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FISH HEALTH RESEARCH AT SEAFDEC/AQD

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Fish pathology as a discipline was of relatively minor importance in the early years of SEAFDEC/AQD because technologies for producing aquaculture commodities were still being developed and high-density fish rearing activities were minimal. With fast adaptation of technologies developed locally and elsewhere and their modification to suit industry needs, disease problems started to occur. Disease develops through the interaction of three important factors: the host, the pathogen or disease agent, and the environment. In most high-density aquaculture rearing units, the environment exerts pressure on the host and favors the pathogen. When the host's defenses are overwhelmed, a disease condition is created which may result in death. Mortalities are often equated to economic losses, and research in fish diseases then becomes significant. Research has the ultimate aim of preventing disease occurrence.

Background of fish health activities

A summary of studies concerning fish diseases at SEAFDEC/AQD can be gleaned from the List of Publications on Fish Health (p. 138-142). The earliest research dealt with studies that determine the tolerance of *Penaeus monodon* larval stages to chemicals such as furanace (Gacutan and Llobrera 1977) and malachite green (Lio-Po et al. 1978). The results were aimed at gathering data on the levels that can be used when epizootics occur. In an effort to find control measures against the fungal species affecting shrimp and crab eggs, Lio-Po et al. (1982, 1985) studied the effects of fungicides on the hyphae and spores of *Lagenidium* spp. and *Haliphthoros philippinensis*.

Studies on the characteristics and biology of various infectious agents like *Caligus* sp. (Laviña 1978), the fungi *Lagenidium* (Gacutan and Baticados 1979; Bian et al. 1979) and *Haliphthoros* (Hatai et al. 1980), and the "cotton shrimp"-causing microsporidian in *Penaeus merguensis* (Gacutan et al. 1979; Enriquez et al. 1980) were also conducted. Further investigations to describe the developmental stages and histopathology of the parasitic microsporidia were done by Baticados and Enriquez (1982a, b). Baticados and Quintio (1984) also reported the occurrence and pathology of *Amyloodinium-like* protozoan affecting the gills of captive mullet, *Mugil cephalus*. Palisoc (1987) studied the host-parasite relationship of the bopyrid *Epipenaeon ingens* and *Penaeus semisulcatus*.

Since the 1970s, bacterial disease problems have been identified for various commodities. Muroga et al. (1984) identified a *Vibrio* associated with eye lesions in milkfish. Studies on the characteristics and pathogenicity of *Pseudomonas fluorescens* associated with tilapia fry mortalities were done by Duremdez and Lio-Po (1985) and Lio-Po and Sanvictores (1987). Secondary localized infection due to bacteria in hormone-implanted sites of milkfish broodstock was studied by Lio-Po et al. (1986). Disease investigation of transported milkfish stocked in Laguna Lake revealed that the internal organs of these fish had significantly higher bacterial counts (Lio-Po et al. 1986). The virulence of the associated bacteria on healthy milkfish fingerlings was tested by Lio-Po and Duremdez-Fernandez (1986).

A few studies on the post-harvest quality of mollusc were done (Llobrera et al. 1986; Gacutan et al. 1986), as well as studies on the occurrence of paralytic shellfish poisoning in the Philippines (Gacutan et al. 1984; 1985).

Some poorly understood syndromes in both fish and crustacean culture facilities were also studied. In sea bass hatcheries, swimbladder stress syndrome affecting larval stages was reported by Bagarinao and Kungvankij (1986). In *Penaeus monodon*, the various aspects of chronic soft shell syndrome were studied by Baticados et al. (1986; 1987) and Bautista and Baticados (1990).

Research work on the effects of ammonia on the gill structure of milkfish was done by Cruz and Enriquez (1982). Further, studies on the tolerance of various species to chemotherapeutants were done (Cruz and Pitogo 1989; Cruz and Tame 1989), as well as the effects of pesticides on tilapia (Cruz et al. 1988), shrimp (Baticados and Tendencia 1991), and milkfish (Cruz-Lacierda 1992).

Highlights of activities (1989 to present)

Since 1989, a concerted effort has been devoted to study the occurrence of epizootic ulcerative syndrome (EUS) in freshwater fish, and the various infectious diseases of *Penaeus monodon* such as luminescent vibriosis and monodon baculovirus. In addition, the Diagnostic Service component of the Fish Health Section continues its service to farmers and AQD researchers. The service has provided the Section with an excellent source of information for gauging the problems besetting the aquaculture industry. It has also served as an effective guide in determining priority areas for future research.

Epizootic ulcerative syndrome. Between early December 1985 and early February 1986, a fish disease characterized by lesions and open necrotic ulcers was observed in seven species of fish in Laguna de Bay, the largest and most productive lake in the Philippines. The occurrence was reported by Llobrera and Gacutan (1987). In 1987-1990, the Network of Aquaculture Centers in Asia funded a research on the predisposing environmental factors of EUS in Laguna de Bay. With a grant from the International Development Research Centre (IDRC) of Canada, a study on this regional problem was started in June 1989 with the specific objective of determining the disease-causing factor or combination of factors. Emphasis is on viral, bacterial, parasitic, and environmental factors, including agricultural and industrial contaminants. A study on the histopathology of the disease in naturally infected fish is also being conducted and

results will be related to the pathogenesis of the disease. The results of the different studies will then determine the ways of protecting susceptible fish stocks.

Important highlights of the study include the establishment of fish cell lines for viral isolation, and characterization and determination of the role of bacteria in the occurrence of EUS (Lio-Po et al. 1992).

Bacterial diseases in shrimps. Common bacterial diseases observed in penaeids include luminous bacterial disease due to *Vibrio harveyi* (Lavilla-Pitogo et al. 1990), shell disease (Lio-Po and Lavilla-Pitogo 1990), and filamentous bacterial infestation (Baticados et al. 1990). Of these, luminescent *Vibrio* and filamentous bacteria are most frequently encountered by hatchery operators. *Vibrio harveyi* may cause larval mortalities of up to nearly 100% of affected populations. Epizootics occur year-round and may destroy hatchery productivity for extended periods. Baticados et al. (1990) studied the efficacy of various antibiotics against *V. harveyi* and found that none among the tested drugs can be used to effectively control the disease due to the limited tolerance of the larvae to the drugs. In 1989, IDRC funded a 3-year study to determine the mechanisms of vertical and horizontal transfer mechanisms of the bacteria. An investigation on the sources of luminescent *Vibrio harveyi* in hatcheries showed that the greatest source of bacteria is the fecal matter shed into the water when the shrimp spawn (Lavilla-Pitogo et al. 1992). Other sources of *V. harveyi* are nearshore seawater and unwashed *Artemia* nauplii. Diatoms like *Skeletonema costatum* and *Chaetoceros calcitrans* have no associated *V. harveyi* population. The major aim of this study is to find ways of minimizing, if not completely eliminating, the luminous bacterial disease problem in *P. monodon* hatcheries.

Monodon baculovirus infection. The occurrence and pathology of monodon baculovirus (MBV) was studied by Baticados et al. (1991). This study showed that MBV was diagnosed in 43% of postlarval samples obtained from various hatcheries in 1989. The records in the Diagnostic Service show an even higher percentage of infection. In grow-out ponds, MBV has been associated with retarded growth and low survival of stocks. Since there is no effective therapy for crustacean viral infections, farmers try to prevent the occurrence of MBV by submitting fry for examination and stocking only the fry not diagnosed with MBV. This practice, however, has created problems for hatchery operators who fail to find markets for infected fry. AQD's Diagnostic Laboratory, as well as a few privately owned ones, detects MBV infection by using the presumptive malachite green method. The more accurate methods of diagnosis, i.e., histology or fluorescence microscopy, are not routinely employed by most laboratories because of lack of equipment and the long time involved before results are obtained.

1992 research studies. In addition to ongoing research on EUS and luminescent vibriosis, there are studies on the role of vibrios in the development of red disease syndrome in *Penaeus monodon*, the effect of the antibiotic Ektecin on bacteria affecting sea bass juveniles, and investigation on the diseases of groupers. Collaborative studies with the Nutrition and Feed Development Section on quality assessment of shrimp feeds is being done. The study focuses on the effects of aflatoxin, thiobarbituric acid value, and urease activity on the

growth of shrimp. The role of Vitamin C in the wound healing process of *P. monodon* juveniles is also being investigated as part of a study on the use of L-ascorbyl-2-phosphate Mg as Vitamin C source for shrimp.

Important diseases/syndromes observed in 1992 and problems for future research

Based on the samples that were submitted for diagnosis, the following are important problems which need to be investigated:

Fish

Swimbladder stress syndrome in hatchery-reared sea bass larvae
Gas bubble disease in milkfish larvae and tilapia fry
Parasitic infestations in various stages of groupers

Penaeid shrimp

Microbial infection due to viruses, rickettsia, bacteria, and other microorganisms
"Loose shell" syndrome in pond-reared sub-adults
Swollen hindgut syndrome in hatchery-reared postlarvae
Development of a simple but reliable criteria for gauging fry quality

In addition, the three-year plan of AQD states that fish health studies on snapper and bighead carp should also be conducted.

Training and extension activities

As part of the Section's commitment to the extension and dissemination of information to shrimp farmers, a pamphlet on the *Recommended Practices for Disease Prevention in Prawn and Shrimp Hatcheries* (Lio-Po et al. 1989) and a manual on *Diseases of Penaeid Shrimps in the Philippines* (Baticados et al. 1990) were put together. Upon the request of both government and private entities, Fish Health researchers also conduct short trainings or lectures for technicians. Also, SEAFDEC/AQD training programs have fish health lectures and practical sessions as part of the courses.

The most comprehensive program that the Section offers to technicians from both the government and private sectors is the *Fish Health Management Training Course*. First offered in November 1987 for Department of Agriculture technicians, the training has been conducted yearly and has about 80 alumni now. In addition to this structured training course, the Section also accommodates internships for technicians and on-the-job training for students.

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