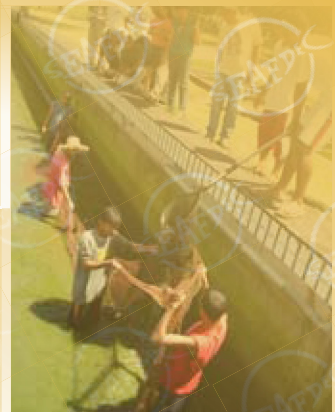
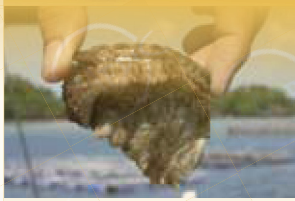
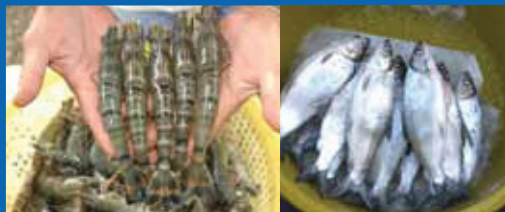




SEAFDEC/AQD Highlights 2008



AQUACULTURE DEPARTMENT
Southeast Asian Fisheries Development Center
Tigbauan, Iloilo, Philippines
www.seafdec.org.ph



In addition to shrimp and milkfish, AQD has developed technologies in rearing abalone, bighead carp, catfish, freshwater prawn, grouper, mud crab, rabbitfish, seabass, seaweeds, snapper and tilapia



Research done by AQD scientists (78% are female researchers) appear in peer-reviewed papers in science journals. Mature technologies derived from these get packaged into fishfarmer-friendly materials



AQD's training courses go a long way in building a skilled aquaculture workforce in the region



Developing mangrove-friendly aquaculture technologies is one of AQD's thrusts toward sustainable and responsible aquaculture

AQD: 35 years of strengthening the legacy of responsible aquaculture in Southeast Asia

The past three-and-a-half decades of its existence has allowed AQD to contribute to the growth of the aquaculture sector in the region by leaving behind some groundbreaking achievements and legacies:

The legacy of tiger shrimp and milkfish, the two pioneering commodities in aquaculture. A sunshine industry in the '70s and '80s, the tiger shrimp industry is one that AQD has practically built. After its collapse in the mid-'90s, the industry was aided in its partial recovery by AQD and its partners with the development of mangrove-friendly shrimp culture technologies and development of disease prevention and control measures.

For milkfish, a national breeding program was implemented with BFAR in 1981. To date, AQD extends technical assistance to 16 hatcheries, and with the growing industry of milkfish cage culture, a constant supply of fry and fingerlings may now be partly assured.

The legacy of diversified aquaculture. In addition to tiger shrimp and milkfish, AQD developed new technologies on the hatchery and grow-out of abalone, mudcrab, freshwater prawn, bighead carp, tilapia, grouper, snapper, seabass, rabbitfish, and seaweeds. These technologies can be adapted to suit the needs of investors, small-scale, medium-scale, or large-scale; in freshwater, brackishwater, or in marine waters. Its goals — food security and poverty alleviation — are close to being achieved.

The legacy of scientific research. AQD technologies are backed by scientific research, by peer-reviewed papers in science journals. More than 100 of these having been cited for best research. To date, nearly 900 research papers — more than 600 of these in international scientific journals — were

published. From scientific data and experimentation come the packaging of mature technologies that are continually verified and tested on a commercial scale with willing and innovative private sector partners.

The legacy of skilled manpower and womanpower for the Philippines and the rest of Southeast Asia. More than 7,000 people have been trained at AQD in 68 kinds of training course topics. Many of these trainees are now holding vital positions in their home agencies/countries.

The legacy of fishfarmer-friendly materials to support technology transfer efforts. Over 200 farmer-friendly publications, at least 700 newsletters, and 32 videos have been written and published by AQD to cater to fishfarmers and new aquaculture entrepreneurs. AQD has compiled all these in a *Compendium of Aquaculture Technologies* on DVD. This is in addition to making these accessible through www.seafdec.org.ph and the AQD library, which is reputed to be the best collection of aquaculture materials in Southeast Asia.

The legacy of responsible aquaculture and fisheries. The SEAFDEC family, including the four Departments in the Philippines, Thailand, Singapore and Malaysia, has regionalized the *Codes of Conduct* for: aquaculture & mangrove ecosystems, fishing operations, fisheries management & co-management, and postharvest & trade. SEAFDEC endeavors to have these adopted by aquaculture and fisheries stakeholders, and turned into law by member-countries.

Here & now: studies on new species

AQD is exploring new frontiers, taking the first steps in domesticating new species for aquaculture or stock enhancement.

The angel wing clam *Pholas orientalis*, locally known as 'diwal', has been successfully induced to spawn at AQD since May 2007. Natural spawning in captivity was observed in November 2007 and again in April and November 2008. New batches of larvae are currently being reared in the hatchery using newly adopted protocols. It is hoped that the successful development of seed production technologies would lead to the rehabilitation of depleted stocks in the wild.

Research on the seed production of the Napoleon wrasse *Cheilinus undulatus* is ongoing in partnership with a private company. The wrasse is listed in the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). This fish was observed to spawn year round, but egg production was highly variable.

The seed production of two freshwater fish species, the climbing perch (*Anabas testudineus*) and snakeskin gourami (*Trichogaster pectoralis*), was also done. While female climbing perch injected with 0.5 µL Ovotide per g body weight spawned after 12–16 hours, the induced spawning of the gourami has not been successful. With further studies, this could ultimately help in putting more fish on the table of people in inland, landlocked communities.

The pompano *Trachinotus blochii* was induced to spawn in captivity at AQD. About 19% of larvae produced in June survived after 60 days. Another spawning occurred in August, with 63% of the larvae produced surviving.

AQD researchers also started work on the sea cucumber *Holothuria scabra*. The larval rearing phase produced about 15,000 early visible juveniles. Highly prized as a delicacy, this species is in danger of being depleted from the wild. To help restore natural populations, studies are being conducted to refine hatchery protocols and monitor the grow-out of sea cucumber for stock enhancement.



From top: the angel wing clam, climbing perch, pompano and sea cucumber

Into the future: strategic plans

AQD conducted a strategic planning meeting in August 2008, thereby setting the research priorities of the Department for 2009–2012:

Development of responsible aquaculture technology and practice. Species that are prioritized for study are carefully chosen. AQD neither supports nor works on species that are exotic or pose risks to the environment when released. The potential effects of 'climate change/global warming' on the reproduction and culture of tropical species will be included.

Responsible use of aquatic genetic resources for aquaculture & resource enhancement. AQD's concern for responsible aquaculture dictates prudence in the use of genetic resources. This is practiced in studies involving native shrimps, mud crabs, and species used in stock enhancement.

Adoption of measures to avoid environmental degradation. Aquatic ecology studies are conducted on the impacts of aquaculture, especially on the use of formulated diets in marine project sites.

Promotion of environmentally sound culture methods and commodities. AQD will bring responsible aquaculture technologies to its many and diverse stakeholders through the ICD-SA and ABOT AquaNegosyo programs and through training & information dissemination.

Harvest of tilapia from cages in Dumarao, Capiz, an ICD-SA project site



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RD – Research Division; TVDD – Technology Verification & Demonstration Division;
TID – Training & Information Division; AFD – Administrative & Finance Division;
BFS – Binangonan Freshwater Station; DBS – Dumangas Brackishwater Station;
IMS – Igang Marine Station

ACRONYMS

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)
DHA, EPA – Docosahexaenoic acid, eicosapentaenoic acid (types of fatty acid)
FCG – Fisheries Consultative Group (of ASEAN-SEAFDEC)
GCHV – Grass carp hemorrhagic virus
GIS – Geographic information system
GOJ or JTF – Government of Japan or Japanese Trust Fund
IAMSLIC – International Association of Marine Science Libraries & Information Centers
IcW – Internal carapace width (of crabs)
ICD-SA – Institutional capacity development for sustainable aquaculture (project)
IEC – Information, education & communication
IHHNV – Infectious hypodermal and hematopoietic necrosis virus
IMNV – Infectious myonecrosis virus
JICA – Japan International Cooperation Agency
LGU – Local government units (in the Philippines)
m or m³ – Meter or cubic meter
MOAVEC – Misamis Occidental Aquaculture Ventures Corporation
MrNV – <i>Macrobrachium rosenbergii</i> nodavirus
NACA – Network of Aquaculture Centres in Asia-Pacific
NCSU – North Carolina State University
NFRDI – National Fisheries Research & Development Institute (Philippines)
NGO – Non-government organization
OJT – On-the-job training / trainee
PACAP – Philippine Australia Community Assistance Program
PAPD – Participatory action plan development
PCR – Polymerase chain reaction (a process)
RESCOPAR – Rebuilding Resilience of Coastal Populations and Aquatic Resources
R&D – Research and development
SEAFDEC – Southeast Asian Fisheries Development Center
SEARCA – Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SVCV – Spring viremia of carp virus
TSV – Taura syndrome virus
UNESCO – United Nations Educational, Scientific and Cultural Organization
UNITAR – United Nations Institute for Training and Research
UPV – University of the Philippines Visayas
VNN – Viral nervous necrosis
WSSV – White spot syndrome virus
WTD – White tail disease

SEAFDEC/AQD Highlights 2008

ISSN 1655-5228

Published by SEAFDEC/AQD © April 2008



The AQD Chief reports

The year 2008 came to a close with AQD making very significant progress. Work targets were mostly achieved, and the year brought increased visibility to AQD in international gatherings.

AQD's programs for collaborating with stakeholders, the *Institutional capacity development for sustainable aquaculture (ICD-SA)* and the *Agree-build-operate-transfer aquabusiness (ABOT AquaNegosyo)* also had a banner year, with new agreements signed with regional and national partners. Preliminary talks with other prospective partners are also ongoing. The feedback and experiences gained from these programs will provide AQD with invaluable information for further improvement and innovation, as outlined in AQD's R&D framework (see box below).

This year, about 700 stakeholders from diverse backgrounds and nationalities trained at AQD, thus registering an increase of about 43% from last year's figure. Notable among the AQD courses is a special trainers' training session on rural aquaculture, conducted under the project *Human resource development (HRD) on poverty alleviation and food security by fisheries intervention in the ASEAN region*. AQD was the first among SEAFDEC Departments to conduct the training series, funded by the Japan-ASEAN Solidarity Fund of the ASEAN Foundation.

In terms of research, more than 80 proposals have been approved for the year. In addition to internal funding (from the Philippine government), other institutions supported AQD's researches as well, including ACIAR, Kagoshima University, USAID-AquaFish Collaborative Research Support Program, UPV and BFAR, among many others.

A total of 15 international organizations, national government agencies and local government units of AQD's host country, the Philippines, and private corporations and individuals signed new agreements with AQD.

AQD's programs are organized into either departmental or regional programs. The former run the gamut from broodstock development & management, nursery & hatchery, and grow-out of economically important aquatic species and include studies on (1) integrated mollusc production; (2) mud crab & shrimp domestication; (3) marine fish; (4) smallholder freshwater aquaculture; (5) seaweed strain improvement; and (6) aquatic ecology.

The regional programs of AQD address the aquaculture needs specific to SEAFDEC member-countries, and are implemented together with collaborators with funding support from GOJ-TF. These programs focus on: (1) development of technologies and human capacity building for sustainable aquaculture; (2) disease surveillance system for aquatic animals; and (3) R&D on stock enhancement for threatened species of international concern.

For the year, AQD scientists have written 24 papers, 16 of which are in science journals indexed by the Institute for Scientific Information in their *Current Contents*; the rest are reviews and papers in conference proceedings or local journals.

AQD was visible in international gatherings, which include participation to the (1) *International workshop on koi herpesvirus* in Caesaria, Israel last Feb. 17-18; (2) 19th NACA meeting in Kathmandu, Nepal last Mar. 6-8; (3) OIE/NACA *Regional workshop on aquatic animal health*



AQD's research & development framework

Partnerships with AQD

International organizations

Australian Centre for International Agricultural Research (ACIAR): the collaboration involves assessing and recommending R&D investment opportunities of the abalone industry of Eastern Indonesia; January 18 – May 31, 2008

National Institute of Fisheries of Ecuador: establishment of aquaculture facilities and conduct of training activities, which involve conducting feasibility studies and provision of technical assistance; December 3, 2008 – December 3, 2010

Philippine government agencies

Department of Agrarian Reform: collaboration to develop programs and provide of technical assistance to agrarian reform beneficiaries; January 23, 2008 – January 23, 2013

Bureau of Fisheries and Aquatic Resources, Provincial Government of Davao Oriental, City Government of Mati, Davao Oriental; mariculture zone and multi-species hatchery project; October 2008

Bureau of Fisheries and Aquatic Resources Region III: site and technology assessment and baseline socioeconomic survey in the municipalities of Baler and Casiguran; April 2008 – completion

Provincial and municipal LGUs

Municipality of Kalibo, Aklan, Bureau of Fisheries and Aquatic Resources Region VI: establishment of a seabass satellite hatchery; June 5, 2008

Province of Misamis Occidental: collaboration to provide technical and training support to Misamis Occidental Aquamarine Park (MOAP); January 31, 2008 – January 31, 2010

Private corporations and individuals

Phillips Seafood Philippines Corporation: integrated mollusc production at the SEAFDEC mariculture park; March 4, 2008 – March 4, 2009

Golden Agribusiness Corporation: technical assistance for an aquaculture enterprise under the ABOT AquaNegosyo program; April 3, 2008 – April 3, 2009

Santeh Feeds Corporation: agreement for pompano breeding; September 10, 2008 – September 10, 2011

Ms. Jane Caras: technical assistance for an aquaculture enterprise under the ABOT AquaNegosyo program; January 16, 2008 – January 16, 2009

Mr. Alfredo Angelo Marte: pilot testing of mud crab hatchery; March 4, 2008 – March 4, 2009

Dr. Anicia Hurtado: integrated mollusc production at the SEAFDEC mariculture park; February 21, 2008 – February 21, 2009

Mr. Carmelo Celis: conduct of verification trials on the net culture of seabass; July 14, 2008 – July 14, 2009

Mr. Victor Boco: technical assistance for an aquaculture enterprise under the ABOT AquaNegosyo program; July 15, 2008 – July 15, 2009

from Mar. 25–28 in Bangkok, Thailand; (4) *Giant Malaysian prawn 2008 international seminar* last Mar. 27–30 in Kuala Lumpur, Malaysia; (5) *World Aquaculture 2008* held in Busan, South Korea last May 19–23; (6) *Diseases in Asian aquaculture symposium* on June 22–26 in Taipei; (7) *Crustacean diseases and immunity seminar* held June 27–28 in Taipei, Taiwan; (8) 2008 NFRDI-FFTC *International workshop on integrated coastal zone management for sustainable aquaculture* in Pusan, South Korea last Aug. 26; (9) *JICA Training program for young leaders in the field of economic development* in Japan last Sept. 10–27; (10) World Bank's 2008 *Development marketplace global competition* from Sept. 22–27 in Washington, DC, USA; (11) UNITAR *Training workshop on sea and human security — towards a comprehensive security for seas and oceans: The Hiroshima Initiative* last Sept. 28–Oct. 3 in Hiroshima, Japan; (12) NACA *TAC meeting* held in China on Oct. 28–30; (13) 8th *International course on biodiversity in mangrove ecosystem* held Oct. 28–30 in India; (14) *Workshop on governance of marine areas beyond national jurisdiction: management issues and policy options* in Singapore last Nov. 2–6; (15) *Global technical trade conference on shrimp* last Nov. 5–10 in Guangzhou, China; (16) *Training on the evaluation methods of genetic diversity for Scylla serrata* from Nov. 17–29 in Ishigaki Is., Okinawa, Japan; (17) *Catfish symposium* in Can Tho City, Vietnam last Dec. 5–7; and (18) 7th *NACA Aquatic animal health advisory group meeting in Bangkok, Thailand* from Dec. 14–17.

Mature aquaculture technologies from AQD were popularized and disseminated through 4 new manuals, 1 handbook, 7 flyers, and 7 large-format posters. Moreover, efforts were also made to disseminate information about AQD's activities through the mass media, participation in fairs & exhibits, and the website www.seafdec.org.ph.

This year, AQD's 35th, proved to be a fruitful one. We owe our success to our various funding partners, stakeholders, collaborators, and the Philippine government for their unfaltering support.

We thank everyone who have, in any way, shape or form, contributed to AQD's successes this year and in many more years to come.



Joebert D. Toledo, D. Agr.
AQD Chief



For its first 35 years, AQD was steered by Chiefs Dr. Rolando Platon, Dr. Rogelio Juliano, Dr. Flor Lacanilao, Dr. Joebert Toledo and Dr. Efred Ed. Flores, here gathered during the anniversary program. Not in picture are: the first Chief, Dean Domiciano Villaluz (deceased) and Dr. Alfredo Santiago Jr. (now based in the US)



AQD's new partners-collaborators include (from left) the Misamis Occidental provincial government, represented by Gov. Loreto Leo Ocampos; and (as visitor) Mr. John Gumbs, the general director of Ecuador's National Institute of Fisheries

Research & development projects 2008

STUDY TITLE	STUDY LEADER	PERCENT COMPLETED	BUDGET		COLLABORATING AGENCY	
			SEAFDEC	EXTERNAL		
DEPARTMENTAL PROGRAMS						
Integrated Mollusc						
1	Experimental hybridization between Philippine native abalone species; <i>Haliotis asinina</i> , <i>H. glabra</i> , <i>H. ovina</i> and <i>H. varia</i>	MR de la Peña	20%	481,250.00		
2	Improvement of hatchery production techniques for the donkey's ear abalone <i>Haliotis asinina</i>	AC Fermin	80%	586,426.00		
3	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	100%	94,283.00		
4	Lipid and essential fatty acid requirements of juvenile abalone, <i>Haliotis asinina</i> , Linne	MB Teruel	50%	400,500.00		
5	Large-scale production of donkey's ear abalone, <i>Haliotis asinina</i> juveniles	NC Bayona	90%	852,046.00		
6	A modular system of culturing the tropical abalone, <i>Haliotis asinina</i> , L. 1758 in mesh cages	VC Encena II	85%	895,928.00		
Mud Crab/ Shrimp						
<i>Penaeus indicus/P. merguensis</i> broodstock development						
7	I. Refinement of broodstock management and larval rearing of <i>P. indicus/P. merguensis</i>	FDP Estepa	95%	494,894.00		
8	Nursery culture of mudcrab <i>Scylla serrata</i> in net cages fed formulated diet	JLQ Laranja Jr. (MEM Rodriguez)	90%	655,668.00		
9	Development of practical feed for the grow-out culture of mud crab <i>Scylla serrata</i> Forsskal	MR Catacutan	40%	721,400.00		
10	Culture of marine annelid <i>Perinereis</i> sp. and its use as substitute for fishmeal, shrimp meal and squid meal in shrimp feeds	VR Alava	75%	167,800.00		
11	New aquaculture technology for various penaeid species: Comparative reproductive performance of pond-sourced <i>Penaeus monodon</i> adults fed natural and artificial diets in floating net cages	MB Teruel	20%	105,000.00	240,000.00	Government of Japan (Kagoshima University)
12	Enabling aquatic animal health capacity through geographic information system (GIS): Diseases of crustaceans	CL Pitogo	95%	138,765.00		
13	Seed production of mud crab <i>Scylla</i> spp.	ET Qunitio	50%	833,500.00		
14	Production of marketable-size mud crabs <i>Scylla serrata</i> using AQD formulated diet	NM Franco	75%	123,004.00		
15	Culture of mud crab (<i>Scylla serrata</i> Forsskal) in mangrove pens	DD Baliao			357,168.35	Land Bank (LBP-TPC)
16	Verification of <i>Penaeus indicus</i> grow-out diets in ponds using environment-friendly scheme	NV Golez	27%	1,611,824.00		
17	Production of juvenile mudcrab <i>Scylla serrata</i> in brackishwater ponds	JLQ Laranja Jr. (MEM Rodriguez)	100%	890,510.00		

STUDY TITLE	STUDY LEADER	PERCENT COMPLETED	BUDGET		COLLABORATING AGENCY
			SEAFDEC	EXTERNAL	
Marine Fish					
18	Studies on the seed production techniques of high value marine species such as grouper, red snapper, seabass and pompano	OS Reyes	50%	2,717,600.00	
19	Alternative feeding strategies to improve milkfish production	EDJ Ayson	30%	1,463,500.00	USAID-AquaFish CRSP
20	Use of PUFA-rich thraustochytrids as enrichment diets for live foods (rotifers and <i>Artemia</i>) in the larviculture of the seabass, <i>Lates calcarifer</i>	DG Estenor	50%	345,959.00	
21	Studies on the seed production techniques of milkfish and rabbitfish	OS Reyes/(EDJ Ayson)	50%	1,510,600.00	
22	Identification of molecular markers for egg quality in cultured marine species	JB Gonzaga	90%	590,500.00	
23	White cowpea meal as alternative source of protein for grouper, <i>Epinephelus coioides</i>	PS Eusebio (RE Mamauag)	45%	635,965.00	
24	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	55%	1,288,500.00	
25	Assessment of the potential of mysid shrimps (Crustacea: Mysidacea) as live food in marine fish culture II. Nutritional evaluation of the mysid shrimps	PS Eusebio	75%	352,210.00	
26	Evaluation of some nutritional and microbial derivatives as immunostimulants in grouper <i>Epinephelus fuscoguttatus</i> I. Influence of environmental stress on innate immunity and resistance to bacteria in grouper fed various immunostimulants	EC Amar	82%		150,000.00 UPV
27	Use of integrated pest management to control snail <i>Cerithidea cingulata</i> infestation in brackishwater ponds	JM Ladja	70%	363,804.00	
28	The use of phased diets (starter, grower and finisher) for grouper (<i>Epinephelus fuscoguttatus</i>) cultured in floating net cages	RM Coloso (RE Mamauag)	65%	338,649.00	
29	Production and intensive culture of seabass (<i>Lates calcarifer</i>) in brackishwater ponds using SEAFDEC formulated diets	RM Coloso	30%	657,269.00	
30	Improvement in the nursery culture techniques for groupers, seabass and snappers in cages and in pond: Assessment of feed performance of different diets	JM Ladja	95%	966,976.00	
31	Refinement and dissemination of intensive grow-out technique for the polyculture of milkfish (<i>Chanos chanos</i>) and white shrimp	NV Golez	30%	538,252.00	
32	Improvement in the nursery rearing techniques and feeding strategies to mitigate cannibalism in the nursery cage culture of grouper, seabass and mangrove red snapper brackishwater ponds	RSJ Gapsin	80%	968,667.00	
33	Netcage culture of seabass, <i>Lates calcarifer</i> (Bloch) in freshwater farm reservoir using SEAFDEC formulated diet and commercial feed	DD Baliao	40%	392,008.00	
34	Culture of high value fish in floating cages	A Gaitan (RE Mamauag)	50%	637,619.00	
35	Milkfish fingerling production in ponds	EB Coniza	95%	597,720.00	
36	Verification of seabass, grouper and snapper grow-out diets in cages in pond	EB Coniza	60%	1,113,732.00	

STUDY TITLE	STUDY LEADER	PERCENT COMPLETED	BUDGET		COLLABORATING AGENCY
			SEAFDEC	EXTERNAL	
Seaweed Strain Improvement					
37	Seed production of <i>Kappaphycus</i> : protoplast isolation and sporulation	MRJ Luhan	65%	1,007,515.00	
Aquatic Ecology					
38	Development of sediment quality assessment and monitoring protocols in mariculture areas	SMS Santander	100%	783,550.00	
39	Monitoring water quality of mariculture park in Humaraon Cove, Igang, Guimaras using chemical and biological indicators	GM Anuevo	80%	587,600.00	
40	The <i>tangab</i> fishery in Iloilo Strait: operations, catch volume and species composition, economic importance, and ecological impact	TU Bagarinao	70%	60,000.00	
41	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	TRC Mallare	65%	113,000.00	
42	A comprehensive sociocultural and economic baseline assessment of the fishing communities of Anini-y and Tibiao for coastal resource, stock enhancement and sustainable aquaculture in the province of Antique	ET Aldon	100%	20,000.00	PSCA
Small Holder Freshwater Aquaculture					
43	Improvement of fillet yield in Nile tilapia (<i>Oreochromis</i> spp.) through farm-based mass selection	RV Eguia	95%	221,957.00	
44	Seed production of selected freshwater foodfishes: climbing perch <i>Anabas testudineus</i> , snakeskin gourami <i>Trichogaster pectoralis</i>	JT Fermin	40%	373,583.00	
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	95%	217,116.00	
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 I. Reproductive performance and fry production of bighead carp on different feeding regime II. Optimum stocking density at different climatic conditions (warm and cold)	MA Laron	100%	257,240.00	
47	Grow-out of white shrimp	MLC Aralar	4%		136,000.04 BFAR
48	Economic impacts of aquaculture development in Laguna lake	DC Israel	100%	185,000.00	
49	Mass production of native catfish, catfish hybrid, red tilapia and Nile tilapia	DM Reyes Jr.	90%	968,508.00	
50	Grow-out culture of Asian catfish <i>Clarias macrocephalus</i> (Gunther) in net cages in Laguna de Bay, Philippines	AD Evangelista	25%	220,756.00	
51	Freshwater aquaculture seedstock production in Laguna de Bay I. Advanced bighead carp fingerling production in a small fishpen	EV Aralar	30%	277,500.00	
52	Refinement of broodstock and hatchery management methods for the commercial production of freshwater prawn <i>Macrobrachium rosenbergii</i> seedstock II. Bioeconomics of freshwater prawn hatchery production in different larval rearing system	MA Laron	100%	86,363.52	

STUDY TITLE	STUDY LEADER	PERCENT COMPLETED	BUDGET		COLLABORATING AGENCY	
			SEAFDEC	EXTERNAL		
REGIONAL PROGRAMS						
Development of Technologies and Human Capacity Building for Sustainable Aquaculture						
53	Domestication and genetic stock evaluation of the indigenous giant freshwater prawn subspecies <i>Macrobrachium rosenbergii rosenbergii</i> I. Assessment of breeding and reproductive performance	MRR Eguia	15%	42,000.00	48,080.00	ASEAN-GOJ-TF
54	II. Determination of larval rearing and seed production requirements	MA Laron	10%		68,920.00	ASEAN-GOJ-TF
55	Domestication of mud crab <i>Scylla serrata</i>	ET Quintio	45%	287,000.00	US\$9,700.00	ASEAN-GOJ-TF
56	Genetic characterization of commercially important Philippine stocks of freshwater prawn, <i>Macrobrachium</i> sp., using DNA markers	MRR Eguia	97%	143,915.00	US\$4,400.00	ASEAN-GOJ-TF
57	Development of specific pathogen free (SPF) shrimp (<i>P. monodon</i> , <i>P. vannamei</i>) broodstock I. Information exchange on the 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 Quintio (FDP Estepa)	95%		US\$1,000.00	ASEAN-GOJ-TF
58	II. Genetic characterization of <i>P. monodon</i> broodstock	MRR Eguia	50%		US\$9,700.00	ASEAN-GOJ-TF
59	III. <i>Penaeus monodon</i> broodstock development: Studies on improvement of maturation of pond-reared <i>Penaeus monodon</i> broodstock	FDP Estepa (ET Quintio)	50%		US\$11,000.00	ASEAN-GOJ-TF
60	Development of strategies to extend the spawning season of Asian seabass (<i>Lates calcarifer</i>)	EDJ Ayson	70%		US\$8,000.00	ASEAN-GOJ-TF
61	Establishment of a land- and sea-based seaweed nursery of new and improved strains of <i>Kappaphycus</i> : Propagation of <i>Kappaphycus</i> plantlets from callus-like structures by tissue culture	AQ Hurtado	70%	631,050.00	US\$8,000.00	ASEAN-GOJ-TF
62	Socioeconomic impact of adoption of sustainable aquaculture technologies in selected fisherfolk communities	DB Baticados	15%	451,970.00	US\$4,000.00	ASEAN-GOJ-TF
Disease Surveillance System for Aquatic Animals						
63	Research and analysis of chemical residue in aquaculture: Survey of pesticide residues in fish and prawns in Western Visayas	MT Arnaiz	90%	229,072.00	US\$5,000.00	GOJ-TF
64	Parasite fauna of bivalves and gastropods in the Philippines	GE Pagador	65%	400,500.00	US\$1,000.00	GOJ-TF
65	Pilot testing of the "indigenous probiotic" in grow-out shrimp ponds	GL Po	80%		US\$5,000.00	GOJ-TF
66	Development of a vaccine against viral nervous necrosis in economically important marine fish	RV Pakingking Jr.	50%	839,880.00	US\$3,000.00	GOJ-TF
67	Epidemiology of the white spot syndrome virus (WSSV) in different shrimp (<i>Penaeus monodon</i>) culture techniques in the Philippines	EA Tendencia	30%		US\$7,000.00	GOJ-TF
68	Surveillance of emerging fish viral pathogens in some Southeast Asian countries	GL Po	80%		US\$16,000.00	GOJ-TF
69	Monitoring and surveillance of transboundary pathogens in cultured shrimps and freshwater prawns	CL Pitogo	80%		US\$13,000.00	GOJ-TF
70	Development of control methods for viral nervous necrosis (VNN) of marine fish	LD de la Peña	80%		US\$7,000.00	GOJ-TF
71	Development of immunological preventive methods for shrimp I. Immunostimulation and vaccination strategies for WSSV prevention	EC Amar	88%		US\$9,000.00	GOJ-TF

STUDY TITLE	STUDY LEADER	PERCENT COMPLETED	BUDGET		COLLABORATING AGENCY	
			SEAFDEC	EXTERNAL		
R&D on Stock Enhancement for Threatened Species of International Concern						
72	Management of seahorses <i>Hippocampus barbouri</i> , <i>H. comes</i> , <i>H. kuda</i>	SMB Ursua/ JT Fermin	40%	510,922.00	US\$4,500.00	GOJ-TF
73	Refinement of hatchery protocols, and trail grow out of sea cucumber juveniles for the stock enhancement program	MFJ Nievaes	90%	219,000.00	US\$ 2,000.00	GOJ-TF
74	Seed production of the humphead wrasse, <i>Cheilinus undulatus</i>	H Ogata	15%		US\$5,000.00	GOJ-TF
75	Experimental release of hatchery-produced donkey's ear abalone, <i>Haliotis asinina</i> , in Carbin Reef, Sagay Marine Reserve, Negros Occidental	SMB Ursua	60%	282,899.00	US\$5,000.00	GOJ-TF
76	Fisheries and seed production of the angelwing clam <i>Pholas orientalis</i> Gmelin 1790 for the rehabilitation of depleted wild stock	MJHL Ramos	60%	301,432.00	US\$5,000.00	GOJ-TF
77	Development of sea ranching techniques for the donkey-ear abalone <i>Haliotis asinina</i> and other economically important molluscs I. Bio-physical factors limiting growth and survival of seeded abalone	AC Fermin	30%	469,422.00	US\$6,500.00	GOJ-TF
78	Growth and survival of hatchery-reared giant clams <i>Tridacna gigas</i> in ocean nurseries in Negros and Panay Island	MJHL Ramos	90%	253,174.00	US\$5,000.00	GOJ-TF
79	Stock enhancement of abalone <i>Haliotis asinina</i> in Sagay Marine Reserve	MJHL Ramos	70%	250,174.00	US\$5,000.00	GOJ-TF
80	Socioeconomic analysis of stock enhancement of abalone and giant clams in Sagay Marine Reserve in the Philippines	ND Salayo	65%	152,502.00	US\$5,000.00	GOJ-TF
OTHER STUDIES						
81	Pilot project on milkfish cage culture as livelihood option for oil spill affected Guimaras fisherfolk	AG Gaitan/ RF Agbayani	50%			Petron
82	Integrated fisheries resource management (Rinconada Lakes, Philippines and NSW Australia): aquaculture and water component	MLC Aralar	75%			ACIAR
83	The USS Albatross Expedition in the Philippines, 1907-1910: Biodiversity collections, research publications, and exploration history	TU Bagarinao	100%			Fulbright Program, Department of State, USA
84	Capacity-building of BFAR-NFRDI in fish health management through training and collaborative research: Identification of emerging problems and economically significant diseases in hatchery and grow-out production systems of <i>Penaes vannamei</i>	CL Pitogo	70%		3,354,280.00	NFRDI
85	Bioremediating bacteria isolated from M/T Solar I affected sites in Guimaras	GL Po/C Sombito	20%			UPV
86	Enhancing adoption of mud crab production technologies in northern Samar	ET Quintio/ RF Agbayani	50%	62,000.00	679,227.95	ACIAR-CATP
87	Monitoring of water sediment quality influenced by grouper cage culture in four municipalities of Misamis Occidental	SMS Santander	approved September 2008	80,160.00	112,000.00	ACIAR-CATP
88	Assessment of resources, technologies, financial, and market of the Mindoro Oriental (SANAMSIM) brackishwater aquaculture farms	RF Agbayani	100%		66,000.00	Provincial government of Oriental Mindoro

Mollusc program

To improve abalone seedstock production for stock enhancement and commercial culture, 2008 studies were focused on standardizing and refining hatchery rearing protocol, improving settlement, and increasing juvenile production.

Since land-based rearing system for growing late juveniles to “cocktail size” (marketable size) is expensive due to high production cost (i.e., electricity), experiments on producing marketable size abalone in cages (using different basket types) were conducted to evaluate growth, survival and feed conversion rates.

1 Improvement of larval settlement and post settlement by manipulating light intensity and photoperiod. Significantly higher number of early juveniles were harvested from tanks lit with 2 bulbs compared to tanks lit with 1 bulb/tank and 1 bulb/2 tanks. The results of photoperiod experiments showed that provision of artificial lighting is not critical in the settlement period of rearing abalone.

2 Improvement of the efficiency of abalone hatchery operations through increased egg production, larval survival, improved larval settlement and higher juvenile production. Experiments on water management techniques and substrate (polyvinyl plate) conditioning were assessed. Results showed that using UV-treated seawater as the rearing medium have no significant difference compared to sand-filtered seawater during the first 10 days of postlarval rearing.



AQD's small-scale abalone hatchery produces about 24,000 juveniles monthly from January to November. AQD has about 1,134 broodstocks in its tanks (above)



His Excellency Makoto Katsura, Ambassador Extraordinary and Plenipotentiary of Japan (center) dropped by AQD's abalone hatchery last September 17

When settlement and survival during the first ten days of rearing were compared in different management systems, both parameters were lower in a flow-through system than in a stagnant system.

Results of the evaluation of waterless and water-filled transport methods combined with temperature manipulations for different sizes of abalone showed that 100% recovery can be achieved in waterless method after 10 hours transit time at temperature ranges of 23–24°C, and 100% recovery in water-filled method after 15 hours at 23–24°C with 12.5% water volume.

Analysis of transport modules tested suggests that the use of PVC pipes is more practical than plastic trays due to higher loading density. This finding provides new alternative cost-effective and less laborious rearing techniques.

3 Demonstration of large-scale production of abalone using recently developed hatchery techniques. A total of 291.4 million eggs/trochophore larvae and 155 million veligers were produced from January–November. Average survival from eggs/trochophore larvae to veliger larvae is 53.68 %.

As a result, AQD's abalone hatchery was able to produce 272 thousand juveniles, or a monthly average production of 24.8 thousand pieces from January to November.

4 Determination of abalone growth rates, survival and FCR using modular system in floating mesh cages and in barrels, and to determine and verify appropriate cage design for abalone culture. Two batches of tropical abalone



From AQD's Iloilo hatchery, abalone juveniles are transported to AQD's Igang Marine Station in Guimaras and reared to market-size in rectangular or circular trays in floating cages

juveniles were stocked at 600 pcs/cage and 1,000 pcs/cage in mesh cages and reared for 360 days using a modular system. Results of both test densities — with daily growth shell length (DGsl) of 110–120 µm/day — were significantly higher than the 88 µm/day DGsl reported among cultured abalone in other parts of the world.

Two nursery systems, using black plastic boxes and prefabricated trays, were tested to rear abalone from 11–15 mm to 26–30 mm SL size prior to stocking in grow-out cages. After 3 months, survival rate for both systems ranged 90–94%.

5 Investigation of the effects of dietary lipid and essential fatty acids on the growth, survival, and biochemical changes in juvenile tropical abalone. Tests of the various diets at 2, 4, 6, 8, 12 and 24 hours showed no significant differences in water stability among diets up to the 8th hour. Results

showed that abalone fed a diet with no lipid had significantly lower recovery rate and weight gain than the rest of the diets. Survival of abalone (90–100%) was not significantly different in all the dietary treatments.

6 Development of a tropical abalone hybrid characterized by fast growth and better meat quality. A hybridization trial crossing a female *H. asinina* and male *H. planata* produced 99 pieces of hybrid abalone that was reared in the laboratory and will be karyotyped to confirm hybridization. However, this hybrid appears to grow slower than pure *H. asinina* when grown in cages. Other crossbreeding trials (10 in all) were also conducted, mostly between *H. asinina* female x *H. glabra* male, but showed very low fertilization, hatching and settlement rates. Unlike the first hybrid, this one seems to grow faster compared to *H. asinina* grown in tanks.

Mud crab & shrimp program

Mud crabs and shrimps are two of the most valuable fisheries in the region. However, their culture continues to rely on wild-caught spawners. As a result, production has not been consistent because larval quality is unpredictable. Overexploitation and habitat losses have also led to reduced landings and smaller mean capture size of broodstock. The need now is for the management of resources and development of seed production techniques.

At AQD, the long-term objective of the mud crab and shrimp program is to develop a viable technology for the production of good quality seed and captive broodstock of native species (*Penaeus monodon*, *P. indicus* and *P. merguensis* for shrimps and *Scylla* spp. for crabs) that can be genetically selected for desired heritable characteristics, particularly disease resistance and/or fast growth.

The activities in this program are linked with the regional programs under the ASEAN-SEAFDEC Fisheries Consultative Group (see also page 22).



Captive white shrimp *Penaeus indicus* subadults

SHRIMP

1 Refinement of broodstock management and larval rearing of *P. indicus*/*P. merguensis*. *P. indicus* broodstock (F2 stocks) were ablated and stocked at a sex ratio of 1 female:1 male in 12 units one-ton tanks. Maturation and spawning were achieved after 5 days. Wild postlarvae that were gathered from Antique and grown to broodstock size are now matched with the F2s to produce another family.

A series of studies were conducted to determine the effect of β -glucan on the survival of larvae until PL5, and survival of younger (PL10) and older postlarvae (PL30) after simulated transport. Results showed that there was no significant improvement in survival of larvae. Similarly, no significant difference in survival was detected between β -glucan-treated and untreated younger postlarvae after transport. However, PL30 treated with a single dose a day before transport showed a significantly higher survival than untreated (control) PLs, or those continuously treated with β -glucan for a week.

2 Culture of marine annelid *Perinereis* sp. and its use as substitute for fish meal, shrimp meal and squid meal in shrimp feeds. Some aspects of the biology of the seaworm, *Perinereis nuntia*, was investigated. It was found to inhabit sandy and pebbly intertidal areas of Iloilo (Tigbauan, Guimbal, Miag-ao, and Concepcion) and San Joaquin (Tiolas and Siwaragan) and burrows into moist substrate (until 30 cm).

Females were more abundant (about 2♀:1♂), heavier and longer (0.73 g, 18 cm) than males (0.57 g, 16.2 cm) and immature ones (0.33 g, 13.6 cm). Sperm diameter was 2.1 μ m while mean oocyte diameter were 108.2 μ m and 112.3 μ m for Buyuan and Nanga samples, respectively.

Reared directly in sandbed inside aquaria with aerated seawater, seaworms survived better after 10 days when fed artificial diet + *Tetraselmis* (78%) than artificial diet (62%) and mussel meat (55%) alone. Higher mortality occurred in replicate aquaria with bigger individuals. Another 3-month trial showed a slight improvement in survival (82%) and production of five juveniles when a biofilter is added to the sandbed and the seaworms are fed mussel meat, artificial diet and their combination.



The life cycles of both *Penaeus monodon* and *Scylla serrata* have been completed in captivity, a prerequisite to domestication. All phases of shrimp and crab culture (broodstock, hatchery, nursery and grow-out) have been studied, and can be integrated to totally domesticate broodstock. The ultimate objective is reliable seed supply. From left: adult mud crab used as broodstock as base population; *S. serrata* crablets produced in the hatchery

MUD CRAB

1 Domestication of mud crab *Scylla serrata*. *S. serrata* from Cagayan, Camarines Norte, Northern Samar and Surigao del Norte were obtained for genetic diversity analysis and husbandry. Antennae and muscle tissues of *S. serrata* base population from four sites have been analyzed for genetic variability at the COI and 16sRNA gene.

First generation (F_1) families were produced from Cagayan (1 family), Camarines Norte (6), Northern Samar (8) and Surigao del Norte (9) and most of the crabs are now adults. Two F_2 families from Northern Samar have been produced 11–12 months after hatching (F_1). For the reproductive performance of parental stock P_0 , the interval between 1st and 2nd spawnings was 34–52 days while the interval between 2nd and 3rd spawnings was 33–34 days. The duration from spawning to hatching was 7–11 days for the first hatching and 6–10 days for the second hatching.

2 Seed production of mud crab *Scylla* spp. *S. serrata* broodstock for seed production were obtained from Surigao, Camarines Norte and Northern Samar. Of the 52 broodstock that spawned, 34 broodstock hatched their eggs (65%). The number of zoea

produced ranged from 0.84–4.2 million per female. Survival rate from zoea 1 to crab instar ranged from 1–4 %.

3 Nursery culture of mud crab *S. serrata* in net cages fed formulated diet. A verification run was conducted at DBS ponds using 12 units 20 m² net cages installed in 800 m² pond for the nursery rearing of megalopa to crablet. Megalopae were stocked at 30 ind/m² and fed 25% natural food (mussel meat) and 75% formulated diet based on the best results of a previous experiment. After 30 days, the survival rate of crablets (1.4 cm carapace width) was 65%.

4 Production of juvenile mud crab *S. serrata* in brackishwater ponds. Hatchery-reared megalopa or crab instar1 were stocked in 24 units of 20 m² net cages set inside a 600 m² pond at 30–50 ind/m². Crablets (0.8–1.5 cm IcW; 1.45 g BW) were disposed to farmers 20–35 days after stocking. A total of 32,038 crablets were produced from 6 cropping cycles from January–September, while additional crablets were harvested in the last quarter of the year.

5 Development of practical feed for the grow-out culture of mud crab *S. serrata*. Feeding experiments were conducted to determine the proportion of dietary nitrogen that goes into the chitin nitrogen production in mud crabs. Six test

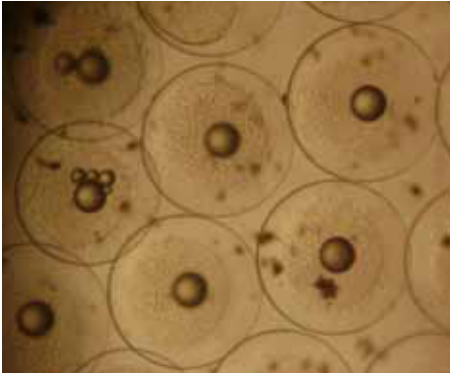
diets consisting of 2 crude protein levels (38 and 45%) and 3 crude fat levels (5, 7.5 and 10%) at each level of protein were formulated. Each dietary treatment was fed to 3 male and 3 female juveniles kept individually in 60 L tanks. The initial weight of crabs ranged from 1.92–5.13 g and the carapace width from 2.4–3.5 cm.

Feeding continued until the mud crabs have molted four times, or about 6 months in tanks. Survival and growth rates of crabs fed a diet with 45% dietary protein were better than crabs fed the 38% protein diet. Partial results of chitin analysis showed that levels in mud crab exoskeleton ranged from 31.7–86%.

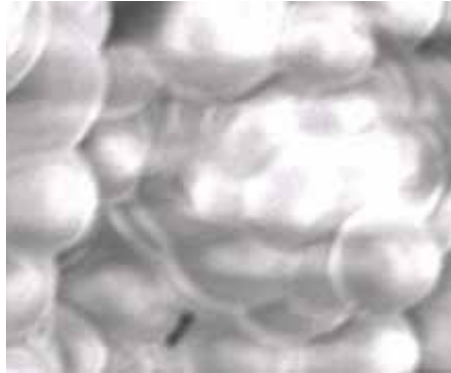
6 Production of market-sized mud crab *S. serrata* using SEAFDEC formulated diet.

Hatchery-reared *S. serrata* with average body weights (ABW) of 1.5 g, 8.28 g and 1.5 g were stocked in 3 separately fenced ponds with an area of 1,500 m² together with tilapia. Mud crabs were fed SEAFDEC formulated starter diet for the first 2 months, grower for the 3rd month and fattening diet for the 4th and 5th month in combination with fish, mussel or chicken lungs. Tilapia fed on natural food and SEAFDEC diet. After 5 months, crabs grew to a range of 233–405 g with 32.8–51.4% survival rate. Tilapia survival was low (25.7%) due to high salinity during the first month.

Marine fish program



For rabbitfish (*Siganus guttatus*) eggs, IGF-II mRNA was identified as a good molecular marker for quality. This could pave the way for the development of an accurate, reliable, simple, and rapid assessment of egg quality in marine fish broodstock



PUFA-rich thraustochytrids can be used as enrichment diet for rotifers and *Artemia* that are used as natural food for marine fish larvae



Studies have shown that mysids are potential live food substitute for *Artemia* in larviculture because they improved the profile of highly unsaturated fatty acids (HUFA), specifically DHA & EPA, and digestive enzyme levels in grouper larvae

AQD's marine fish program continues to refine technologies in the breeding, seed production, nursery and grow-out culture of high-value fishes, including seabass, milkfish, pompano and grouper. Larval production of these species has been improved largely by using SEAFDEC formulated larval feeds to reduce the use of natural food (especially brine shrimp) during larval rearing, and consequently reduce the cost of production.

In grow-out culture, verification studies on various marine fishes using SEAFDEC formulated diet compared with commercial diet showed that the SEAFDEC diet was comparable, if not better, than the corresponding commercial diet.

Refining seed production techniques

As part of the initiative to develop strategies to extend the spawning season of seabass in captivity, the effects of temperature on reproductive performance was evaluated. Broodstock fish that were reared at elevated temperature (29–30°C) from June to August showed early maturation, higher fecundity (13.7 million compared to 3.4 million in control) and larval production.

For milkfish, the diet of broodstock was changed from the old formulated diet to the fortified diet (with vitamins and lipids) to improve the quantity and quality of eggs. Egg production and the quality of larvae improved after the diet change. The use of fortified larval diet, as well as emulsion to enrich the rotifer, reduced the incidence of abnormal larvae.

For pompano (*Trachinotus blochii*), broodstock was induced to spawn in captivity in June. Larvae had 19% survival after 60 days of culture. Another spawning occurred in August but with fewer good eggs collected. The eggs were hatched and normal larvae were obtained with 63% survival.

Improving nursery

Studies on reducing cannibalism in juvenile marine fish showed that growth and survival were significantly better for marine fish in nursery cages in pond given tryptophan (TRP)-supplemented diets than those given trash fish.

Stocking larger marine fish in nursery cage culture in ponds and feeding high protein SEAFDEC diet generally resulted in higher growth and survival rates and improved FCR.



Hatchery-bred milkfish fry from the integrated broodstock and hatchery in TMS were successfully reared to fingerlings in brackishwater ponds at DBS with good growth, survival, feed conversion ratio and less than 1% abnormalities

Improving grow-out

Studies on alternative feeding strategies were conducted to improve production efficiency in milkfish. The results of tank experiments suggest that compensatory growth mechanisms might be at work in fish subjected to an alternate two-week starvation and refeeding cycle. Results will be verified in marine cage grow-out systems.

Studies were also done to improve the nutritional value of locally available feed resources by submerged fermentation and solid substrate fermentation using milkfish gut bacteria and/or selected fungi. Two isolates from milkfish gut (presumptive *Bacillus cereus* and *Lactobacillus* sp.) were able to ferment a variety of sugar substrates and produce a variety of extracellular enzymes such as protease, lipase, cellulase, carbohydrase, and phytase. These enzymes could help modify the biochemical characteristics of feed ingredients for practical feeds. Confirmatory tests on the identity of these isolates by 16S rRNA analysis are ongoing.

Employing IPM (integrated pest management) strategies in brackishwater ponds (i.e., use of ducks as predators, manual handpicking, and use of commercially available molluscicides such as nicotiniline sulfate, metaldehyde and Terminator) is an effective way to control snail infestation in milkfish ponds. Nicotiniline sulfate powder was effective as molluscicide despite its low nicotine concentration. However, tests revealed that it had a tin level of 62 mg/kg (ppm), higher

than the estimated environmental concentration of 5 ppm. The test does not rule out the possibility that this preparation contains organotin (triphenyltin, tributyltin or other derivatives).

Grouper (*Epinephelus fuscoguttatus*) were cultured in floating net cages at AQD's Igang Marine Station at a stocking density of 17 fish/m³ and fed SEAFDEC grouper diet, beginning with starter, grower and finisher. After 120 days of culture, fish had an average body weight gain of 550%, survival of 75%, and FCR of 2.7.

In finding alternatives to fishmeal in aquaculture feed, white cowpea is being tried to partially replace fishmeal in grouper diets. Initial results of feeding trials in floating net cages show that a cowpea level of 20% of the diet could result in growth and survival that compares well with those obtained with a fishmeal-based diet.

Several immunostimulants such as ginger, onion, ascorbic acid, and β -glucan were tested in grouper. Resistance to *Vibrio* sp. challenge was better in ascorbic acid-, ginger-, and onion-supplemented diets but not in β -glucan-supplemented diets. When the fish were subjected to sampling stress (second lot) and then challenged with *Vibrio* sp., resistance to the challenge was better in β -glucan, onion, ginger, and β -glucan groups but not in the ascorbic acid group.



Seabass larvae fed with the brine shrimp *Artemia* (left column) and mysids (right column)



Harvest of market size seabass *Lates calcarifer* fed SEAFDEC diet at DBS



Feeding of milkfish with formulated diet, and harvest from floating marine net cages at IMS



Harvest of market size grouper *Epinephelus fuscoguttatus* fed SEAFDEC formulated diet from marine floating net cages at IMS

Small-holder freshwater aquaculture

The objective of the program is to generate, verify, demonstrate, and disseminate science-based technology for breeding, hatchery and farming of selected freshwater aquaculture commodities. The following studies were undertaken in 2008:

1 Bighead carp *Aristichthys nobilis* (Richardson). The reproductive performance and fry production of bighead carp on four feeding regimes (3, 2, or 1 month before spawning, and none at all) was studied. Four-year-old carp were stocked in B-net cages in Laguna de Bay. After 12 months, there was no significant difference in terms of mean gonadal maturity, fertilization, hatching and fry production among the first three treatments. However, generally lower fertilization rate and fry production were observed in the unfed broodstock.

2 Freshwater prawn *Macrobrachium rosenbergii*. A study was conducted and aimed at producing freshwater prawn larvae tolerant to reduced salinities. Results show that freshwater prawn larvae are able to grow and metamorphose equally well in 6 ppt

as they do in 12 ppt, which is the normally preferred rearing salinity. Low-salinity tolerant seedstock grow better in tanks and cages.

MtDNA RFLP data for three *M. rosenbergii rosenbergii*, two *M. rosenbergii dacqueti* stocks and one *M. mamilodactylus* outgroup stock at the cytochrome oxidase I (COI) gene using restriction enzymes HaeIII, Rsa I, MboI and TaqI have been analysed. Genetic variation based on haplotype diversity was highest for the Leganes *M. rosenbergii rosenbergii* stock (0.673 with 5 haplotypes). A dendrogram based on these results shall be constructed to show the phylogenetic relationships among the various stocks.

The breeding and reproductive performance of *M. rosenbergii rosenbergii* was assessed by

conducting preliminary breeding trials. After setting up spawning groups, fourteen berried females produced 5,774 to 26,450 hatchlings each. Salinity rearing trials were done to determine the optimum rearing salinity required for this native stock. It is noted that *M. rosenbergii rosenbergii* takes one year and 10 months to mature compared to *M. rosenbergii dacqueti*, which only takes 4–6 months. This is the first known local record of *M. rosenbergii rosenbergii* maturation in captivity.

The larval rearing and seed production requirements of *M. rosenbergii rosenbergii* was also determined. Freshwater prawn larvae were reared in three 100-L plastic tanks at 100 larvae/L in green water. Larvae survived until day 10 but did not progress beyond stage IV.



The bighead carp *Aristichthys nobilis*; (inset) induced spawning of carp at AQD's Binangonan Freshwater Station



The freshwater prawn *Macrobrachium rosenbergii* (left) and *M. dacqueti*



Tilapia harvest in Lake Buhi (upper left) and Lake Bato (top, lower left)

The bioeconomics of freshwater prawn hatchery production in different larval rearing systems was also studied, using clear and green water for larval rearing. Results show that green water larval rearing system is better than clear water. Significantly higher survival, production of postlarvae (PL), and shorter time for larvae to metamorphose to PLs were observed in the green water system.

3 Nile tilapia (*Oreochromis* spp.).

An apparent improvement in fillet yield based on increments in total fish surface area was noted in broodstock selected through a farm-based mass selection technique. Growth parameters gathered from progeny testing experiments indicate higher growth in terms of girth (width) and length of the selected strain compared to the control, especially in the third generation.

Four feeding treatments (daily high, daily low, intermittent or skip-feeding at a high rate, skip-feeding at low, and daily feeding) for Nile tilapia were tested in the two lakes, Lake Bato and Lake Buhi. Results show survival to be significantly better in skip-feeding treatments compared to daily feeding, regardless of feeding level in Lake Bato. In Lake Buhi, no differences in survival was observed among treatments. This study is part of the project on *Integrated fisheries resource management (Rinconada Lakes, Philippines and NSW Australia): aquaculture and water quality component*.

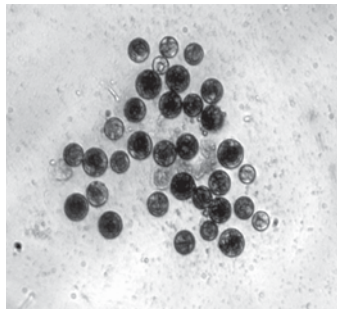
4 Climbing perch *Anabas testudineus* and snakeskin gourami *Trichogaster pectoralis*.

To breed the climbing perch and gourami, different sizes were collected from various sources.

The fishes grew faster and attained sexual maturity at smaller sizes a few months after transferring to bigger tanks and feeding with pelleted diet containing 37% crude protein. For climbing perch, five spawning runs were done in 2008, producing about 20 thousand 23-day-old climbing perch larvae from the last spawning run. For gourami, induced spawning using natural stimuli or hormone injection was not successful.

5 White shrimp. High health white shrimp postlarvae (day 11) were acclimated from a salinity of 27 ppt to freshwater using deep-well water. Acclimation lasted for five days with survival at 92%. After four weeks in nursery hapas, mean survival of juveniles (0.603 g) was 96.7%. Mean FCR for the nursery phase was 0.988. The juveniles were stocked in 3 x 5 x 1 m B-net grow-out cages.

Seaweed program



Clockwise from top left: carpospores of *Kappaphycus* CT1P; germlings of CP1T-Kappa; farmed seaweed after the typhoon; farmed CP1T-Kappa in Cabalagnan, Guimaras Island

The objective of the program is to develop strains of *Kappaphycus* that are fast growing, resistant to diseases, and with improved carrageenan characteristics. These strains will become sources of new cultivars for land- and sea-based nurseries and pilot commercial farming.

A novel technique has been used successfully to regenerate *Kappaphycus* plantlets. It uses soluble seaweed extract powder + plant growth regulators (PGR) + colchicine. Optimization of concentrations was used either singly or in combination with PGR for each variety of *Kappaphycus*. Mass production of explants for regeneration purposes was done using the optimized concentration, producing several microplantlets. The green and purple morphotype of *Kappaphycus* were outplanted in circular cages at AQD's Igang Marine Station to initiate biomass for nursery purposes. Regenerated microplantlets from NTG and EMS mutagens treatment are presently raised in tanks.

In another study, carposporophytes from the wild were induced to shed spores in the laboratory. After 355 days, the carposporophyte progenies (CP1T) were transferred to cages.

The CP1T *Kappaphycus* were compared with commercially farmed *Kappaphycus*, with the former showing better heat resistance during the months of April and May, when crops suffer from whitening due to extended exposure to heat. "Ice-ice"-infected CP1Ts healed and survived after 4 weeks of culture. CP1T *Kappaphycus*, also surprisingly, survived the typhoon in July, and are slowly propagated to obtain enough biomass to start experimentation and testing.

The CP1Ts matured into tetrasporophytes while grown in cages and were induced to shed spores in the laboratory. The tetrasporophyte progenies (TP1G-Kappa) are now cultured in the laboratory.



Outplanted *Kappaphycus alvarezii* developed from tissue culture grown in small cages at Igang station: September (inset) and November 2008



Aquatic ecology program

The program addresses four different concerns: water and sediment quality of the Igang mariculture park, *tangab* fishing gear operations, use of seaweed as biofilter, and microbial interaction in oil spill-affected sites.

1 Monitoring the mariculture park in Humaraon Cove, Igang, Guimaras. The measured water quality of Humaraon Cove in Igang, Guimaras for eleven months shows that the nutrient concentrations for all physicochemical parameters are still below the critical values for Class C water (fishery water for propagation of fishes) set by Department of Environment and Natural Resources (DENR) for water quality guidelines and general effluent standards.

Nutrients and sedimentation rates were found to be generally higher in the cage area than the no-cage area. In addition, development of

fishfarmer-friendly monitoring techniques in the cage area is underway.

2 The *tangab* fishery in Iloilo Strait: operations, catch volume and species composition, economic importance, and ecological impact. Areas of study included Atabayuan in Tigbauan; Arevalo and Calumpang in Iloilo City; and Morobuan in Jordan, Guimaras.

3 Use of seaweed as biofilter in the co-culture of abalone (*Haliotis asinina*) and *Gracilariopsis bailinae*. The study aims to determine the bioremediation potential of *G. bailinae* in a

recirculating system. Three experiments were conducted: (1) nitrogen uptake of the seaweed using different concentrations of $\text{NH}_4\text{-N}$; (2) two levels of NH_4 , two stocking densities, two water volume exchanges; and (3) diurnal ammonium excretion pattern of abalone fed different diets.

4 Bioremediating bacteria isolated from MT Solar 1 affected sites in Guimaras. The presence of petroleum hydrocarbon-degrading bacteria (PHDB) in Guimaras was confirmed after samples were taken from the water, beach sand and mangrove soil. These indigenous PHDB may be tapped for the bioremediation of the oil-contaminated water and soil.



Monitoring sediment quality in Igang Mariculture Park using a fabricated Ekman grab



Typical *tangab* catch from Calumpang, Iloilo City



Regional programs

ASEAN-SEAFDEC FCG mechanism

[Projects funded by the Japanese Trust Fund]

As part of the activity to transfer viable technologies, two international training courses on marine fish hatchery and abalone hatchery were conducted at AQD with funding support from JTF



A mud crab farming training course was conducted on-site in Myanmar in October, while AQD fish disease experts visited Cambodia and conducted two on-site training courses in September. In addition, the distance learning course on principles of health management in aquaculture was implemented through the Internet from July–December

Development of technologies and human capacity building for sustainable aquaculture

New activities implemented in 2008 include: (1) the development of tissue culture techniques for the mass production of plantlets of new and improved strains of *Kappaphycus*, and (2) the socioeconomic impact on the adoption of sustainable aquaculture technologies in fisherfolk communities. The continuing studies are as follows:

1 Freshwater aquaculture of indigenous species. For the giant freshwater prawn *Macrobrachium* spp., mtDNA-RFLP analysis shows that the degree of genetic variation was different among the local stocks. The results will be used as a basic genetic information for assessing genetic traits during domestication.

2 Captive broodstock and seed production. For *Penaeus monodon*, the marine annelid *Perinereis nuntia* was used to replace shrimp meal in the broodstock diet.

Information on shrimp captive broodstock studies done in Southeast Asian countries were gathered from available literatures and conferences. Data were also obtained through communication with workers or through visits and surveys.

The domestication programs on *P. monodon* and mud crab have produced two generations of offspring from the wild/virus-negative broodstock. A study on the genetic variation of the prawn and crab is in progress.

3 Mariculture. For the Asian seabass *Lates calcarifer*, results of water temperature manipulation shows improved gametogenesis and consequent spawning. This also suggests that 'climate change/global warming' could potentially affect the reproduction of tropical fish.

4 Integrated aquaculture systems. Dissemination of rice-fish aquaculture system is further promoted by expanding activity sites in rural areas of Cambodia.

The joint annual progress and planning meeting of JTF-funded programs was held in December to: (1) review achievements; (2) evaluate the implementation of the projects by external evaluators; and (3) take into consideration the views/comments of evaluators in implementing future JTF projects. Four external evaluators were invited, and 70 participants, including study leaders from AQD and from Indonesia, Thailand and Vietnam attended the meeting. Thirty-two activities under the JTF programs were reported



Development of fish disease surveillance system

The project aims to develop a surveillance system for diseases of aquatic animals in Southeast Asia by establishing resources and facilities for fish health diagnosis and human capacity building. The activities in 2008 include:

1 Refinement of diagnostic methods and development of new prevention methods for aquatic animal diseases. A study on immunological preventive methods was conducted for the Asian seabass *Lates calcarifer*. Results show the fish exhibiting strong immune responses against a single injection of the inactivated red-spotted grouper nervous necrosis virus. This indicates the potential of inactivated vaccine against VNN in seabass.

A large-scale vaccine preparation using a recombinant protein of WSSV was also developed.

2 Surveillance for important viral diseases of fish and shrimps in the region and establishment of mobile clinics. Samples of *Penaeus monodon*, *Litopenaeus vannamei*, and the freshwater prawn *Macrobrachium rosenbergii* were collected from various sites in the Philippines. TSV, IMNV and WTD are still presumed to be exotic because all samples obtained from surveillance activities have tested negative. A survey of TSV and IMNV of the Pacific white shrimp *L. vannamei*, and surveys of giant freshwater prawn viral diseases (MrNV), were also implemented in Indonesia and Thailand, respectively.

Surveillance activities of emerging fish viral pathogens of KHV, SVCV and GCHV have been continued for samples of koi carp, common carp, grass carp and silver carp collected in Cambodia, Lao PDR, Myanmar, the Philippines and Vietnam. To date, these fish viruses were not detected from the samples. The activity also trained staff for mobile clinic services for Lao PDR and the Philippines.



The abalone, seahorse, and giant clam are some of the species being studied by AQD for stock enhancement

Stock enhancement of threatened species under international concern

This project aims to develop stock enhancement methodologies such as seed production, release strategy, monitoring and impact assessment (including socioeconomics) for seahorse, giant clam, sea cucumber and abalone.

In 2008, AQD has succeeded in increasing the production of hatchery-bred seahorse (*Hippocampus barbouri*, *H. comes*, *H. kuda*) juveniles by water management using UV-treated seawater and improvement of feeding schemes for stock release. However, the survival of juveniles less than 30 days old is still unstable.

To increase recapture rates of abalone *Haliotis asinina* juveniles released in 2007 in cages in Carbin Reef, Sagay Marine Reserve (SMR), a study was made to observe abalone behavior and survival. The juveniles kept in pens showed complicated behaviors as follows: (1) abalone showed up on the third or fourth sampling; (2) 52% of abalone were not found 15 days after release; and (3) 40% were found in corals inside the cages. Survival 180 days post-release was 28%. The pen trial was done parallel to the release of tagged abalone juveniles in Carbin Reef. Recapture and growth rates of released abalone are being monitored monthly. These results will be useful in designing a release strategy.

In addition, AQD is refining technologies on the seed production and hatchery operation of the angelwing clam *Pholas orientalis* and sea cucumber *Holothuria scabra*.

AQD also conducted seminars on (1) the biology of abalone and giant clam; (2) ecotourism initiatives and opportunities in Sagay; and (3) grow-out culture of abalone, seahorse, and marine fish attended by fishers and other stakeholders in Molocaboc, an island within the Sagay Marine Reserve.

IEC activities were done to increase the awareness and understanding of stock enhancement. A workshop on participatory action plan development (PAPD) was held to come up with a community resource map and was attended by 41 stakeholders. Results of a survey in SMR was also presented, which showed that tourists have high awareness levels on corals (91%), starfish (73%), and seahorse (61%) than on abalone (13%) and giant clam (42%)



Institutional capacity development for sustainable aquaculture (ICD-SA)

Now on its third year of implementation, ICD-SA is AQD's program aimed at empowering and building the capacities of "on-the-ground" institutions (LGUs, fisherfolk organizations, NGOs, fishery schools) in sustainable aquaculture livelihood. The program is comprised of three activities, namely training, technology demonstration, and research.

New this year is the implementation of the project in the province of Misamis Occidental and the initial site and socioeconomic assessments in the province of Aurora. Sampling activities and rapid resource assessment were also conducted in Mindoro Oriental.

TRAINING

Training programs are comprised of a series of modules conducted throughout the production cycle of a cultured species. Each module runs for 2–3 days, consists of lectures and hands-on practical sessions, and can go from 4–6 months or longer depending on

the culture duration of the stock. The training strategy will enable participants to learn as much technical knowledge and skills by exposing them to actual culture practices such as site selection, construction and preparation of pond/cage/pen, stocking, feeding, water management, fish health management, harvest and marketing.

Participants during the closing ceremonies of the fourth session of the season-long training course on freshwater aquaculture in Dumarao, Capiz



A marine multi-species fish hatchery was set up at MOAP, which is expected to produce 576 thousand grouper fry annually. Other species to be reared include snapper, seabass, seahorse, and crabs



Beneficiaries of the milkfish cage culture project harvest their stocks from the cages situated at AQD's mariculture park in Igang, Nueva Valencia, Guimaras. The project is funded by Petron Foundation Inc



Trainees acclimatize crablets for stocking in a nursery in Pambujan, Northern Samar

TECHNOLOGY DEMONSTRATION

A three-tiered approach is employed in the demonstration of aquaculture technologies in the project sites. The communities are first consulted to find out if

the beneficiaries are capable of implementing the project and if the resources are suitable. AQD scientists then analyze and assess the local resources and design the facilities tailored to the locale in consultation with the beneficiaries and donors. AQD researchers and economists then analyze the

financial feasibility of the project. The costs-and-returns, return-on-investment, payback period, net present value, internal rate of return, and benefit-cost ratio are used as budgeting instruments in production runs.

Completed modules of season-long ICD-SA training courses for 2008

Province	Season-long course & venue	No. of participants	Module 1, date	Module 2, date	Module 3, date	Module 4, date	Module 5, date
Antique	Freshwater aquaculture ^a	37 fisheries students, 13 faculty, 6 LGUs	Tilapia, catfish & freshwater prawn culture, October 7–10				
Capiz	Freshwater aquaculture ^b	32 fisherfolk, module 3; 42 fisherfolk, module 4			Fish health management & economics, February 18–19	Harvest & post-harvest techniques, March 31 – April 1	
Guimaras	Milkfish cage culture ^c	25 fisherfolk, module 4; 27 fisherfolk, module 5				Harvest, post-harvest & marketing, January 29–30	Business planning & marketing; February 28
Northern Samar	Mud crab culture ^d Phase 2	72 students, 22 LGUs, 16 NGOs & POs, 11 BFAR & DENR personnel, 6 private individuals		Mud crab culture September 15–18			
Misamis Occidental	Grouper cage culture ^e	30 fisherfolk	Nursery culture, July 16–19	Grow-out culture, September 10–11			

^a Polytechnic State College of Antique (PSCA), Tibiao, Antique

^b barangays Codingle & Bungsuwan, Dumarao, Capiz

^c Nueva Valencia, Guimaras

^d UEP Campus, Catarman, Northern Samar

^e Mindanao Polytechnic State College (MPSC) Panaon Campus & Patafla, Jimenez, Misamis Occidental



Harvest of catfish from concrete pond in PSCA, Tibiao, Antique



The project site in Dumarao, Capiz



Existing ponds in Sitio Motiong in Aurora was assessed and recommended for nursery development

RESEARCH

Studies involve aspects such as socioeconomics to gauge the impact of the projects on the beneficiaries. Research on aquatic ecology is also done to determine the impacts of aquaculture activities on the environment. Data derived from this will be analyzed and used in formulating policies that encourage sustainable aquaculture.



Researchers interact with the communities to determine the social and economic impacts of AQD collaborative projects

Technology demonstration and research activities in ICD-SA sites

Project site	Technology demonstration activities	Research studies
Antique – Provincial Government of Antique, Polytechnic State College of Antique (PSCA)	About 100 kg of hybrid catfish with ABW of 250 g were harvested from the concrete pond situated at PSCA Tibiao Campus. Culture took 5–6 months, with survival at 85%	A comprehensive sociocultural and economic baseline assessment of the fishing communities of Anini-y and Tibiao for coastal resource, stock enhancement and sustainable aquaculture in the province of Antique
Capiz – Provincial Government of Capiz, Municipal Government of Dumarao	Almost 200 kg of tilapia, 40 kg of catfish, and 3.5 kg of freshwater prawn were harvested from four net cages in Dumarao	
Guimaras – Petron Foundation Inc, Citigroup, Provincial Government of Guimaras, Municipal Government of Nueva Valencia	More than 9 tons of milkfish were harvested from 3 cages situated at AQD's Igang Marine Station. Initial stocking was 24,000 fingerlings, which grew to an average of about 420 grams per fish after 6 months of culture. Survival was at 97%	Pilot project on milkfish cage culture for oil spill-affected Guimaras fisherfolk
Misamis Occidental – Provincial Government of Misamis Occidental, Philippine Australia Community Assistance Program-CATP, Misamis Occidental Aquamarine Ventures Company	The municipalities of Panaon and Sinacaban were deemed feasible for grouper culture for PACAP/MOAVEC and Gata Daku beneficiaries. A fish nursery (2 x 4 x 1.5 m) and cage structures for grow-out (4 x 4 x 3 m) were set up in the two sites. Grouper stocked in cages were harvested after 6 months (May-November) at 90% survival, with ABW of about half a kilo. Subsequent stockings were done during the latter part of the year	Monitoring of water sediment quality influenced by grouper cage culture in four municipalities of Misamis Occidental
Northern Samar – Provincial Government of Northern Samar, Action for Community Empowerment Association Inc, ACIAR, CATP	Fly size crablets (<0.1 cm) stocked in nursery ponds enclosed with net fence in Rosario and Lao-ang had low survival rate due to low salinity caused by continuous rain and delay in harvest (>4 weeks culture period). Crablets stocked in Pambujan and Lavezares had survival rates of 20 and 30%, respectively Mud crab stock assessment in Rosario and Pambujan, Northern Samar will be determined for at least a year. Stock samplings from December 2007 to August 2008 showed that mud crabs ranged from 17.5 to 56.9% and 13.8 to 93.5% of the total catch composition in Rosario using bamboo traps (bubo) and lift nets (bintol), respectively. In Rosario, the oceanic paddler and crenate crabs and prawns dominated the total catch using bamboo tube traps. In Pambujan, crenate crabs and prawns dominated the total catch using bamboo tube traps and lift nets.	Enhancing adoption of mud crab production technologies in Northern Samar Socioeconomic impact of adoption of sustainable aquaculture technologies in selected fisherfolk communities

ABOT AquaNegosyo



An ABOT project site in Bogo, Cebu during the construction phase

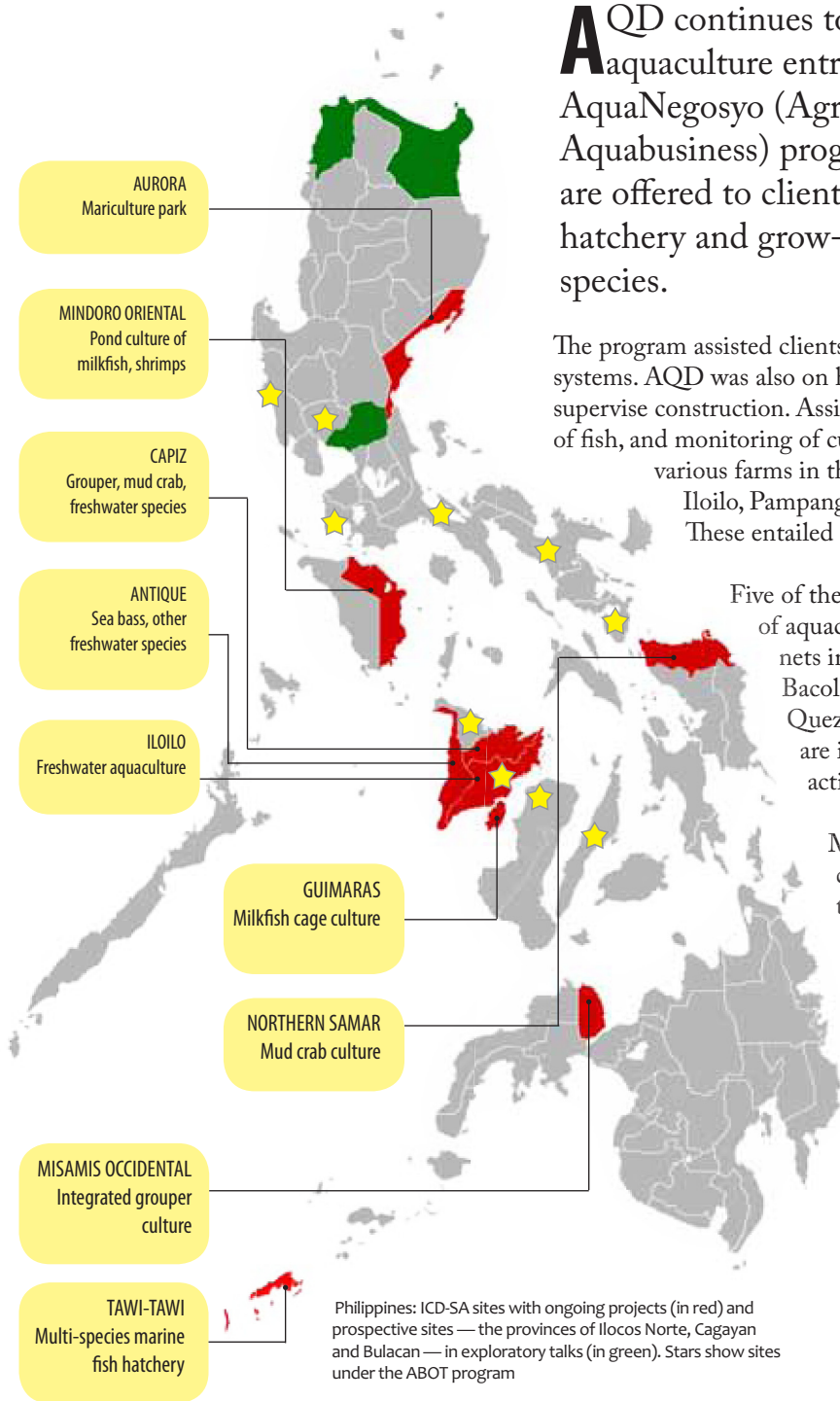
AQD continues to extend technical assistance to Aquaculture entrepreneurs through the ABOT AquaNegosyo (Agree-Build-Operate-Transfer Aquabusiness) program. Complete aquaculture packages are offered to clients interested in the breeding, nursery, hatchery and grow-out of economically important aquatic species.

The program assisted clients in assessing their farming sites and existing culture systems. AQD was also on hand to prepare facility design and feasibility and to supervise construction. Assistance was also extended in the transport and stocking of fish, and monitoring of culture systems and stocks. These entailed 43 trips to various farms in the provinces of Aklan, Batangas, Camarines Sur, Cebu, Iloilo, Pampanga, Quezon, Sorsogon, Zambales and Bacolod City. These entailed about 120 man-days of direct technical assistance.

Five of these clients signed formal agreements with AQD to avail of aquaculture business packages for tilapia hatchery in hapana ponds in pond in Pampanga; milkfish grow out in ponds in Bacolod City; and multi-species pond grow-out in Cebu, Quezon, and Sorsogon, respectively. The rest of the clients are in various stages of planning and other preparatory activities.

Moreover, the program took part in a financial literacy campaign for Overseas Filipino Workers (OFWs) and their families in Iloilo City and Kalibo, Aklan. The forum, organized by the Bangko Central ng Pilipinas (BSP), allowed AQD to promote its aquaculture business packages to about 50 attendees in each venue.

AQD assessed proposed sites and did ocular surveys in preparation to a planned project by a private company in Maldives for marine fish breeding, hatchery and cage culture. The company's management committee was briefed on initial data and impressions gathered by the AQD. A report has been submitted to the company for their evaluation.



Training & information dissemination

SEAFDEC/AQD trained 700 government officers, fish farmers, fisherfolk, students and private sector practitioners in 38 training sessions in 2008 (including on-the-job training for students (OJT) and internship training) which amounts to a 43% increase over the previous year's (2007) record. Twenty-eight percent (28%) of the training sessions had funding support from GOJ-TF and other international funding agencies; 13% were on-site season-long training

which form part of the *Institutional capacity development on sustainable aquaculture (ICD-SA)* project; and 45% were specialized or client-driven courses conducted on a self-liquidating manner, where the trainees or requesting agencies are charged training fees to cover the cost of training materials, honoraria of lecturers, and transportation for field trips.

In addition, AQD also had study tour arrangements for individuals or groups from both local and foreign nationals.

Training courses with funding support from GOJ-TF

1 Abalone hatchery and grow-out. This was conducted on 07–27 May for 9 participants from Indonesia (1), Malaysia (1), Myanmar (1), Sultanate of Omar (1) and the Philippines (5). Of the 9 participants, 4 had GOJ-TF fellowship grants and 5 were from the private sector.

2 Marine fish hatchery. This training was held on 20 May–25 June with nine (9) participants from Lao PDR (1), Myanmar (1),

Vietnam (1), Saudi Arabia (1), France (1), and the Philippines (4). Of the nine participants, 4 had GOJ-TF fellowship grants and 5 were from the private sector.

3 Distance learning course on principles of health management in aquaculture (AquaHealth Online). This online course was conducted from 29 July–04 December with 14 participants from Brunei Darussalam (1), China (1), Hongkong (4), the Philippines (4), Singapore (1), Sri Lanka (1), Thailand (1), and the USA (1).

Training courses with funding support from other international agencies

Grouper hatchery. Funded by the Australian Centre for International Agricultural Research (ACIAR) and in collaboration with Network of Aquaculture Centres in Asia-Pacific (NACA), the 19-day training was conducted from 07–25 April with 15 official participants (10 from the private sector, 4 from the local government units (LGUs), 1 from the academe) and 3 observers.

Mangrove ecology, taxonomy and community structure. Offered by AQD for the first time and in collaboration with RESCOPAR (a program funded by Wageningen University of the Netherlands), the course was conducted on 30 April–04 May with 25 participants composed of 3

RESCOPAR-funded students, one each from Indonesia, Vietnam, and Philippines; 5 BFAR Central Office personnel; 1 LGU from Mindoro, 2 AQD staff, and 14 GTZ-funded LGUs from Southern Leyte and Negros Occidental, Philippines.





Clockwise from top: Training courses on abalone hatchery and grow-out; marine fish hatchery; crab seed production; freshwater fish health; and marine fish health management

Of the 14 participants, 7 had GOJ-TF fellowship grants and 7 were from the private sector.

4 Crab seed production. The course was conducted on 10 June–01 July with a participant funded by GOJ-TF, while participants from Myanmar (1), USA (1) and the Philippines (1) were privately funded.

5 On-site basic training on freshwater fish health management. This activity was conducted on 22–24 September in Inland Fisheries Research and Development Institute (IFReDI) Phnom Penh, Cambodia with funding support from the GOJ-TF Fish Disease Project in collaboration with Cambodia's Department of Fisheries (DOF) and Ministry of Agriculture and Fisheries.

Sixteen (16) fisheries officers of the DOF attended the course. Two scientists of AQD's Fish Health Section served as resource persons.

6 On-site basic training on marine fish health management. Another on-site training was conducted on 25–27 September at the Marine Aquaculture Research and Development Center (MARDeC), Cambodia funded by GOJ-TF Fish Disease Project in collaboration with Cambodia's Department of Fisheries (DOF) and Ministry of Agriculture and Fisheries. The 3-day on-site course was attended by 14 participants comprising of 13 fisheries officers of DOF and a staff from a private processing company. Resource persons include two AQD scientists from the Fish Health Section.



Seaweed (*Kappaphycus*) farming. At the request of World Wildlife Foundation (WWF) based in Palawan, the 5-day course was conducted on 05–09 May with 6 participants consisting of 5 WWF-funded LGUs from Palawan and a French national.

HRD training of trainers on rural aquaculture. Initiated by SEAFDEC and with funding support from the ASEAN Foundation through the Japan-ASEAN Solidarity Fund, the training was conducted last 10–19 November at AQD's TMS. Eight (8) official participants from Thailand, Malaysia, Indonesia, Lao PDR, Myanmar, Vietnam, Cambodia, and the Philippines, together with 1 invited participant from Northern Samar, Philippines and 3 students from Maejo University, Chiangmai, Thailand attended the course.

Joining on the third day was the Secretariat HRD Project Coordinator, who clarified some points on HRD project activities, particularly on the implementation of succeeding on-site HRD activities in the participants' respective countries beginning February 2009. Rural aquaculture is one of the thematic areas of the HRD project.

The project aimed to enhance the capacity of fishers of selected rural fishery communities, as well as relevant fisheries government officials and those working at the local level in support



of fishery communities, through fisheries intervention, covering areas on co-management, responsible fishing practices, backyard fishery post-harvest and processing, rural aquaculture, and inland fisheries development.



7 On-site training on mudcrab farming. With funding support from GOJ-TF and in collaboration with Myanmar's Department of Fisheries and Myanmar Federation of Fisheries, the 2-day on-site course was conducted on 08–09 October in Yangon, with 64 participants comprising of 12 DOF officers and 52 from the private sector. Two AQD Scientists gave the first lecture series on mudcrab farming.



Specialized or client-driven training

1 Basic techniques in the culture of cyanobacteria. Two female instructors from Batangas were trained at AQD's BFS from 31 January–02 February. On 16–18 July, another two PhD students from the UP College of Engineering, Diliman, Quezon City attended the same training at BFS with funding support from AUN/Seed Net JICA.

2 Brackishwater aquaculture. At the request of a trainee from the private sector, this training was conducted on 04 February–04 March at AQD's DBS.

3 Plankton identification, water analysis, and disease diagnosis. In response to the request of AquaCards Inc based in Negros Occidental, the training was conducted on 03–28 March for a male technician.

4 Breeding and culture of selected freshwater species. Two belonging to the private sector from the USA and India trained at BFS last 14–25 April.

5 Detection of viral disease. At the request of a male French national, the training was conducted on 12–17 May and consisted of a series of lectures on fish and shrimp diseases and hands-on diagnosis using cell culture-based detection of viruses, infection bioassay, and PCR/RT-PCR detection of fish viruses.

6 Grouper nursery and grow-out systems in cages. Sponsored by PACAP, the training was offered from 14–30 May to 3 staff each from PACAP/MOAVEC and Gata Daku involved in the SEAFDEC-Misamis Occidental collaborative project on grouper culture.

7 Induced spawning of clariid catfishes. A US Navy *balikbayan* and a merchant marine engineer were trained at BFS from 30 June–04 July. A similar training was undertaken at BFS for a male student from 13–17 October.

8 Milkfish hatchery. Three personnel of the Zamboanga State College of Marine Science and Technology (ZSCMST) were trained last 05–14 July.

9 Fish health management. At the request of a Tanzania national and funded by the Ministry of Livestock Development and Fisheries, Department of Fisheries-Tanzania, the one-month specialized training course was conducted last 11 September–12 October. The same training was conducted on 03 October–02 November for a male technician of the Fish Farming Center (FFC) in Jeddah, Saudi Arabia funded by Food and Agriculture Organization of UN, and a male staff of the Freshwater Fish Research Center (FFRC) in Wuxi, China.

10 Crab seed production. This was conducted on 15 September–01 October for one trainee from the private sector in Malaysia.

11 Tilapia hatchery and grow-out operations. At the request of an entrepreneur, the training was conducted at BFS from 15–22 September.

12 Grow-out culture of mudcrab. Two local entrepreneurs were trained at AQD's TMS and DBS from 22 September–10 October.

13 Soil and water quality. The 3-day specialized training was undertaken 01–03 October at the request of an Iranian who would like to set up an aquaculture project in Iran.

14 Freshwater prawn hatchery and grow-out operations.

The 5-day specialized training was conducted at BFS from 27–31 October at the request of two from the private sector.

15 Culture of natural food organisms.

Funded by the Food and Agriculture Organization of UN, this one-month specialized training was conducted for a male staff of the Fish Farming Center in Jeddah, Saudi Arabia on 03 October–02 November.

16 Methods of bacterial isolation and identification.

Sponsored by GenoMar Inc, a company that develops genetic maps and breeding programs in tilapia, this 5-day specialized training was held on 24–28 November for one of their staff, a French national.

17 Basic techniques in the culture of natural food organisms.

Three students taking doctorate and masters degrees from UP and University of Santo Tomas trained at BFS on 24–26 November.

Internships and on-the-job training

AQD's internship training caters to out-of-school youths, new graduates and private individuals who would like to acquire the needed knowledge and expertise in preparation for seeking a job or running a personal aquaculture enterprise. An intern participates in day-to-day activities in a particular area of interest under the supervision of a specialist or scientist.

In 2008, fifty-nine (59) interns were trained in different areas: mollusc/abalone (16); crustacean hatchery (6); finfish hatchery (9); fish health diagnostic analysis (6); feed processing and feed mill operation (1); natural food culture (1); brackishwater aquaculture (1); catfish hatchery (2); seahorse hatchery (2); and library/data banking/engineering (5).

On-the-job (OJT) training, on the other hand, is designed for graduating students in fisheries

and related fields to satisfy a school requirement for graduation. It aims to provide students practical knowledge and skills in aquaculture to supplement their theoretical orientation in school by assisting in ongoing research and verification studies at AQD stations.

Study tour arrangements

Aside from training programs, AQD also accepts requests for study tour arrangements for individuals or groups from both local and foreign nationals. In 2008, twenty-five (25) arrangements had been made which brought in a total of 420 visitors, including 20 foreign nationals, to the Department. Orientations/briefings and tours of AQD facilities and stations were given to visitors from LGUs (24.3 %), entrepreneurs (4.3%), farmers/fisherfolks (7.8%), faculty & students (50.5%), government personnel (8.3), and foreign nationals (4.8%).



For 2008, AQD's internship program catered to 173 students from 28 schools and universities, including 3 foreign students from Maejo University in Chiangmai, Thailand who are completing their 4-month overseas training which started in November



Graduate students from Kagoshima University visited AQD's TMS and IMS during their training on *Status of Philippine fisheries, agriculture and health* from 10–20 December

Publications

The year 2008 saw AQD produce the following information packages which were distributed to the R&D and academic communities (46.06%), private sector (28.71%), and local government units & national government agencies (20.82%).

PROGRAM & INSTITUTIONAL PROMOTION



AQD Highlights 2007. A 44-page annual report on the departmental and regional programs and activities of AQD



SEAFDEC/AQD. A 2-page flyer containing information on AQD's mission, vision, and departmental & regional programs



Research output of the Fisheries Sector Program Volume 2. This 252-page report is the second volume on fisheries R&D funded by BAR



ABOT AquaNegosyo. A 2-page flyer on AQD's Agree-Build-Operate-Transfer (ABOT) AquaNegosyo, with information on the benefits of venturing into aquaculture, available business packages and activity guide

The AQD Magic.

A 3.5-minute institutional video. A longer, 8-minute version was produced in 2007

TECHNOLOGY UPDATES



Rural aquaculture. This 308-page advance reading copy in limited print was used during the *Training of trainers on human resource development*



Biology & hatchery of mud crabs. [AEM 34] A 47-page revised edition of the 2003 manual on AQD hatchery protocols for the mass production of mud crabs



Grow-out culture of the Asian catfish. [AEM 41] A 29-page manual on the grow-out of the Asian catfish



Abalone culture. A 2-page flyer on the biology, site selection, cage design, transport and other relevant aspects in the culture of the tropical abalone *Haliotis asinina*



Breeding & seed production of the Asian catfish. [AEM 40] A 28-page manual on the breeding, hatchery and nursery, and health management of the Asian catfish



Gracilaria culture. A 2-page flyer on the pond and fixed-bottom culture of the seaweed *Gracilaria*



Abalone hatchery. [AEM 39] A 31-page how-to manual on the hatchery operation of abalone

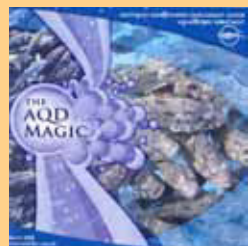


What's in a tangab? A 16-page flyer about the large fixed filter net locally known as *tangab*

NEWSLETTER



AQD Matters. Eight issues of the internal newsletter have been produced and distributed either electronically or in print to AQD employees and friends and select mass media



Compendium of aquaculture technologies.

This DVD (beta version) compiles AQD-developed technologies on the hatchery and grow-out of abalone, mud crab, tiger shrimp, grouper, milkfish, catfish, seabass, tilapia, freshwater prawn and seaweeds.

The DVD commemorates AQD's 35th anniversary





Eleven of the large-format poster produced by AQD displayed during fairs and exhibits

Fairs & exhibits, mass media

AQD was once again visible in fairs and exhibits, having participated in 12 venues sponsored by the World Bank, private sector and various government agencies, and in the process allowed AQD to directly get in touch with its clientele.

Sagay Agro-Fair 2008. Organized by the local government of Sagay City on 14–19 March. The AQD booth was estimated to attract 200 visitors

Semana sg Iloilo (Agri-Fair). Organized by the Iloilo provincial government last 07–11 April. AQD's booth was visited by around 500 people

Bicol Business Week (Agri-Aqua Exhibit). An estimated 200 people dropped by AQD's exhibit from 13–20 April

6th Philippine Shrimp Congress. Organized by the Negros Prawn Producers' Cooperative, DA-BFAR and other partners including AQD, the gathering was held last 28–30 May. AQD's booth was visited by an estimated 700 Congress participants

Capiz Farmer's Day. The affair, organized by the Capiz provincial government, was held last 14 April, with AQD's booth attracting about 200 people

Rizal Provincial Trade Fair. The fair, held last 12–15 June, was organized by the Rizal local government and DTI. About 200 people visited the AQD exhibit booth

1st Pinoy Aquatic Food and Tech Expo. About 500 people dropped by AQD's booth in the expo organized by AANI and BFAR last 29–30 August

2008 Development Marketplace Global Competition. Co-sponsored by the World Bank, the Global Environment Facility (GEF), the International Finance Corporation (IFC), the Bill & Melinda Gates Foundation, and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the event was held 22–27 September in Washington, DC, USA

AgriLink-FoodLink-AquaLink. The affair was held last 09–11 October, organized by a private sector-government consortium. Of the 700 visitors to AQD's booth, 200 sought aquaculture technical support

19th National Statistics Month. AQD's booth was visited by at least 500 people in this event, which ran from 07–17 October and organized by NEDA Iloilo

2008 Fish Conservation Week. The activity, held from 19–25 October, was organized by BFAR. About 20 people dropped by AQD's booth

Meeting on high-value fishes. AQD sold its publications in this meeting held last 02 December in Iloilo City, sponsored by the American Soybean Association Marketing International



From top: AQD at the Sagay Agro-Fair, Semana sg Iloilo, Shrimp Congress, Pinoy Aquatic Food & Tech Expo, and Development Marketplace Global Competition

AQD press statement	Resulting media exposure
Good deals for fishfarmers	1 newspaper, 3 websites, 1 magazine
Training courses for 2008	2 newspapers
Marine fish hatchery training course for the Philippines	1 newspaper, 4 websites, 1 magazine
SEAFDEC to conduct training on mangroves	1 newspaper, 1 website
BSP briefing of OFWs; ABOT AquaNegosyo; and mangrove-friendly shrimp farming	1 website each
Ilonggo heads world-class research center	1 newspaper, 2 websites
Shrimp farmers in the Philippines go for the Pacific white shrimp	3 newspapers, 1 magazine
SEAFDEC is developing early warning system for pollution in mariculture park	2 newspapers
Technical assistance	1 newspaper
General information on abalone, catfish, and sea cucumber	1 TV program
<i>January-December: various topics covered by public media which are about SEAFDEC or mention SEAFDEC</i>	<i>24 newspapers, 89 websites and blogs (monitored by Google Alerts), 3 TV programs</i>



AQD Library

The AQD library's present collection increased by 1.52% monographs, 2.03% SEAFDEC publications, 5% bound serial volumes, and 0.85% pamphlets from 2007, in addition to a variety of maps, posters, and microfiche collections.

The Follett database collections likewise increased by 3.3% titles and 3% volumes/copies. These were available for use through the online public access (OPAC) at the AQD website and the library local area network. A total of 17,910 global searchers visited the AQD library OPAC in 2008.

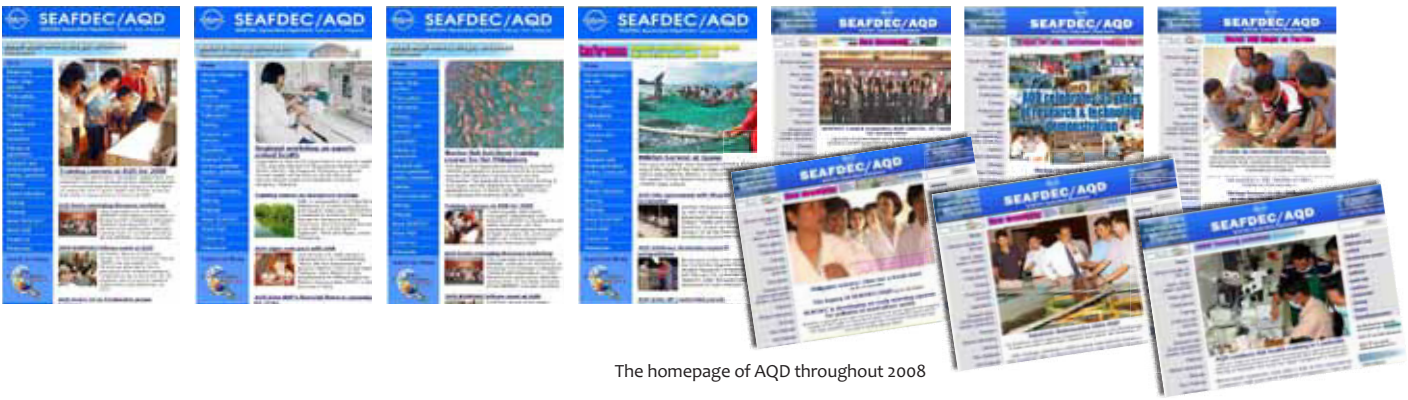
Seventeen (17) serial subscriptions (4 foreign journals, 1 national journal, 1 national monthly magazine, 4 local and 7 national dailies) were renewed during the period. One hundred thirty (130) books, 12 CDs, 25 pamphlets, 15 reprints, 649 journal issues and 6 posters were received as gifts and exchanged for AQD publications from different libraries and institutions.

Moreover, 302 back issues of assorted journal titles, 15 books and 3 pamphlets were donated by

IAMSLIC thru their Exchange Duplicates Program. Several assorted SEAFDEC publications and other titles were either given free to or exchanged with the following libraries: (1) FAO Fisheries; (2) Australian Institute of Marine Science; (3) Central Institute of Brackishwater Aquaculture India; (4) Philippine Development Assistance Programme Inc (PDAP); (5) BFAR Region 7; (6) Don Mariano Marcos Memorial State University in Sto. Tomas, La Union; (7) Central Luzon State University; (8) Central Mindanao University Library; (9) Mindanao State University College of Fisheries; (10) Southern Philippines Agribusiness Marine & Aquatic School of Technology; (11) University of San Carlos Cebu City; and (12) Zamboanga State College of Marine Sciences and Technology.

About 12,515 search queries were made and 153 records were generated from OPAC and from CD-ROM databases like the Aquatic Sciences and Fisheries Abstracts (ASFA), Aquatic Biology, Aquaculture & Fisheries Resources, FishBase, and Current Contents ABES & Life Sciences.

The library served 7,925 readers and lent out 2,381 materials for the year. About 1,104 library users came from 142 different schools, government agencies and private sectors. Thirty-one (31) queries from the Philippines, 1 each from Australia, Canada, Iran, Singapore, Sweden and Thailand were received and answered.



The homepage of AQD throughout 2008

AQD on the web

AQD made significant forays in the online realm in 2008, expanding its global reach.

The AQD website (www.seafdec.org.ph) was updated 10 times, with an average of 3,328 unique visitors and 6,493 webhits per month, up from last year's <2,000 unique visitors and 5,000 webhits. Mini-sites on *Stock enhancement for species of international concern* and *ICD-SA* were launched and updated, respectively. AQD's webmail was migrated from being hosted in-house to Google Apps.

AQD news and updates (in the form of web logs or 'blogs'), photos and videos were shared with the online community through some popular sites. News are constantly updated and posted at Blogspot (www.aqdnews.blogspot.com). Photos of aquaculture commodities, AQD stations, activities and projects are shared through flickr (www.flickr.com/photos/seafdecaqd). AQD also has a channel on YouTube (www.youtube.com/user/SEAFDECAQD), where visitors could view the institutional video 'The AQD Magic' and other videos showcasing aquaculture technologies developed at AQD.



The AQD website's webhits (line graph) and unique visits (bar) for 2008. Monitoring by Google Analytics



From top: the stock enhancement and ICD-SA minisites; AQD's YouTube channel, which registered more than 1,200 views of the 'AQD Magic' and 804 views of 16 other AQD videos; flickr photo gallery which had 12,000 views; and Blogspot page

AQD visitors

In 2008, AQD had its share of visitors who toured hatcheries, laboratories, pond facilities and stations. About 11,040 persons visited in 2008:

Category	TOTAL
Fisheries-related agencies from countries hosting a SEAFDEC department (Philippines, Singapore, Malaysia, Thailand)	366
Fisheries-related agencies from member countries not hosting departments (Japan, Cambodia, Vietnam, Myanmar, Brunei Darussalam, Indonesia, Lao PDR)	5
Fisheries-related agencies from non-member countries	23
International-regional organizations (fisheries and non-fisheries)	1,442
Schools (students and faculty/researchers)	8,668
Others (private sector, NGOs, public, others)	536
TOTAL	11,040

AQD was likewise privileged to host short seminars from visitors, and in the process, gave AQD staff the latest information and trends in science and technology.

Dr. Marielle van Riel¹ – Crown of thorns–starfishes, 17 April

Ms. Fatimah Corazon Abdullah² – Ongoing biotechnology research activities at Universiti Industri Selangor, Malaysia, 14 May

Dr. John Weaver³ – Evaluation of the performance of veterinary services, 14 May

Dr. Wenresti Gallardo⁴ – Tropical abalone culture: status and prospects, 12 June

Mr. Kerrie O'Donnell⁵ – Integrating fisher interview, log book, and available life history data to reconstruct an IUCN-listed seahorse fishery in the Philippines: a first step toward recovery targets, 19 June

Dr. Jurgenne Primavera⁶ – A review of mangrove rehabilitation in the Philippines – successes, failures and future prospects, 24 July

Dr. Raul Suarez⁷ – Explorations of functional biodiversity: fuel use during exercise, 17 July

Ms. Marie Frances Nieva⁸ – Sea cucumber fishery, research and culture initiatives in Western Visayas, Philippines, 25 September

Mr. Jon Altamirano⁹ – Estimating current mangrove area: mapping for non-GIS users, 8 October

Dr. Fahrul Huypop¹⁰ – Pesticide/herbicide degrading bacteria, 21 October

Dr. Satoshi Watanabe¹¹ – Relationship between nutritional conditions of manila clam *Ruditapes philippinarum* and feeding environment, 29 October

Mr. John Gumbs¹² – Research at the National Institute of Fisheries (NIF), Ecuador, 02 December

Dr. Motohiko Sano¹³ – Current research topics in the Aquatic Animal Health Section of National Research Institute of Aquaculture, 08 December

¹Council of Anini-y, San Jose, Tobias Fornier & Hamtic for the Advancement of Viable Environment (COASTHAVEN), Anini-y, Antique; ²Universiti Industri Selangor, Malaysia; ³Food and Agriculture Organization; ⁴Aquaculture & Aquatic Resources Management, School of Environment, Resources & Development, Asian Institute of Technology, Thailand;

⁵University of British Columbia Fisheries Centre; ⁶Pew Fellow in Marine Conservation ⁷Ecology, Evolution and Marine Biology Department, University of California; ⁸University of the Philippines Visayas; ⁹University of Tokyo; ¹⁰University Technology Malaysia; ¹¹JIRCAS;

¹²NIF Ecuador; ¹³National Research Institute of Aquaculture, Japan



Clockwise from top: Fishworld R&D interns at a fishing village; discussing the impacts of the *tangab* during the workshop; sampling entries in the seafood dish contest during the Aquaculture Week; and tagging & releasing of an endangered marine turtle



FishWorld

Visitors, composed mostly of 5,067 students from 86 schools, were briefed and given a guided tour of facilities in 2008. The museum's collection stands at about 4,000 different species of aquatic plants and animals for identification and cataloguing.

FishWorld was able to rescue and rehabilitate endangered marine animals (2 hawksbill turtles, 3 olive ridleys, 2 green turtles) and preserve a dead killer whale and a dead bottlenose dolphin.

In addition, 24 high school science teachers and students had their workshops and internships on R&D at the FishWorld. During the 2008 Aquaculture Week, competitions were held for 102 students from 12 elementary and high school students.

A workshop on the *tangab* (filter net) fishery in Iloilo Strait was held with participants from BFAR, fisherfolk, and other stakeholders to determine the impacts of *tangab* fishery on resources and improve policies on fisheries management.

AQD research publications

In science journals

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- Cuvin-Aralar MLA, Lazartigue AG, Aralar EV. 2008. Cage culture of the Pacific white shrimp *Penaeus vannamei* at different stocking densities in a shallow eutrophic lake. *Aquaculture Research* 40:181–187
- de la Peña LD, Lavilla-Pitogo CR, Villar CBR, Paner MG, Capulos GC. 2008. Prevalence of monodon baculovirus (MBV) in wild shrimp *Penaeus monodon* in the Philippines. *Aquaculture* 285:19–22
- Hurtado AQ, Critchley AT, Trespoe A, Bleicher-Lhonneur G. 2008. Growth and carrageenan quality of *Kappaphycus striatum* var. *sacol* grown at different stocking densities, duration of culture and depth. *Journal of Applied Phycology* 20:551–555
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- Jing NH, Sulaiman FT, Wahab RA, Pakingking RV Jr, Rashid NAA, Huyop F. 2008. Purification and properties of a non-stereospecific dehalogenase enzyme E (DehE) from *Methylobacterium* sp. HJ1. *African Journal of Microbiology Research* 2:187–191
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- Lavilla-Pitogo CR, de la Peña LD, Tendencia EA. 2007. Enhancing disease monitoring in shrimp through a geographical information system (GIS) application. *Preventive Veterinary Medicine* 81 (Special Issue):218–219 (meeting abstract)
- Le Vay L, Lebata MJH, Walton M, Primavera J, Qunitio E, Lavilla-Pitogo C, Parado-Esteva F, Rodriguez E, Ut VN, Nghia TT, Sorgeloos P, Wille M. 2008. Approaches to stock enhancement in mangrove-associated crab fisheries. *Reviews in Fisheries Science* 16:78–80
- Maluping RP, Ravelo C, Lavilla-Pitogo CR, Krovacek K, Romalde JL. 2005. Molecular typing of *Vibrio parahaemolyticus* strains isolated from the Philippines by PCR-based methods. *Journal of Applied Microbiology* 99:383–391
- Okuzawa K, Maliao RJ, Qunitio ET, Buen-Ursua SMA, Lebata MJHL, Gallardo WG, Garcia LMB, Primavera JH. 2008.

- Stock enhancement of threatened species in Southeast Asia. *Reviews in Fisheries Science* 16:394–402
- Primavera JH, Esteban JMA. 2008. A review of mangrove rehabilitation in the Philippines: successes, failures and future prospect. *Wetlands Ecology and Management* 16:345–358
- Primavera JH. 2007. Integration of aquaculture and mangroves. *Bulletin of Marine Science* 80:931 (meeting abstract)
- Quilang JP, Basiao ZU, Pagulayan RC, Roderos RR, Barrios EB. 2007. Meristic and morphometric variation in the silver perch, *Leiopotherapon plumbeus* (Kner, 1864) from three lakes in the Philippines. *Journal of Applied Ichthyology* 23:561–567
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In books and proceedings

- Agbayani RF, Toledo JD. 2008. Institutional capacity development for sustainable aquaculture and fisheries: strategic partnership with local institutions. *In: Tsukamoto K, Kawamura T, Takeuchi T, Beard TD Jr, Kaiser MJ (eds.) Fisheries for Global Welfare and Environment, 5th World Fish Congress 2008*, pp. 435–448
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Statement of source & application of funds 01 January – 31 December 2008

Sources of funds	Philippine peso (PhP)
Contributions from the Government of the Philippines	128,500,000
Government of Japan Trust Fund	15,108,857
Development of fish disease surveillance system for aquatic animals	4,686,758
Stock enhancement for threatened species of international concern	1,914,191
Technology development of sustainable aquaculture	4,687,593
GOJ committed funds from prior year	3,820,315
External grants	6,045,598
ACIAR	1,182,500
ASEAN Foundation	1,265,256
NACA	105,294
UNESCO	218,720
DA -BFAR	
Paoay project	136,000
Aurora project	75,000
Capiz provincial government	278,491
Northern Samar provincial government	617,474
Misamis Occidental	931,284
Petron Foundation Inc	1,235,578
Internally generated funds	24,298,909
Income -Research Division	5,348,953
Income -Training & Information Division	3,012,910
Income -Technology Verification & Demonstration Division	7,340,134
Income - Administrative & Finance Division	8,156,871
Income -Management Office	440,042
Committed funds from prior year	17,352,868
Total funds	191,306,231

Application of funds	Philippine peso (PhP)
General/administrative & non-project expenses:	102,836,053
Research Division	39,007,567
Training & Information Division	10,466,204
Technology Verification & Demonstration Division	3,223,370
Administrative & Finance Division	35,211,647
Management Office	14,927,265
Program/project expenses	36,937,727
Research Division	20,948,916
Training & Information Division	4,257,084
Technology Verification & Demonstration Division	11,725,897
Management Office	5,830
Government of Japan Trust Fund projects	15,108,857
Development of fish disease surveillance system for aquatic animals	4,768,399
Stock enhancement for threatened species of international concern	1,903,744
Technology development of sustainable aquaculture	3,840,672
GOJ committed funds/advances	4,596,042
Externally funded projects	9,793,045
ACIAR grouper projects	1,116,263
ASEAN Foundation	937,344
NACA – aquaculture study	83,635
UNESCO – guidebook on Philippine mangroves/mangrove associates	431,679
NCSU – alternative feeding strategies to improve milkfish	612,570
DA-BAR – Review & publication of BAR/FSP-funded research	53,332
DA-BFAR – Paoay project	55,251
DA-NFRDI	
Capacity building of BFAR-NFRDI in fish health	1,452,016
Joint implementation of aquaculture biotechnology projects	77,128
LGU-ICDSA	2,056,677
ABOT AquaNegosyo	459,107
Tetra Tech EM Inc (USAID)	139,993
Petron Foundation Inc	2,318,050
Committed funds	26,630,550
Advances for on-going activities	3,350,447
Capital outlay/repairs	23,280,103
Total application of funds	191,306,231

Snapshots



Palaro 2008: Nurturing a healthy lifestyle among AQR staff through exercise and sports. For several Fridays in the months of May to July, AQR employees from TMS, BFS, DBS, IMS and MO got out of their laboratories and offices to participate in a variety of games. Moreover, AQR staff also brought along their family one Saturday to compete in family-friendly games. In the end, Team *Chanos* conquered Team *Penaeus*, 145-125.



Relief from typhoon Frank. The onslaught of the typhoon (international name: Fengshen) last 21 June in Western Visayas caused a lot of devastation. AQR took part to help, with employees donating clothing, food and some money to help the affected municipalities of Tigbauan and Guimbal in this great time of need.



AQR's 35th anniversary: Strengthening the legacy of responsible aquaculture in Southeast Asia. Activities held last July included a free medical consultation for nearby AQR communities, blood drive with the Philippine National Red Cross, book launching of new AQR publications, the Dean Domiciano K. Villaluz Memorial Lecture of Silliman University's Dr. Angel Alcala, gift giving, and the anniversary program.



Biotech update meetings. Staff from AQR's Molecular Endocrinology and Genetics (MEG) laboratory and Algal Production Laboratory (APL) have biotech update meetings once every two months. These provide them a chance to discuss the problems encountered in the course of lab work and toss around ideas to solve them. Staff also exchange techniques learned and tips during these meetings.



SEAFDEC/AQR: Brighter future through aquaculture 'AQR family wishes everyone fish and prosperity for the years to come.' The holidays was commemorated at AQR with a gift-giving for the communities near AQR, auctioning of *parols*, a program, and games for everyone to enjoy



Tigbauan Main Station (TMS)



Binangonan Freshwater Station (BFS)



Dumangas Brackishwater Station (DBS)



Igang Marine Station (IMS)

About SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in December 1967 to promote sustainable fisheries and responsible aquaculture in the region. The member countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, 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. AQD also has a Manila Office in Quezon City.

SEAFDEC Aquaculture Department

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