaeffter from Germany; Caroline Danielle Laursen from the Netherlands; Joseph Eslao from the USA & Timothy Andrew Whitton from the United Kingdom; and James Dorricott & Zara Toledo, also from the UK

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FISHWORLD

The AQD FishWorld continued to help educate Filipinos and visitors from around the world about science and the environment. In 2007, it increased its museum collections with a large number of larval and juvenile fishes and crustaceans from the *tangab* fishery in Iloilo Strait. There were also two specimens of the rare golden cowry (*Cypraea aurantium*) acquired. FishWorld's biological collections now stand at about 3,600 different species of aquatic plants and animals.

Many of the more than 11,000 visitors (see also page 39), especially the teachers, use the FishWorld collections to identify marine animals in their own research, and to study for the competitions.

Seventeen elementary schools (102 contestants, 66 coaches) participated in four contests and eight high schools (26 contestants, 20 coaches) in five contests during *Aquaculture week*. The best performing schools were Kinaadman Elementary School and Colegio del Sagrado Corazon de Jesus (high school), both in Iloilo.

The rare golden cowry



Tangab is a large fixed filter net many of which are set and operated along Iloilo Strait, here installed in front of FishWorld



Sinabawan, one of the two murals by 18-year old Andrea Bagarinao, makes a perfect background for the yearly aquaculture week contests held every July in celebration of AQD's founding anniversary

Produced in 2007 are the following popularized publications for the use of the industry, collaborating partners, and the general public:

PROGRAM & INSTITUTIONAL PROMOTION



Recent developments in the genetic improvement of the giant freshwater prawn *Macrobrachium* sp.

This is an 83-page compendium of results from the collaborative GOJ-Trust funded program. It gives research updates and summarizes proposals; phase two of the project continues up to 2010

AQD Highlights 2006, a 64-page annual report on AQD's departmental and regional programs and activities

The AQD Magic, an 8-minute video that introduces visitors to AQD's research-and-development programs with historical notes and interviews of stakeholders. First shown at the 10th SEAFDEC-ASEAN FCG meeting in November at Iloilo City, Philippines

AQD core values-vision-mission, an 8.5 x 11 inch, two-pocketed folder that can hold AQD publications

AQD publications catalogue, a 2-page flyer listing available books, manuals, CD-videos for sale

ABOT AquaNegosyo, a 3-fold flyer on the details of the forum that was held Oct 16-18 in Quezon City, Philippines

Large-format posters on seabass culture, AQD's products and services, technology packages of the Agree-Build-Operate-Transfer program, stock enhancement in southern Antique and in Sagay Marine Reserve, Igang mariculture park, and other topics



TECHNOLOGY UPDATES

Tilapia broodstock management and hatchery [Aquaculture Extension Manual or AEM No. 38] This is a 40-page how-to manual

Giant clam hatchery, ocean nursery, and stock enhancement, AEM 37. This is a 109-page guide to the culture of giant clams

Translations and update of three manuals in Filipino (Philippine language): tilapia hatchery, tilapia grow-out, and seaweed culture [AEMs 32, 22 and 21]



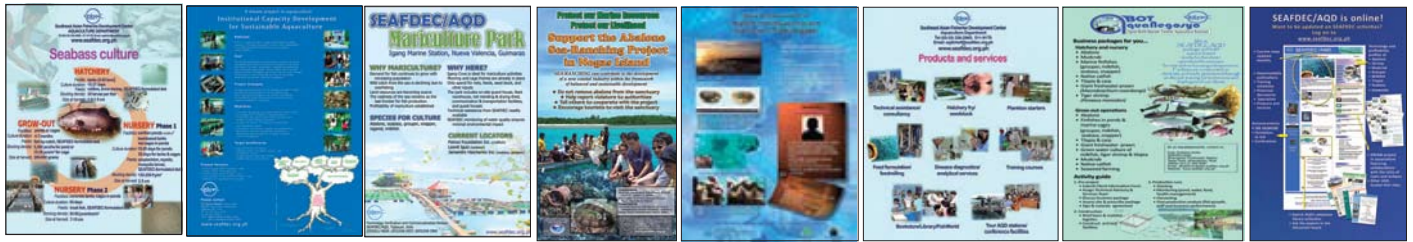
Dream project: Institutional capacity development for sustainable aquaculture, a 2-page flyer summarizing project aims to inform and invite collaborators



Spring viremia of carp, a 2-page flyer on a disease threatening freshwater aquaculture

Biosecurity for shrimp farms, a 2-page flyer on what shrimp farmers need to do before, during and after a disease outbreak

Seabass culture, a 2-page flyer promotes the little-known seabass (the fish) and its culture technology



Eight of the large-format posters produced by AQD in 2007 as information campaign materials for communities and for fairs & exhibits (above). The website changes for the year (below right)

AQD WEBSITE

www.seafdec.org.ph

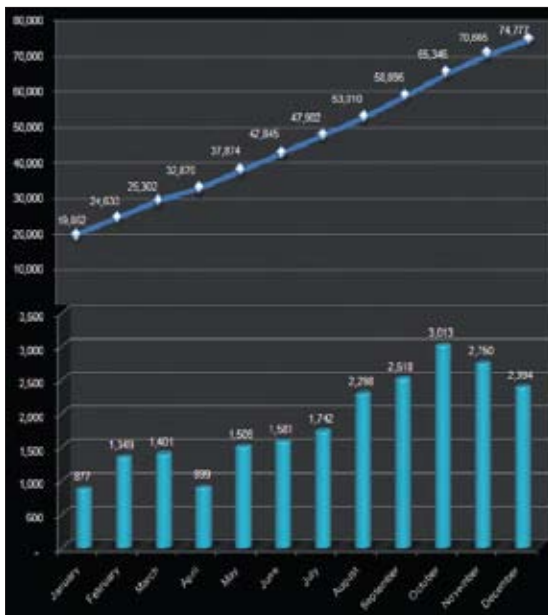
To make AQD information materials accessible to the public, AQD continues to update its website, www.seafdec.org.ph. For 2007, the site was updated 12 times; in particular, the technology summaries for tiger shrimp, mudcrab, milkfish, grouper, seabass, tilapia, and seaweeds were posted with the latest costs-and-returns analysis. Historical reports and a new mini-website on the ICD-SA project were also uploaded. The record of the almost monthly changes can be viewed in *What's new*.



Browsership of the AQD website in 2007: line shows cumulative raw website hits from PHP JunkYard; bars show numbers of unique visitors each month from GoogleAnalytics (ie. a visitor from the same URL is counted only once a month regardless of repeat visits)

Website rawhits have remained consistent at around 5,000 a month. Unique visitors peaked in October at 3,000. Browsers mostly arrived through Yahoo and Google, were mostly interested in the commodities and in downloadable publications; and most stayed for 10 minutes.

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NEWSLETTER

AQD Matters, the internal newsletter that is at least 8-pages long. Nine issues were produced to enhance communication and information sharing. It is emailed as a PDF file to employees and friends of AQD, select mass media, and PTAC.

Mass media helped AQD disseminate information to the general public by utilizing the 12 press statements that AQD distributed beginning February through August (table next page). There were also 66 more articles – 21 in traditional print-TV-radio plus 45 in web or blogsites – about SEAFDEC which were independently written by the mass media. In all, a total of 135 articles on SEAFDEC was noted.

The mass media was a good focus for AQD because it's essentially free, has a wide reach, and can help generate public support for its programs.



Four of the AQD newsletter issues

7hrough continued active participation in fairs & exhibitions organized by the private sector, AQD is able to interact directly with its stakeholders in the Philippines. In 2007, AQD participated in five venues:

1st Purina AquaCongress organized by Cargill Purina in Bacoor, Bulacan, on 23 March. The AQD exhibit focused on freshwater aquaculture technologies. The congress had an estimated 100 participants

FishLink 2007 organized by the University of the Philippines Aquaculture Society Inc in Iloilo City; 17-19 May. The AQD exhibit on its programs and publications was visited by more than 200 people

15th Metro Manila area business conference, organized by the business community in Manila, 16-17 August; and a separate **conference for the Visayas** area,



Bacolod City, 7-8 September. Exhibits focused on AQD's new program for entrepreneurs, the *Agree-build-operate-transfer* aquaculture business, and had about 100 visitors in each location

AgriLink-FoodLink-AquaLink 2007 at the PICC, Manila; 3-4 October. The AQD booth featured technical consultancy. AQD gave a presentation (abalone and seahorse hatchery) in the accompanying lecture series. The exhibition opened its doors to an estimated 500 and more visitors

AQD's media exposure in 2007

<i>Date and title of press statement from AQD</i>	<i>Resulting media exposure (including websites)</i>
7 Feb: Seabass project reaps good harvest	8 newspapers
2 Mar: SEAFDEC tests its feed formulations for marine fishes	2 magazines, 1 newspaper
30 Mar: SEAFDEC conducts training on seaweed biotech	8 newspapers
1 June: Capizeno wins in U.S. science tilt	5 newspapers
14 June: SEAFDEC urges biosecurity for shrimp farms	4 newspapers, 2 websites
10 July: TV interview of AQD Chief, Research and Technology Verification Heads	1 TV station
13 Jul: Collaborative program of AQD and BFAR on national breeding and culture program on abalone, 34 th anniversary celebration with special guest DA Secretary Arthur Yap	11 newspapers, 1 TV station, 6 websites
16 July: Petron gives P3 million for AQD's project in Guimaras (Phil)	5 newspapers, 8 websites
16 July: SEAFDEC/AQD and ACIAR collaborate on mudcrab in northern Samar (Phil)	1 newspaper, 1 website
3 Aug: Sea-ranching of abalone launched in Nogos Island (Phil)	1 newspaper, 1 website
22 Aug: SEAFDEC to hold forum for business people	2 newspapers, 1 website

Jan-Sept: various topics independently covered by public media which are about SEAFDEC or mention SEAFDEC 21 newspapers-TV-radio, 45 web/blogsites





visitors to AQD in 2007 were oriented about its activities and shown around the various hatcheries, laboratories and pond facilities. More than 13,000 visited this year from:

SEAFDEC member-countries	125
Non-member countries	82
International or regional organizations	173
Schools (students & faculty)	11,385
Others	1,321
Total	13,086

Upon AQD's invitation, some visitors were kind enough to deliver short seminars, informing AQD staff of the most recent developments in aquatic science around the world. The presentors, their topics, and dates:

- Dr. **Nora Caberoy**¹ : Developmental gene expression in *Myxococcus xanthus*: analyzing the role of NtrC-like activators; 15 Jan
- Dr. **Richard Lee**² : Molecular diagnostics for diseases in marine crustaceans and mariculture of black sea bass; 25 Jan
- Ms. **Janette Sapilan**³ : Ecological solid waste management; 7 Mar
- Ms. **Millicent Sanciangco**⁴ : A molecular phylogeny of the grunts (Perciformis: Haemulidae) inferred from nuclear rag1 gene sequences; 14 June
- Dr. **Christopher Brown**⁵ : Biogeography and aquaculture of fish; 7 June
- Dr. **Russell Borski**⁶ : "Catch-up growth": hormones and mechanisms; 7 June
- Mr. **Jon Altamirano**⁷ : The Batan Bay estuary: why poor fishers get poorer?; 29 June
- Dr. **Iain Neish**⁸ : Seaplant value chains: three opportunities in global markets... especially in China; 16 Jul
- Dr. **Shugo Watabe**⁹ : Biochemical and molecular biological studies on muscle proteins of aquatic organisms; 10 Aug
- Dr. **Helén Marcial**¹⁰ : Rotifer as model animal for ecotoxicological studies; 10 Aug
- Ms. **Sheila Santander**¹¹ : Impacts of organic matter input from mariculture on the bioturbation recycling capacity of polychaetes in marine sediments; 6 Sept
- Mr. **Victor Soliman**¹² : Population dynamics of sinarapan, the world's smallest commercial fish; 11 Sept
- Dr. **Andrea Agillon and Atty. James Dennis Gumpal**¹³ : Intellectual property awareness; 20 Sept
- Dr. **Shoji Kitamura**¹⁴ : Development of aquaculture technologies suited to Southeast Asia; 26 Sept
- Dr. **Hisashi Kurokura**¹⁵ : History of kuruma prawn (*Penaeus japonicus*) stock enhancement in the Hamana Lake, Japan; 5 Oct
- Dr. **Wee Kok Leong**¹⁶ : Challenges in the aquafeed industry, 26 Oct
- Dr. **Fu Hongtup** and Mr. **Liu Bo**¹⁷ : Brief overview of research activities conducted by Freshwater Fisheries Research Center of Chinese Academy of Fishery Sciences; 15 Nov
- Mr. **Joseph Leopoldo Laranja**¹⁸ : *In vitro* determination of the prebiotic potential of dietary carbohydrates in fish; 23 Nov

¹Syracuse University, New York, USA; ²Skidaway Institute of Oceanography, University Systems of Georgia, USA; ³Solid Waste Management Unit, DENR VI, Philippines; ⁴Old Dominion University, Virginia, USA; ⁵Aquaculture & Enhancement Division, National Marine Fisheries Service, Milford Laboratory, Connecticut, USA; ⁶Department of Zoology, North Carolina State University, USA; ⁷Laboratory of Global Fisheries Science, University of Tokyo, Japan; ⁸IFC Seaplant Net Initiatives, Indonesia; ⁹Laboratory of Aquatic Molecular Biology & Biotechnology, Department of Bioscience, University of Tokyo; ¹⁰Graduate School of Agricultural and Life Sciences, University of Tokyo; ¹¹Marine Science Institute, University of the Philippines; ¹²Bicol University, Philippines; ¹³Intellectual Property Office, Bureau of Agricultural Research, Philippines; ¹⁴JIRCAS, Japan; ¹⁵Laboratory of Global Fisheries Science, University of Tokyo; ¹⁶Nutrition & Technical Services (Aquaculture), Gold Coin Services Pte Ltd, Singapore; ¹⁷ Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences, Wuxi City, China; ¹⁸Laboratory of Aquaculture & Artemia Reference Center, Universiteit Ghent, Belgium

Visitors to AQD from its host country include the Honorable Senator Edgardo Angara (in the middle among AQD senior managers) who visited September 28, food manufacturer Mr. Jose Ong of CDO (Sept 7), and basketball celebrity player Mr. Ramon Fernandez (Sept 11)



FROM TOP Entrepreneurs from Bari Aquatech of Malaysia visit AQD March 5-7; Dr. Russel Borski of the North Carolina State University in the USA, June 7; top fisheries officials from Sri Lanka, September 3-8; Dr. Yamazaki Ikeda of the Hokkaido International Foundation, January 28-30; and Dr. Barney Smith & Dr. Mike Rimmer of Australia on April 28

The AQD Library collection is available on the internet through the *Online Public Access Catalogue* (OPAC) in the AQD website. The number of unique (=counted only once) global information searchers who accessed the catalogue totaled 1,794; if repeat visits are included, there were 24,699 hits in all. Browsers and AQD clients also made requests for full-length articles by phone or email, and 46 were received coming from 23 countries.

The Library continued to serve walk-in readers, and they numbered about 5 per hour. The walk-ins came from 125 different schools, government offices, and companies. They made

use (14,447 searches) of the OPAC in the local area network and the various commercial databases ~ ASFA; Aquatic Biology; Aquaculture & Fisheries Resources; FishBase; and Current Contents ABES & Life Sciences. They generated 667 records from their searches.

LIBRARY COLLECTION AND SOURCES

The Library collection now stands at 19,032 monographs, 4,563 SEAFDEC publications, 8,468 bound serial volumes, 9,785 pamphlets, and a variety of maps, posters, microfiche & CD-ROMs. Of these, 35,534 titles and 55,227 volumes or copies have been inputted in OPAC / Follet databases.

To continually increase and update its aquaculture & fisheries collection, AQD continued its subscriptions to 15 serials, including *Aquaculture*, *Fish Pathology* and *Asia Life Sciences*. A total of 41 journal issues were received, including a new update of ASFA on DVD format that covered 1971 to June 2007 bibliographies. AQD also bought 44 books, with 4 paid for by GOJ-TF. In addition, some 291 news items mainly on science were clipped and posted in bulletin boards.

The rest of the Library collection has been sourced from gifts and publication exchange agreements with other institutional libraries: 144 books, 8 CDs, 49 pamphlets, 25 reprints, 567 journal issues. While IAMSLIC, of which AQD is a member, donated 140 back issues of assorted journals, 2 CDs, and 28 books. IAMSLIC also facilitated the requests for 6 full-length journal articles not in the AQD collection.

Private individuals also made donations: (1) Dr. Koichi Okuzawa, 2005-2006 issues of the journals *Fisheries Science* and *Zoological Science* and (2) Dr. Clarissa Marte, assorted magazines like *Time* and *Newsweek*. Dr. Chhorn Lim, Dr. Brian Davy, Dr. Kevin Fitzsimmons, and Dr. Barry Costa-Pierce gave their respective publications in exchange for AQD's.

While the AQD library collection continues to grow, duplication of materials became a problem in view of the limited shelf space. AQD thus gave away between 4 to 102 duplicate volumes to 12 school libraries and LGU recipients in Luzon (Camarines Sur), Visayas (Iloilo, Roxas City, Negros Occidental, Bohol, Samar), and Mindanao (Tawi-Tawi, Marawi, Cotabato City, Sultan Kudarat).

Finances

STATEMENT OF SOURCE & APPLICATION OF FUNDS

1 January to 31 December 2007

SOURCE OF FUNDS	
	Philippine peso (PhP)
Government of the Philippines	<u>128,500,000</u>
Government of Japan Trust Fund	
Development of fish disease surveillance system for aquatic animals	4,577,907
Stock enhancement for threatened species of international concern	1,632,680
Promotion of Sustainable Aquaculture in the ASEAN Region	3,201,333
GOJ Committed Funds from prior year	<u>5,731,444</u>
	15,143,364
External Grants	
National Fisheries Research and Development Institute (NFRDI)	3,200,000
Australian Centre for International Agricultural Research (ACIAR)	326,945
ASEAN Foundation	413,851
Capiz Provincial Government	373,846
DA - Bureau of Fisheries and Aquatic Resources (BFAR)	150,000
Department of Science and Technology (DOST 10)	27,100
Northern Samar Provincial Government	343,924
Petron Foundation Inc	1,500,000
SEAFDEC Secretariat	204,576
United Nations Educational Scientific & Cultural Organization (UNESCO)	<u>207,055</u>
	6,747,297
Internally Generated Funds	
Income - Research Division	4,687,195
Income - Training and Information Division	1,517,121
Income - Technology Verification and Commercialization Division	2,800,513
Income - Administrative & Finance Division	5,462,671
Income - Management Office	<u>759,129</u>
	15,226,629
Committed Funds from prior year	<u>7,745,929</u>
Total Funds	PhP <u><u>173,363,220</u></u>

APPLICATION OF FUNDS	
General/Administrative & Non-project Expenses	
Administrative & Finance Division	34,588,709
Management Office	13,997,288
Research Division	32,807,403
Technology Verification and Commercialization Division	4,093,106
Training and Information Division	<u>9,693,191</u>
	95,179,697
Program / Project Expenses	
Administrative & Finance Division - Management Office	843,094
Research Division	19,449,531
Technology Verification and Commercialization Division	13,482,886
Training and Information Division	<u>3,394,233</u>
	37,169,744
Government of Japan Trust Fund Projects	
Development of Fish Disease Surveillance System for Aquatic Animals	5,045,434
Stock Enhancement for Threatened Species of International Concern	2,487,229
Promotion of Sustainable Aquaculture in the ASEAN Region	3,659,316
NFRDI - Regional Surveys and Study	131,070
GOJ Committed Funds/Advances	<u>3,820,315</u>
	15,143,364
Externally Funded Projects	
ABOT AquaNegosyo	104,667
ACIAR - Grouper Projects	239,154
APEC - Health & Husbandry Manual for Grouper Farming	270
ASEAN Foundation	335
BFAR - Review and Publication of BAR/FSP Funded Research	70,889
DOST 10 - Seaweeds Production in Lanao del Norte	74,549
FRA - Comparison of Characteristics of KHV isolates	213,214
LGU Antique - Institutional Capacity Development for Sustainable Aquaculture	774,921
NFRDI - Capacity Building of BFAR-NFRDI in Fish Health	490,660
NFRDI - Joint Implementation of the Aquaculture Biotechnology Projects	123,469
Private Collaboration - Milkfish Cage Culture as a Livelihood Option for Affected Guimaras Fisherfolk	1,034,485
UNESCO - Guidebook to Philippine Mangroves/ Mangrove Associates	<u>228,852</u>
	3,355,466
DA-BFAR-NFRDI - Aquaculture Biotechnology Projects	<u>5,162,081</u>
Committed Funds	
Advances for on-going activities	1,241,563
Capital outlay/repairs	<u>16,111,305</u>
	17,352,868
Total Application of Funds	PhP <u><u>173,363,220</u></u>

Footnotes to 2007

CORE VALUES
AQD is committed to sustainable development and the responsible stewardship of aquaculture resources through research and the promotion of appropriate aquaculture technologies and information relevant to Southeast Asia



AQD hosts back-to-back SEAFDEC meetings

The 30th SEAFDEC Program Committee Meeting and the 10th ASEAN-SEAFDEC Fisheries Consultative Group Meeting were hosted by AQD in Iloilo City 26-28 November and 29-30 November, respectively. Forty-seven representatives from the ASEAN and SEAFDEC member countries (except Lao PDR) as well as the SEAFDEC departments and the Secretariat attended.



Earlier on 18 October, AQD organized the 18th Meeting of the Philippine Technical and Administrative Committee or PTAC to ensure that the priorities of the Philippines, AQD's host country, will be brought forward to SEAFDEC.

AQD joins global concert for climate protection

Employees answered the call on 7/7/07 to join the Live earth party across the globe. The concert calls for awareness and action for climate protection.

Aquaculture may already be seeing one of the impacts of global warming. Milkfish, one of its priority species for R&D, has been spawning out of its previously documented season in west central Philippines.



AQD's most senior Scientist retires

AQD's world-renown, multi-awarded and most senior Scientist Dr. Jurgenne Primavera retired from AQD in February after more than three decades of service. Her advice to colleagues: be loyal to science and to the institution.

Dr. Primavera has focused on shrimp breeding in her early studies in the mid-70s, and has since shifted to mangroves, mangrove rehabilitation and related studies.



Feedback from some stakeholders

“Malaysia has greatly benefitted from SEAFDEC through trainings, through the technical knowledge it has shared.”

- Mr. ABDUL RAHMAN BIN ABDUL WAHAB
Planning and International Division
Department of Fisheries, Malaysia

“AQD has already transferred technology of milkfish hatchery and aquaculture. This is highly appreciated and commended by our government.”

- Ms. NGUYEN THI TRANG NHUNG
International Cooperation Department
Ministry of Agriculture and Rural Development
Vietnam

“I personally want to thank SEAFDEC for all the work they did here, which is enormous; and for all the research they are doing for us to be good farmers.”

- Mr. JEAN CLAUDE DRUET
Fishfarm owner, ED Aquafarm
Masbate, Philippines

“I went to Igang (Marine Station) and when I looked at the cages there, I said I could do it. We're now doing our own cages. (The idea) came from SEAFDEC.”

- Mr. PETER UY
Outstanding Fisherfolk (Fish Culture)
Gawad Saka Awardee 2007
Negros, Philippines

“I see a good number of SEAFDEC researchers devoting a lot of time on the practical side (of aquaculture) which is really what farmers need.”

- Mr. PHILIP CRUZ
Ramon Magsaysay Memorial Awardee for
Aquatic Technology Enterprise 2006
Cruz Aquaculture Corporation
Bacolod City, Philippines

“I am deeply thankful to SEAFDEC because if not for them, I will not learn what I do today. If they did not extend some training to us, I would not be earning extra income from aquaculture.”

- Mr. Daniel de Leon
Fishfarmer
Rizal, Philippines

“We [families affected by the oilspill] thought there was no hope to restore our livelihood but now, we can bring it back to normal [with cage culture of milkfish.]

- Mr. Reynaldo Dominguez
Fisherman
Guimaras, Philippines

MISSION
AQD will provide dynamic and competent leadership in the generation and promotion of science-based responsible technologies to strengthen stakeholder capacities in aquaculture and aquatic resources management



Dumarao, Iloilo, west central Philippines: rice farmers whose plots were partly submerged by the backwaters of a small dam are trained by AQD in freshwater aquaculture. They hope to eventually harvest tilapia, catfish, bighead carp ^[above left], and freshwater prawn to replace their lost income from rice. And like the people's cooperative in Pandan, Antique ^[above right], they want to sustain this activity with AQD's assistance



www.seafdec.org.ph

About SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in December 1967 to promote fisheries development in the region. The member countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. The policy-making body of SEAFDEC is the Council of Directors, made up of representatives of the member countries.

SEAFDEC has four departments that focus on different aspects of fisheries development:

- Training Department (TD) in Samut Prakan, Thailand (1967) for training in marine capture fisheries
- Marine Fisheries Research Department (MFRD) in Singapore (1967) for post-harvest technologies
- Aquaculture Department (AQD) in Tigbauan, Iloilo, Philippines (1973) for aquaculture research and development, and
- Marine Fishery Resources Development and Management Department (MFRDMD) in Kuala Terengganu, Malaysia (1992) for the development and management of fishery resources in the exclusive economic zones of SEAFDEC member countries

AQD is mandated to:

- Conduct scientific research to generate aquaculture technologies appropriate for Southeast Asia
- Develop managerial, technical and skilled manpower for the aquaculture sector
- Produce, disseminate and exchange aquaculture information

AQD maintains four stations: the Tigbauan Main Station and Dumangas Brackishwater Station in Iloilo province; the Igang Marine Station in Guimaras province; and the Binangonan Freshwater Station in Rizal province.

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TMS



Tigbauan Main Station (TMS)



Dumangas Brackishwater Station (DBS)



Igang Marine Station (IMS) and Mariculture Park



Binangonan Freshwater Station (BFS)

