

RESEARCH ACTIVITIES AND ACCOMPLISHMENTS OF THE SEAFDEC AQUACULTURE DEPARTMENT, 1988-1991

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ABSTRACT

Research studies conducted from 1988 to 1991 focused on breeding, seed production, and farming of thirteen aquaculture species of regional importance. Studies aimed at developing economical feeds, as well as disease prevention and control were undertaken. Guided by the recommendations of ADSEA I (*Seminar-Workshop on Aquaculture Development in Southeast Asia*; 8-12 Sept. 1987; Iloilo City, Philippines), workshops to review the previous years' progress and identify specific studies for implementation were held annually since 1989 with the participation of academic institutions, government and private sectors.

Some 212 studies were implemented. Majority were on tiger shrimp, milkfish, and sea bass. Studies on other species of fishes, crustaceans, molluscs, and seaweeds, as well as larval food organisms, sea-farming and economics of hatchery and grow-out culture systems were also undertaken. As of December 1991, 168 studies were completed. Research results were published in 204 scientific journals, proceedings, and other publications. In addition, 27 papers were in press and 63 manuscripts had been submitted.

That research output is gaining recognition in the international scientific community can be gleaned from the number of papers published in refereed journals covered by *Current Contents* (CC). Of the 142 papers published in scientific journals in 1988-1991, 115 (81%) appeared in CC-covered journals. This has increased from 58.8% (124 of 211) in 1976-1987. The active participation of the research staff in scientific meetings is equally evident from the number of publications in proceedings of scientific meetings from 1988-1991 (63).

The *Seminar on Aquaculture Development in Southeast Asia* (ADSEA I) held in 1987 reviewed the status of aquaculture in the region, identified gaps and constraints, and prioritized aquaculture species of regional importance and major areas for research for each species. Areas for collaboration in research and training among SEAFDEC Member Countries were also identified.

Among the 24 species identified were seven marine and brackishwater fishes, five freshwater fishes, five crustaceans, four molluscs, and three seaweed species.

The following were identified as priority areas for research:

Marine and brackishwater fishes (sea bass, grouper, red and golden snapper, mullet, rabbitfish, and milkfish) - (1) development of hatchery and nursery techniques, (2) feed development for nursery and grow-out, and (3) disease prevention and control in nursery and grow-out.

Freshwater fishes (red tilapia and other tilapias, marble goby, carp, and catfish) - (1) selective breeding, (2) refinement of hatchery techniques, (3) feed development for nursery and grow-out, (4) improvement of water management technique for nursery and grow-out, and (5) disease prevention and control.

Crustaceans (*Penaeus monodon*, *P. merguensis*, *P. indicus*, *Macrobrachium rosenbergii*, *Scylla serrata*, *Metapenaeus ensis*/*M. monoceros*) - (1) development of captive broodstock, (2) development of cost-effective feeds for broodstock, hatchery and grow-out, (3) refinement of hatchery-nursery technology, (4) improvement of water management techniques for grow-out, (5) development of techniques for disease prevention and control, and (6) selective breeding.

Molluscs (*Perna viridis*, *Crassostrea* sp., *Anadara* sp., *Placuna placenta*) - (1) development of depuration techniques, (2) product development, (3) resource evaluation, (4) site identification and development of spatfall forecasting, (5) evaluation of culture technology, and (6) refinement of grow-out techniques.

Seaweeds (*Gracilaria*, *Porphyra*, *Eucheuma*) - (1) biological studies, (2) refinement of culture techniques, (3) screening and characterization of natural products and product utilization, (4) selective breeding, and (5) establishment of seed banks.

Research activities

With the ADSEA I recommendations as framework on which to base the research activities of the Aquaculture Department, a three-year plan of research activities was approved for implementation in 1989-1991 during the 21st meeting of the SEAFDEC Council. Annual workshops to review the previous years' research progress, and identify specific studies for implementation were held annually since 1989 with the participation of representatives from academic institutions, government and private sectors.

In 1986, research activities were centered on ten species, including four marine and brackishwater fishes (sea bass, grouper, rabbitfish, and milkfish), two freshwater fishes (carp and tilapia), two crustaceans (*P. monodon* and *M. rosenbergii*), two molluscs (oyster and mussel). The number of species being investigated has since increased to thirteen with the addition of catfish, *Clarias macrocephalus* (1987), *Gracilaria* (1988), mullet and *P. placenta* (1989), and snapper (1990). Research on *Macrobrachium* was discontinued in 1987, while work on rabbitfish was temporarily suspended in 1991.

The following were the major focus of research undertaken for each species: (1) sea bass - improvement of induced spawning techniques and improvement of hatchery and nursery technologies; (2) grouper, snapper, and

mullet - broodstock development; (3) rabbitfish - improvement of seed production techniques; (4) milkfish - improvement of seed production techniques, hormonal induction of off-season sexual maturation, nutritional requirements, and improvement of grow-out culture methods; (5) tilapia - development of methods for strain selection and nutritional requirements of fry and fingerling; (6) carp and catfish - improvement of methods for induced spawning and development of seed production techniques; (7) tiger shrimp - disease prevention and control in hatchery and grow-out, nutritional requirements of broodstock and juveniles, and feed development for various life stages; (8) white shrimp - broodstock nutrition and development of seed production techniques; (9) molluscs - biology and stock assessment of *P. placenta*; and (10) seaweeds - development of methods for management of wild *Gracilaria* stocks and identification of species for culture.

Preliminary studies were undertaken to identify a pilot site for an integrated seafarming and searanching project. Studies to investigate factors associated with the occurrence of epizootic ulcerative syndrome or EUS in freshwater fishes and economic studies to assess cost-effectiveness of developed technologies were also undertaken.

Research accomplishments

The total number of studies implemented in 1988-1991 is 212 (Table 1). As of December 1991, 168 studies were completed (Table 2); the rest were deferred/cancelled or are continuing.

Research results were published in 204 scientific journals, proceedings, and other publications (Table 3). In addition, 21 papers were in press and 67 manuscripts had been submitted as of December 1991. Significant research findings are discussed in the papers by Estepa, Garcia, Duray, Pitogo, and Millamena in this volume.

Some of the significant results include: (1) natural spawnings of milkfish and grouper in tanks; (2) reliable induced spawning techniques for sea bass, milkfish, catfish and bighead carp; (3) improved hatchery techniques for sea bass and tiger shrimp; (4) development of an experimental and statistical procedure for strain selection of tilapia; (5) determination of nutritional requirements of milkfish and tiger shrimp; (6) development of feed formulations using indigenous feed ingredients for milkfish, tiger shrimp, tilapia, and carp; (7) development of a microbound diet for tiger shrimp larvae; (8) determination of the etiology and route of infection of luminous bacterial disease in tiger shrimp, and development of methods for its prevention; (9) development of a method to reverse the soft-shell disease in tiger shrimp; and (10) screening of suitable *Gracilaria* species for culture, and development of methods for management of wild stocks.

The number of scientists was reduced from 72 in 1987 to 56 in 1990 and non-technical staff by more than half, from 258 in 1987 to 110 in 1990. The research performance of SEAFDEC/AQD scientists, however, has vastly improved. The number of scientific journal publications (142) during the period (1988-1991) exceeded that published in 1981-1987(136). That research output of

Table 1. Research studies by major species, 1988-1991

Commodity	1988	1989	1990	1991	Total
Sea bass	7	11	9	3	30
Grouper	1	6	5	3	15
Snapper			1		1
Mullet		1	1		2
Rabbitfish	4		1		5
Milkfish	9	3	12	2	26
Tilapia	7	5	3	1	16
Catfish	1			1	2
Carp	6	1		1	8
Tiger shrimp	25	13	10	3	51
White shrimp	5	2	2	1	10
Molluscs		3	4	2	9
Seaweeds	4	2	4	1	11
Other studies	12	5	8	1	26
Total	81	52	60	19	212

Table 2. Completed research studies, 1988-1991

Commodity	1988	1989	1990	1991	Total
Sea bass	4	9	6	7	26
Grouper		5	4	3	12
Snapper				1	1
Mullet			1	1	2
Rabbitfish	2	1	1		4
Milkfish	4	5	3	6	18
Tilapia	3	3	4	1	11
Catfish			1		1
Carp	5	1	1		7
Tiger shrimp	17	11	8	6	42
White shrimp	1	3	4		8
Molluscs		1	4	2	7
Seaweeds		2	3	4	9
Other studies	8	4	8		20
Total	44	45	48	31	168

SEAFDEC/AQD is gaining recognition in the scientific community can be gleaned from the number of papers published in journals covered by *Current Contents* (CC) (Table 4). Of the 142 papers published in 1988-1991, 115 (81%) appeared in CC-covered journals, an increase from 67% (98 of 146) in 1981-1987

Table 3. Research publications in scientific journals, proceedings, and other publications, 1988-1991

Commodity	1988	1989	1990	1991	Total
Sea bass	1	4	4	5	14
Grouper		1		2	3
Snapper					0
Mullet					0
Rabbitfish	3	1	2	3	9
Milkfish	16	9	11	10	46
Tilapia	12	1	5	3	21
Catfish				2	2
Carp	2	2	1	4	9
Tiger shrimp	15	15	13	12	55
White shrimp					0
Molluscs	1		1	1	3
Seaweeds		1	1	1	3
Other studies	5	10	15	10	40
Total	55	44	53	53	205

and 40% (26 of 65) in 1976-1980. The participations of research staff in scientific meetings continue to make significant contribution as evident from publications in proceedings during the period (63).

Collaborative projects

Collaboration with local and foreign universities, government agencies, international research institutions, and funding agencies during the period has increased. SEAFDEC/AQD is actively involved in several International Development Research Centre (IDRC) networks such as the Fish Genetics, Fish Microbiology, Fish Nutrition, and the Asian Fisheries Social Sciences Research Network (AFSSRN). Through these networks, research collaborations with the International Center for Living Aquatic Resources Management (ICLARM), Dalhousie University and Simon Fraser University in Canada, and the Universiti Pertanian Malaysia were facilitated.

Other collaborative projects were implemented with the University of Hohenheim, University of Ghent, University of Rhode Island, Food and Agriculture Organization/Network of Aquaculture Centers in Asia (FAO/NACA), and IFREMER. Seven research grants were awarded to AQD researchers by the International Foundation for Science (IFS). Collaborations with the University of the Philippines - Visayas (UPV), Marine Science Institute (UP-MSI), Seafarming Research Development Center (SRDC), Bureau of Aquatic Resources (BFAR), and the Negros Prawn Producers and Marketing Cooperative (NPPMCI) continue. Through the Japan International Cooperative Agency (JICA), five

Table 4. Research publications in scientific journals, 1988-1991

Commodity	1988	1989	1990	1991	Total
Sea bass	1	3	3	5	12
Grouper		1			1
Snapper					0
Mullet					0
Rabbitfish	2	1	2	2	7
Milkfish	13	7	5	8	33
Tilapia	6		2	2	10
Catfish				2	2
Carp	2	1	1	4	8
Tiger shrimp	2	10	10	11	33
White shrimp					0
Molluscs				1	1
Seaweeds		1	1	1	3
Other studies	4	8	10	10	32
Total	30	32	34	46	142
<i>Current Contents- covered</i>	25	25	27	38	115

Japanese experts conducted various studies in the Department. A total of 23 local and foreign graduate students also conducted their thesis research through various collaborative projects.

Research awards

During the period, nine AQD researchers were recipients of eight national and international awards for their research contributions. These include the Elvira O. Tan Memorial Award for Fisheries, Best Paper in Aquaculture (1988 and 1991); the American Institute of Nutrition, Graduate Student Research Award in Abstract Writing Competition (1988); and the Department of Agriculture-Bureau of Agricultural Research Best Paper Award in Fisheries and Aquatic Resources Category (1989, 1991 - first and second prizes), Best Paper in Socioeconomic Category (1990, 1991 - second prize), and Best Paper in Agricultural Engineering Category (1991).