

HEALTH MANAGEMENT IN AQUACULTURE

SECOND EDITION



Edited by: Gilda D. Lio-Po and Yasuo Inui



Southeast Asian Fisheries Development Center
Aquaculture Department
www.seafdec.org.ph



Government of Japan
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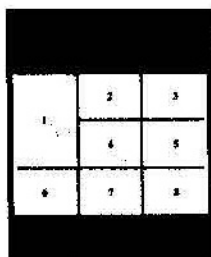
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For copies and inquiries:

Training and Information Division
SEAFDEC Aquaculture Department
Tigbauan 5021, Iloilo, Philippines

fax : (63 33) 511 8709
email : training@seafdec.org.ph
devcom@seafdec.org.ph
website : <http://www.seafdec.org.ph>

ON THE COVER



- 1 Common carp with KHV showing notched nostrils and grayish-white, necrotic gills (Photo courtesy of A Sunarto);
- 2 *Penaeus monodon* infected with the White spot syndrome virus (Photo courtesy of DV Lightner);
- 3 *Zeylanicobdella arugamensis* on pectoral fin of *Epinephelus coioides* (Photo courtesy of ER Cruz-Lacierda);
- 4 Several monogeneans, *P. lantauensis*, on gill filaments of *E. coioides* (Fresh mount, 100x) (Photo courtesy of ER Cruz-Lacierda);
- 5 *Epinephelus coioides* broodstock with bloated belly associated with Viral nervous necrosis infection (Photo courtesy of L de la Peña);
- 6 Shell disease on the carapace of *Penaeus monodon* (Photo courtesy of GD Lio-Po);
- 7 *Oreochromis niloticus* with hyperemia and enlarged abdominal cavity due to *Aeromonas hydrophila* (Photo courtesy of GD Lio-Po);
- 8 *Procamallanus (Spirocamallanus) guttatusi* in intestine of siganid (*Siganus guttatus*) (Photo courtesy of GD Lio-Po).

Foreword

Health education and management play crucial roles in fish farming operations because healthy stock translates to profit. And because the need for a specific educational material on fish health remains, SEAFDEC Aquaculture Department (AQD) is updating its 2001 textbook and re-issuing a second edition.

The textbook contents are anchored on AQD's considerable fish health research findings which AQD experts are pleased to share. AQD stands for responsible aquaculture, and for us, building capability in fish disease diagnosis and treatment is a priority.

We hope that students and other stakeholders in the aquaculture industry such as fish farmers, farm workers, and technicians will find this textbook relevant and useful.



JOEBERT TOLEDO, D. Agr.

Chief

SEAFDEC Aquaculture Department

Message

Fish and shellfish species of high economic value are inevitably faced with various threats, particularly health problems and diseases. It is therefore imperative that scientific studies and information dissemination on new and emerging pathogens should advance such that fish diseases are prevented and outbreaks are controlled.

The Government of Japan under Trust Fund 5 (GOJ-TF5) continuously upholds its commitment to provide SEAFDEC/AQD the means to promote responsible and sustainable aquaculture in the Southeast Asian region. By shifting its focus from developing fish disease surveillance systems (2005-2009) to accelerating awareness and capacity-building in fish health management (2010-2014), GOJ-TF5 sought to inform aquaculturists, students, and scientists on recent findings regarding the pressing issues in fish health management. The publication of the second edition of Health Management in Aquaculture has become the by-product of such efforts.

Making information on fish health management available to fish farmers is an important undertaking. As fish farmers learn to efficiently use their resources, they are likewise able to contribute to sustainable aquaculture practices.

東 照 雄

TERUO AZUMA, Ph.D.
SEAFDEC/AQD Deputy Chief and
Co-Manager of GOJ-TF Projects

Message

In the last three decades, aquaculture in Southeast Asia grew rapidly and contributed to the increase of food supply and well-being of the people in the ASEAN region. However, due to careless health management, a large number of infectious diseases emerged and are threatening sustainable aquaculture. The occurrence of fish diseases has not only led to low production, but also to food safety and environmental issues.

To counter these problems and to meet the challenges of sustainable and responsible aquaculture, the Government of Japan-Trust Fund (GOJ-TF) realized the need for reference materials that will serve as guide for farmers, aquaculturists, students and those interested in aquaculture-related fish health issues in this region. As a consequence, the GOJ-TF Project from 2005 to 2009 entitled "Development of fish disease surveillance system" decided to fund the printing of the second edition of SEAFDEC/AQD's Health Management in Aquaculture book.

This second edition now includes the most recent findings on emerging and other fish diseases that are relevant to the management of fish health in the region.

尾崎 博

HIROSHI OGATA, Ph.D.
SEAFDEC/AQD Deputy Chief and
Co-Manager of GOJ-TF Projects
(Mar 2007 - Mar 2009)

Preface

Within a span of five years after publication of the first edition of this book, scientific findings on economically-important fish and shellfish diseases increased dramatically. On top of these, outbreaks of new and emerging pathogens such as Koi Herpesvirus (KHV), Spring Viremia of Carp Virus (SVCV), Grass Carp Reovirus (GCRV), Infectious Myonecrosis Virus (IMNV), Taura Syndrome Virus (TSV), White Tail Disease, were reported at alarming frequencies in the region. Most of these were viruses endemic among fish and shellfishes in the Americas and Europe but found its way to this region through legal or illegal importation.

Thus, in 2006, the revision of the book to include the voluminous literature updates was initiated. New chapters that had become significant in the field of Fish Health such as Histology, Probiotics, and Epidemiology were added. A new layout of the book was adopted to maximize the formatting of the chapters. In addition, each chapter now starts with a summary of subtopics to provide a birds-eye view of what is covered.

This second edition consists of fourteen chapters detailing essential information on the basic principles of disease causation, major diseases of cultured fish and crustaceans, particularly shrimps/prawns, harmful algae, methods of prevention and control, molecular/serological/histological diagnostic techniques and epidemiology. Emphasis is still on major diseases that occur in the Philippines and other countries in the Asian region. Each chapter begins with a brief preview of its contents, followed by an in-depth discussion that culminates in a summary. The basic concepts presented were derived from textbooks on microbiology and fish health while the scientific information put forth were drawn from the research and diagnostic findings of the authors, colleagues at SEAFDEC and other institutions in the Philippines and in other countries. The figures and photos included were selected from the authors' collection of disease cases or shared by colleagues in this field but duly acknowledged directly on the respective figure caption/s. Another modification is the specific reference citation following the corresponding text with its complete bibliography in the references. As in the first edition, the references are supplemented with additional suggested reading materials for the expanded information of interested readers. To make the concepts more understandable, a glossary is included. An index is also incorporated at the end of the book for quick location of desired subtopics. It is hoped that this second edition will be more responsive to the needs of students, aquaculturists and scientists in preventing fish/shellfish diseases and in dealing with outbreaks effectively.

The publication of the second edition of this book is financed by the Government of Japan-Trust Fund through the auspices of the SEAFDEC Deputy Chiefs, Drs. Koichi Okuzawa (2005-2007), Hiroshi Ogata (2007-2009), and Teruo Azuma (2009-2010). Furthermore, the support of SEAFDEC/AQD and its Chief, Dr. Joebert Toledo; Research Division Head, Dr. Evelyn Grace de Jesus-Ayson; Milagros Castaños and Imee Hacla as copy editors and Jojo Pursuelo as layout artist are highly appreciated. Finally, Dr. Celia Lavilla-Pitogo's comments are acknowledged.

GD Lio-Po
Y Inui

Contributors

Eleonor V. Alapide-Tendencia, MS
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: gigi@seafdec.org.ph

Jesus Manolo E. Almendras, MS
Cebu City
Email: jmealmdras@yahoo.com

Edgar C. Amar, MAq, PhD
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: eamar@seafdec.org.ph

Ignacio de Blas, DVM, PhD
Laboratory of Fish Pathology
Faculty of Veterinary, University of Zaragoza
c/o Miguel Servet 177, 50013 Zaragoza, Spain
Email: debblas@unizar.es

Elena S. Catap, MS, PhD
Institute of Biology, College of Science
University of the Philippines, Diliman
Quezon City 1101, Philippines
Email: elenacatap@yahoo.com

Romeo D. Caturao, MS, PhD
University of Antique
Tario-Lim Memorial Campus
Tibiao, Antique 5707
Email: rcaturao_49@yahoo.com

Erlinda R. Cruz-Lacierda, MS, PhD
Faculty of Fisheries, Kagoshima University
Shimoarata 4-50-20, Kagoshima City 890-0056, Japan
Email: erlinda@fish.kagoshima-u.ac.jp
eclacierda@yahoo.com

Gregoria E. Erazo-Pagador, MS
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: gepagador@seafdec.org.ph

Celia R. Lavilla-Pitogo, MS, PhD
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: celiap@seafdec.org.ph

Eduardo M. Leño, PhD
Network of Aquaculture Centres in Asia-Pacific
Suraswadi Building
Kasetsart University Campus
Ladyao, Jatujak, Bangkok 10900, Thailand
Email: eduardo@enaca.org

Gilda D. Lio-Po, RMT, MPH, PhD
Diplomate/Fellow in Microbiology (PAM)
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: liopo@seafdec.org.ph

Rolando V. Pakingking Jr., RMT, MS, PhD
Diplomate in Microbiology (PAM)
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: rpakingking@seafdec.org.ph

Leobert D. de la Peña, MS, PhD
Southeast Asian Fisheries Development Center
Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Email: leobertd@seafdec.org.ph

About the Editors



Dr. Gilda D. Lio-Po graduated magna cum laude from University of Negros Occidental-Recoletos (UNO-R) in Bacolod City with a B.S. degree in Medical Technology. She completed her Master of Public Health (Medical Microbiology) at the University of the Philippines Manila and her Ph.D. in Biological Sciences (Aquatic Virology) at Simon Fraser University, Canada, through scholarship grants from the National Science Development Board and the International Development Centre of Canada, respectively. In 1976, she joined the Southeast Asian Fisheries Development Center (SEAFDEC) as a Research Associate. She formally organized SEAFDEC Aquaculture Department's (SEAFDEC/AQD) Fish Health diagnostic services in 1980 and served as Head of the Fish Health Section for several years. Dr. Po has authored and co-authored over 45 publications in scientific journals and has served as a reviewer for *Aquaculture*, *The Israeli Journal of Aquaculture-BAMIDGEH*, *Asian Fisheries Science*, *Journal of Aquatic Animal Health*, *International Journal of Oceans and Oceanography*, among others. She served as lecturer on fish and shrimp diseases to trainees from SEAFDEC member countries, University of the Philippines Visayas (UPV), and Ocean University of Qingdao (PR China), as well as to graduate students of the Universiti Pertanian Malaysia (UPM), 7th Network of Aquaculture Centres in Asia (NACA) Training Courses for Senior Aquaculturists in Asia and the Pacific Region, and UPV. She has been the specialist on Viral Diseases in the on-line training course of SEAFDEC/AQD. Dr. Po has been actively involved in professional organizations, scientific conferences, and review of research proposals for various local and international agencies.



Dr. Yasuo Inui earned his B.S. in Fisheries Science at the Tokyo University of Fisheries and his M.S. and Ph.D. in Fisheries Science at the University of Tokyo. His work experience includes: Assistant (University of Tokyo), Researcher Associate (Department of Zoology, University of Washington), Researcher (Freshwater Fisheries Research Institute), Chief and Researcher (Pathophysiology Section, National Research Institute of Aquaculture), Director (Pathology Division, National Research Institute of Aquaculture), Research Planning and Coordinator (Nansei National Fisheries Research Institute), and General Director (Tohoku National Fisheries Research Institute). Dr. Inui was the Fish Disease Expert of Japan International Cooperation Agency (JICA) for SEAFDEC/AQD from 2000 to 2003. He is also a Professor at the Fukuyama University. He has been a member of various professional organizations, namely, Japanese Society of Fish Pathology, The Japanese Society of Fisheries Science, Japanese Society of Comparative Endocrinology, and Asia-Oceania Society of Comparative Endocrinology. Likewise, he has served as the Editor-in-Chief of the academic *Journal Fish Pathology* of the Japanese Society of Fish Pathology. Dr. Inui, whose areas of expertise are on fish health and fish physiology, has received the Japanese Society of Fisheries Award and has acquired license for Chief Officer for Radio-Isotope Handling.

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About SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in December 1967 to promote fisheries development in the region. The member countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, 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 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

Tigbauan 5021, Iloilo Philippines

Tel/Fax No.: (63-33) 511- 8709

Email: aqdchief@seafdec.org.ph

<http://www.seafdec.org.ph>