

Research activities of Team-4

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Team-4 has been included in the research field-2; production and utilization of fishery resources in the Philippines and aimed at aquaculture: Methodological development for production of seed and propagation of organisms in the Philippines.

Studies on the following research topics were recommended such as; 1) Technical development for production of seed of useful species in the waters of the Philippines, 2) Development of aquaculture feed appropriate to the Philippines, 3) Natural demands and nutritional metabolism for fishes and crustaceans, 4) Mechanisms of disease control for organisms, and 5) Maintenance and propagation of coastal living resources.

In phase-2, for the purpose of rational utilization of aquatic resources in harmony without endangering the environment of coastal waters in the Philippines, members of Team-4 conducted the researches on the aquaculture technology for commercial species. Aquaculture technology to avoid negative impact to coastal environment would be developed and future directions for culture fishes in the Philippines were studied.

In phase-3, Team-4 continued the researches on the aquaculture technology for commercial species, aiming at aquaculture technology to eliminate negative impacts to coastal environment. The expected major researches were as follows. Methodology for production of seed including the development of suitable techniques on the live feed production would be developed. Environment-friendly and disease resistant feeds using substitutional proteins available in the Philippines would be developed. Sustainable biological reproduction would be established on the basis of improved culture techniques. Aquaculture in lagoon waters and ecosystem were studied. A disease outbreak and identification of disease sources should be obtained including the search for the methods for solving disease problems.

This paper presents the activities and output of Team -4 Aquaculture during Phases 2 and 3 (2001-2004 and 2005-2007) of the Core University Program (CUP) of the Japan Society for the Promotion of Science (JSPS) and the Philippine Department of Science and Technology (DOST).

Research Field and Team: The core university program was composed of two research fields and team-4 and team-5 were included in field 2, where the production and utilization of fishery resources in the coastal waters in the Philippines were studied. Independent and cooperative researchers in team-4 focused on concerns in aquaculture. More specifically, the team worked on the development of methods towards enhanced and efficient production of seed and aquaculture organisms in the Philippines.

Research Topics: Studies on the following topics in team-4 were recommended, namely,

1) Technical development for production of seed of use-

- ful species in the waters of the Philippines,
 2) Development of aquaculture feed appropriate to the Philippines,
 3) Nutritional demands and nutritional metabolism for fishes and crustaceans,
 4) Mechanisms of disease control for organisms, and
 5) Maintenance and propagation of coastal living resources.

Participating Universities: Under the umbrella of the two core universities, there were ten participating universities in Japan and four in the Philippines (Table 1). They were academic institutions with existing fishery-related programs.

Exchanges: During Phase-2, an overall total of 23 Japanese researchers (338 man×day) went to the Philippines and 42 Filipino researchers (842 man×day) visited Japan (Table 2). During this period, this team enjoyed top priority for the exchange and as a result, more team participants from the Philippines came to Japan than did any

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other team members stemming in part from the importance and popularity of aquaculture sector in the Philippines.

With the objectives of rational utilization of aquatic resources without endangering the ecological balance of the coastal environment in the Philippines, team-4 members conducted researches on aquaculture technology for commercial species. Initially, some aquaculture technologies were developed which avoided negative impacts to coastal environment and considerations for future directions for culture fisheries in the Philippines were made. Expected outcomes of the above studies of Team-4 were:

- 1) Methodology for production of seed including the development of suitable techniques on the live feed production would be developed. Initial results showed that mass production of small rotifers was possible, and the enrichment of phytoplankton was necessary for the mass production of rotifers.
- 2) Environment-friendly and disease resistant feeds using local products would be developed. From feeding trials conducted, it was shown that locally available products were very good sources for tilapia as a protein replacement.
- 3) Sustainable biological reproduction would be established on the basis of improved culture techniques. Studies had shown that the introduction of probiotics was the one of the good ways to establish the both safe aquaculture and environments at the same time.
- 4) The information on the disease outbreak and identification of disease sources should be obtained including the search for the methods for solving disease problems.

Specific results from these researches were noted, namely: 1) it had been clarified that some plankton species were suitable to be reproduced under artificial aquatic conditions in the Philippines from which papers on live feed production techniques had been published, 2) potential utilisation of substitutional proteins available in the Philippines were studied for the purpose of developing environment-friendly artificial feeds, consequently, those for tilapia and other fish species were continued, 3) studies on aquaculture in lagoon waters and ecosystem were conducted, and 4) researches on shrimp and fish disease were recently

introduced with high demand and some new findings were reported.

International Seminar: International Seminar on Sustainable Aquaculture and Environment was held on October 16 and 17, 2004 at Kagoshima University. The participants consisted of members of the Core University Program, selected on the basis of the outcomes for their cooperative researchers. Also invited speakers were investigators from Malaysia, Indonesia and Thailand. Twenty-two papers were presented, the results of which comprised various expected outcomes that were part of the plans of the program: methodology for environmental-friendly seed production, improved culture techniques for sustainable biological reproduction, and development of environment-friendly and disease resistant feeds.

In phase-3, the team participated in the International Forum on Coastal Environment and Utilization of Fisheries Resources on September 13-14, 2006 held at UPV in Iloilo, Philippines. Four papers under the team had been orally presented, the categories of which were the following: Immunostimulation of shrimps in ponds, Rapid diagnostic tests of *Vibrio harveyi* in shrimp ponds, Chemical remediation of shrimp in ponds, and Probiotics in fish in recirculating water system.

Members of Team 4 have published 11 papers in the ISI-covered journals, 10 papers in local refereed journals, and 5 papers in a proceeding. The following are the specific list of publications during the period 2001-2007 by the members of Team 4.

A. International Refereed Journals

- Caipang, C. M. A., Hirono, I., Aoki, T. (2005). Induction of antiviral state in fish cells by Japanese flounder, *Paralichthys olivaceus*, interferon regulatory factor-1. **Fish & Shellfish Immunology**, 19: 79-91.
- Evangelista, A. D., Fortes, N. R., Santiago, C. B.. (2005). Comparison of some live organisms and artificial diet as feed for Asian catfish *Clarias macrocephalus* (Gunther) larvae. **Journal of Applied Ichthyology**, 21: 437-443.
- Salvador S., Serrano, A. E. (2005). Isolation Culture of protoplasts from tissue fragments of Philippine cultivars of *Kappaphycus alvarezii* (Solieriaceae, Rho-

- dophyta). **Journal of Applied Phycology**, 17:15-22.
- Toledo, J.D., Ganzon-Naret, E.S., Nakagawa, H.. (2005). Comparison of fatty acid profile between cultured and wild-caught grouper *Epinephelus coioides*. **Aquaculture Science**, 53: 127-134.
- Urmaza, E. B., Aguilar, R. S. O. (2005). Growth performance of saline tolerant tilapia produced from cross combinations of various tilapia species. **Journal of Aquaculture in the Tropics** 20: 11-27.
- Caipang, C. M. A., Takano, T., Hirono, I., Aoki, T. (2006). Genetic vaccines protect red seabream, *Pagrus major*, upon challenge with red seabream iridovirus (RSIV). **Fish & Shellfish Immunology**, 21: 130-138.
- Genodepa, J., Southgate, P. C., Zeng, C. (2006). Determining ingestion of microbound diet particles by mud crab, *Scylla serrata*, larvae. **Journal of Fisheries and Aquatic Science**, 1: 244-252.
- Huervana, F. H., Dela Cruz, J. J. Y., Caipang, C. M. A. (2006). Inhibition of luminous *Vibrio harveyi* by "green water" obtained from tank culture of tilapia, *Oreochromis mossambicus*. **Acta Ichthyologica Et Piscatoria**, 36: 17-23.
- Jaspe, C. J., Caipang, C. M. A., Corre, V. L. J. (2006). Salinity resistance of F1 progenies from crosses between *Oreochromis mossambicus* and a tilapia hybrid, *Oreochromis spilorus* x *O. niloticus* GIFT x *O. aureus*: implications to high-saline culture. **Acta Ichthyologica Et Piscatoria**.
- Yoshimatsu, T., Higuchi, T., Zhang, D., Fortes, N. R., Tanaka, K., Yoshimura, K. (2006). Effect of dietary cobalt supplementation on the population growth of rotifer *Brachionus rotundiformis*. **Fisheries Science**, 72 : 214-216.
- Sara, L., Ingles, J. A., Aguilar, R. O., Laureta, L. V., Baldevarona, R. B., Watanabe, S. (2007). Abundance and distribution patterns of *Scylla* spp. larvae in the Lawele Bay, Southeast Sulawesi, Indonesia. **Asian Fisheries Science**, 19, 331-347.
- B. Local refereed journals
- Yoshimatsu, T., Saade, E., Fortes, N. R., Pahila, I., Han, K., Mihelakakis, A., Yoshimura, K. (2001). Effectiveness for sieving small rotifers in high density culture. The Yellow Sea, 7: 70-74.
- Fortes, N. R., Hagiwara, A., Marcial, H., Carton, R. J., Pinoso, L. A. G. (2005). Gamma-butyric acid added to bakers yeast as culture medium for rotifers, *Brachionus plicatilis* and *Brachionus rotundiformis*. **UPV Journal of Natural Sciences**, 10: 1-8.
- Ganzon-Naret, E. S., Koshio, S., Teshima, S., Ishikawa, M. (2005). Utilization of solvent-extracted soybean meal in pelleted feed for tilapia (*Oreochromis niloticus*). **UPV Journal of Natural Sciences**, 10: 9-16.
- Corre, V. L. J., Janeo, R. L., Ronquillo, J. D., Kurokura, H. (2005). Use of greenwater technology as biocontrol of luminous bacteria in intensive shrimp (*Penaeus monodon*) grow-out culture. **UPV Journal of Natural Sciences**, 10: 51-60.
- Laureta, L. V., Pinoso, L. A. G., Fushimi, H. (2005). Effects of different feeding schemes on the morphological conditions and growth performances of hatchery-raised milkfish fry grown to fingerling in brackishwater pond. **UPV Journal of Natural Sciences**, 10: 61-68.
- Carton, R. J., Fortes, N. R., Hagiwara, A. (2005). Effects of salinity on the life table demography and population growth of SS-type *Brachionus* sp. from an enclosed mangrove forest. **UPV Journal of Natural Sciences**, 10: 83-90.
- Toledo, N. A., Dureza, L. A., Ronquillo, J. D., Itami, T., Sakata, T., Suarnaba, V. (2005). *In Vivo* assay of live microalgae on *Vibrio harveyi* co-cultured with *Scylla serrata* larvae. **UPV Journal of Natural Sciences**, 10: 91-102.
- Fortes, R. D. (2005). Aquaculture in the Philippines: An economic activity and agent for a sustainable fisheries and aquatic resources. **UPV Journal of Natural Sciences**, 10: 103-112.
- Itami, T., Toledo, N.A., Maeda, M., Mekata, T., Yoshida, T. (2005). Detection of superoxide and nitric oxide in kuruma shrimp (*Marsupenaeus japonicus*) hemocytes. **UPV Journal of Natural Sciences**, 10: 135-144.
- Peralta, J. P., Garibay, S. S., Espina, R. M. M., Noble, J. R. N., Nualla, A. N. (2006). An investigation of the algal bloom occurrence in the coastal waters of barangay Kirayan Norte, Miag-ao, Iloilo, Philippines.

The Philippine Agricultural Scientist, 89: 97-100.

C. Proceedings

Ganzon-Naret, E.S., Koshio, S., Teshima, S., Ishikawa, M.

(2002). Performance of indigenous protein sources as diets for tilapia under laboratory condition. **Proc. Int. Commemorative Symp.**, 68: 797-800.

Corre, V.L., Janeo, R.L. (2002). Use of probiotics for sus-

tainable shrimp culture in Southeast Asia. **Proc. Int. Commemorative Symp.**, 68: 835-838.

Aguilar, R. O., Ohno, A. (2002). Observations on the feeding ecology and behavior of newly-hatched grouper, *Epinephelus coioides*, larvae. **Proc. Int. Commemorative Symp.**, 68: 1000-1001.

Yoshimatsu, T., Furusawa, T., Hayashi, M. (2002). A preliminary experiment on the dietary value of vitamin E-fortified *Chlorella* for rotifer. **Proc. Int. Commemorative Symp.**, 68: 1004-1005.

Fortes, R.D. (2005). Fish cage and pen aquaculture: Impact on lake environment. Proc. 1st Lake Congress held at Develop. Ac. Phil.

The following are ongoing activities of the members of team-4: Status of coastal resources and fisheries communities in the Philippines, Defense systems of shrimps, Transplantation of angel wings, Tank-based nursery protocols for mud crab, Bioaugmented systems in black tiger shrimp culture, Rapid detection of bacterial and viral pathogens in black tiger shrimp by molecular techniques, Immunostimulants in grouper, Phytase from *Bacillus* sp., Wastewater management practices of hatcheries, Methods of growth measurements in larval fish, Alternative plant sources for tilapia feeds, Characterization of plankton in lablab, and Commercially important seashells in Panay.

One member of the team is presently enjoying a Monbukagusho doctorate fellowship through this JSPS-DOST Core University Program. We will consider his works on Fucoidan immunostimulation of shrimp and fish as a future output of the CUP. Manuscripts to be prepared are the following:

Influence of fucoidan on growth, nutrient assimilation and humoral immunological responses of juvenile *Mar-supenaeus japonicus*.

Immunoprotective effect of dietary supplemented fu-

coidan on postlarval *Penaeus monodon* challenged with pathogenic *Vibrio harveyi*.

Comparative assessment of immunoprotective effects of various immunostimulants delivered via dietary inclusion on juvenile *Penaeus monodon* challenged with pathogenic *Vibrio* bacteria.

Table 1. Participating universities in Japan and the Philippines in Team-4.

Japan	Philippines
Hokkaido University (Faculty of Fisheries)	Zamboanga State College of Marine Science and Technology (College of Science)
Tohoku University (Faculty of Agriculture)	Iloilo State College of Fisheries
Tokyo Univ. of Marine Science and Technology (Faculty of Marine Science)	Central Luzon State University (College of Fisheries)
Tokyo University (Faculty of Agriculture)	Panay State Polytechnic College (College of Fisheries)
Tokai University (Marine Science & Technology)	
Hiroshima University (Graduate School of Biological Science)	
Keio University (Faculty of Agriculture)	
Kyushu University (Department of Bioscience and Biochemistry)	
Nagasaki University (Faculty of Fisheries)	
Miyazaki Univ (Faculty of Agriculture)	

Table 2. Statistics of independent researches and cooperative research exchanges in Team-4.

phase	Japan		Philippines		
	dispatches	man*day	dispatches	man*day	
1	1998	1	10	1	10
	1999	2	35	2	58
	2000	2	41	4	134
	2001	3	73	7	136
2	2002	5	90	8	164
	2003	7	72	9	206
	2004	2	16	11	145
	2005	4	46	3	57
3	2006	4	119	2	44