

Early Mortality Syndrome Ems Or Acute Hepatopancreatic

A clear illustration of the important role of aquaculture in supporting food security, livelihoods, and economic development around the world. This new edition of *Aquaculture: Farming Aquatic Animals and Plants* covers important aspects of the culture of fish, shellfish, and algae in freshwater and marine environments. Subject areas covered include principles of aquaculture, water quality, environmental impacts of aquaculture, desert aquaculture, reproduction, life cycles and growth, genetics and stock improvement, nutrition and feed production, diseases, vaccination, post-harvest technology, economics and marketing, and future developments of aquaculture. Separate chapters also cover the culture of algae, carps, salmonids, tilapias, catfish, marine and brackish fishes, soft-shelled turtles, barramundi, marine shrimp, mitten crabs, and other decapod crustaceans, bivalves, gastropods, and ornamental species. This edition also provides greater coverage of aquaculture in China, reflecting the country's importance in the global scene. Providing core scientific and commercially useful information, and written by 35 eminent international authors, this expanded and fully updated Third Edition of *Aquaculture* is essential reading for all students and professionals studying and working in aquaculture. Fish farmers, hatchery managers, and those in aquaculture support and supply industries, such as feed manufacturing, will find an abundance of commercially useful information within this important and now established book.

Describes the multitude of developments that have occurred within the aquaculture field over the last 15 years. Includes a major revision of production statistics and trends, discussion of technical developments, and revised and extended coverage provided by broader international authorship. Brings together 35 internationally recognized contributors, including a number of new contributors. *Aquaculture: Farming Aquatic Animals and Plants, Third Edition* is a recommended text for students of the subject and a concise reference for those working in or entering into the industry.

Abstract: Multiple stressors contribute to Early Mortality Syndrome (EMS) in salmonid fisheries and its effects on the Great Lakes region, but the factors responsible for the variation of EMS are not clearly understood. EMS is a characteristic embryonic mortality that affects the offspring of salmonines, and its impact on lake trout has significantly reduced natural recruitment. In this study, adult individuals were collected from Lake Michigan and their progeny were fed experimental diets containing different concentrations of thiamine and magnesium. A protocol was used to stain cartilage and bone separately for the histology portion. An image processing program was used to determine the percentage of bone and cartilage that was present in each head digitized. Color histograms were produced for each fish and determined the percentage of bone and cartilage proportions for each sample. The seventeen fish samples used were divided into two categories. The first category consisted of nine fish that were collected after the ninth week of the feeding experiment which were all fed commercial diet, and the second category was composed of all seventeen fish with commercial and experimental diets. For the first category, correlations were seen when comparing overall fish weight to percentage of bone and cartilage. This suggests that as the fish increased in size, they portrayed more advanced ossification and less cartilage was remaining. However, correlations between the differing diets and ossification were difficult to determine in the second category due to unevenly distributed samples.

This report presents the results of a Round-table discussion: moving forward through lessons learned on response actions to aquatic animal disease emergencies organized by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Norwegian Agency for Development Cooperation (NORAD) under the auspices of the project GCP/GLO/979/NOR: "Improving Biosecurity Governance and Legal Framework for Efficient and Sustainable Aquaculture Production" that was held from 16–18 December 2019 at the FAO Headquarters in Rome, Italy. The meeting was attended by 43 experts from 22 countries, representing governance authorities, intergovernmental organizations, academia, research institutions and the private sector. Twenty presentations were delivered, namely: (1) National Competent Authority: role and experiences; (2) Inter-governmental organization: role and activities/experiences related to investigating specific mass mortalities of aquatic animals; (3) Producer and research/academic sectors: role and activities/experiences related to investigating specific mass mortalities of aquatic animals and (4) Global Burden of Animal Diseases (GBAD). The meeting successfully achieved its objective of taking stock and sharing experiences and lessons learned which were used for generating recommendations for the further development and improvement of the draft FAO Decision-tree for dealing with aquatic animal mortality events and supporting guidance. The meeting generated an annotated table of contents for this decision-tree document with the following major sections, namely: Introduction; Phases in an Emergency; Elements of an Emergency Response (Preparedness Phase, Response Phase, Recovery Phase); Decision-tree for Mass Mortality Events; Conducting Field Investigation; Tools and Guidance; and Case Study Examples. It is expected that this document will be made available in 2021.

The contents of this Shrimp acute hepatopancreatic necrosis disease strategy manual provides information and guidance relevant to the development of policies to respond to outbreaks of acute hepatopancreatic necrosis disease (AHPND) in farmed marine shrimp. The etiologic agents for AHPND are virulent strains of bacteria belonging to the genus *Vibrio parahaemolyticus* and related species, which harbor specific toxin genes. While these bacterial species are part of the normal microflora of the marine environment, they may cause substantial mortalities in whiteleg shrimp (*Penaeus vannamei*) and giant tiger prawn (*Penaeus monodon*) cultured in countries in Asia and the Americas. These strains of these *Vibrio* bacteria secrete a PirABvp binary toxin resulting in sloughing of tubule epithelial cells and dysfunctions of the hepatopancreas in the acute form; mortality can reach 100 percent in affected ponds. Chronic presentation of this disease involves secondary bacterial infection of hepatopancreas and running mortality over the culture cycle. Acute or chronic presentation would greatly depend on the culture conditions. This disease can be considered a toxicosis rather than an infection. Economic losses due to this disease have amounted to over USD 7 billion annually. Further outbreaks of AHPND, particularly in areas that are currently free of the disease, would be expected to experience similar devastating effects on local shrimp producers and the surrounding communities; and thus, there is an urgent need to develop a contingency plan to control and eradicate this disease. This manual includes information on: 1) the nature of AHPND: a brief review of current knowledge in disease etiology, susceptible species and global distribution; 2) diagnosis of disease: a description of gross clinical signs and laboratory methods; 3) prevention and treatment: farm management, the use and development of antibiotics, bacteriophages, probiotics, disease-tolerant shrimp, shrimp immunity and vaccination; 4) epidemiology: AHPND's geographic distribution, genotype, persistence in the environment, reservoir hosts, modes of transmission, risk factors, and economic impacts; 5) principles of control and eradication: methods for containment, mitigation and eradication of AHPND, and trade and industry considerations; and 6) policy development and implementation: AHPND-specific objectives, options and

strategies for eradication and control, education, capacity building, funding, and compensation.

This is the ninth volume of ten in the The Natural History of the Crustacea Series. The chapters in this volume synthesize the diverse topics in fisheries and aquaculture. In the first part of the book, chapters explore worldwide crustacean fisheries. This section comes to a conclusion with two chapters on harvested crustaceans that are usually not within the focus of the mainstream fisheries research, possibly because they are caught by local fishing communities in small-scale operations and sold locally as subsistence activity. In the second part of the book, the authors explore the variety of cultured crustacean species, like shrimps, prawns, lobsters, and crabs. Chapters in the third part of the volume focus on important challenges and opportunities, including diseases and parasitism, the use of crustacean as bioindicators, and their role in biotechnology.

Report of the FAO/MARD Technical Workshop on Early Mortality Syndrome (EMS) Or Acute Hepatopancreatic Necrosis Syndrome (AHPNS) of Cultured Shrimp (under TCP/VIE/3304) Hanoi, Viet Nam, 25-27 June 2013 Proceedings of Workshop on EMS - Early Mortality Syndrome Ann Arbor, Michigan, July 12-14, 1994 Great Lakes Lake Trout Early Mortality Syndrome (EMS) Contaminants, Thiamin Status, and Their Possible Interaction

Aquaculture, Resource Use, and the Environment places aquaculture within the larger context of global population growth, increased demand for sustainable, reliable sources of food, and the responsible use of natural resources. Aquaculture production has grown rapidly in recent decades as over-exploitation and environmental degradation have drastically reduced wild fish stocks. As fish production has increased, questions have persisted about the environmental sustainability of current aquaculture practices. Aquaculture, Resource Use, and the Environment is a timely synthesis and analysis of critical issues facing the continued growth and acceptance of aquaculture practices and products. Chapters look at the past, present, and future demands for food, aquaculture production, and tackle key issues ranging from environmental impacts of aquaculture to practical best management practices in aquaculture production. Providing broad coverage of issues that are essential to the continued development of aquaculture production, Aquaculture, Resource Use, and the Environment will be vital resource for anyone involved in the field of aquaculture.

One of the emerging disease threatening the shrimp industry is caused by a bacterial pathogen which harbors a plasmid, containing a deadly toxin that triggers high mortality in shrimps. The disease has been identified as acute hepatopancreatic necrosis disease (AHPND) or commonly known as early mortality syndrome (EMS). To help in the efforts of sustaining the shrimp industry, this study is focused on detecting *Vibrio parahaemolyticus* causing AHPND/EMS affecting *Litopenaeus vannamei* (Boone, 1931), (Pacific white shrimp) and *Penaeus monodon* (Fabricius, 1798), (Black Tiger shrimp) in the Philippines. Microbiological methods, conventional Polymerase Chain Reaction (PCR) and histopathology were applied to confirm the presence of AHPND/EMS. Prevalence of the pathogenic strain of *V. parahaemolyticus* from different locations were; 22 % for *L. vannamei* and 8% for *P. monodon* in Bulacan; 73% for *L. vannamei* and 83% for *P. monodon* in Bataan; 40% for *L. vannamei* and 20% for *P. monodon* in Pampanga and 27% for *P. vannamei* in Batangas . Collectively, the prevalence of AHPND/EMS is 33% in Luzon. Shrimp samples tested 25% for *P. vannamei* in Cebu and 20% for *P. vannamei* in Bohol making the 21% prevalence of AHPND/EMS in Visayas. Shrimp samples resulted to three percent (3%) for *L. vannamei* in General Santos and six percent (6%) for *L. vannamei* in Sarangani, hence, five percent (5%) prevalence of AHPND/EMS in Mindanao. Taken all together, the prevalence of this emerging disease in the Philippines was 24% during the period of testing. Recognizing the presence and effect of this emerging disease in the shrimp industry in the Philippines is essential in identifying and strategizing ways to combat the disease. Specific primers for the detection of the virulent strains of AHPND/EMS *V. parahaemolyticus* through PCR were utilized so that timely possible measures to prevent AHPND outbreaks can be developed.

Genomics and Biotechnological Advances in Veterinary, Poultry, and Fisheries is a comprehensive reference for animal biotechnologists, veterinary clinicians, fishery scientists, and anyone who needs to understand the latest advances in the field of next generation sequencing and genomic editing in animals and fish. This essential reference provides information on genomics and the advanced technologies used to enhance the production and management of farm and pet animals, commercial and non-commercial birds, and aquatic animals used for food and research purposes. This resource will help the animal biotechnology research community understand the latest knowledge and trends in this field. Presents biological applications of cattle, poultry, marine and animal pathogen genomics Discusses the relevance of biomarkers to improve farm animals and fishery Includes recent approaches in cloning and transgenic cattle, poultry and fish production

Whether through loss of habitat or cascading community effects, diseases can shape the very nature of the marine environment. Despite their significant impacts, studies of marine diseases have tended to lag behind their terrestrial equivalents, particularly with regards to their ecological effects. However, in recent decades global research focused on marine disease ecology has expanded at an accelerating rate. This is due in part to increases in disease emergence across many taxa, but can also be attributed to a broader realization that the parasites responsible for disease are themselves important members of marine communities. Understanding their ecological relationships with the environment and their hosts is critical to understanding, conserving, and managing natural and exploited populations, communities, and ecosystems. Courses on marine disease ecology are now starting to emerge and this first textbook in the field will be ideally placed to serve them. Marine Disease Ecology is suitable for graduate students and researchers in the fields of marine disease ecology, aquaculture, fisheries, veterinary science, evolution and conservation. It will also be of relevance and use to a broader interdisciplinary audience of government agencies, NGOs, and marine resource managers.

A series of studies were conducted on an emerging disease in farmed penaeid shrimp. This disease was first named as Early Mortality Syndrome (EMS) or more descriptively as Acute Hepatopancreatic Necrosis Syndrome (AHPNS). As part of the outcome of this research, the etiology of EMS/AHPNS was demonstrated. EMS was first classified as an idiopathic disease because no causative agent had been identified. Preliminary studies conducted in Vietnam in 2012 by the

University of Arizona Aquaculture Pathology Laboratory (UAZ-APL) indicated that EMS is infectious (Tran et al., 2013). The agent was identified as a unique strain of *Vibrio parahaemolyticus*. Hence, EMS has a bacterial etiology confirmed by satisfying Koch's Postulates. Further studies focusing on the bacterial isolate causing EMS revealed that the agent could produce toxin(s), which is responsible for the primary pathology in affected shrimp. Since the causative agent has been identified, we propose a new name for EMS as Acute Hepatopancreatic Necrosis Disease (AHPND).

Characterizations of the AHPND-causing *Vibrio parahaemolyticus*: Biochemical methods and molecular methods were used. Based on these results, various diagnostic methods were developed including polymerase chain reaction (PCR) test and biochemical tests. Other aspects of the AHPND causing *V. parahaemolyticus* were also run to determine such as antibiogram and the development of resistance mechanism of the bacteria exposed to farm conditions with antibiotic medications, pathogenicity, and infection dose of the bacteria, mode of infection, mechanisms governing the toxin production, and effects of environmental parameters on the invasion of the agent. Some proposed control measures for AHPND: Several antibiotic-free approaches were tested to determine viable control methods for AHPND. The principle proposed control method is to increase biosecurity. With the PCR method that has been developed, potential sources of the pathogen such as post-larvae and broodstock can be tested. As more and more insights of the pathogen were explored, the behavior of the pathogen was further elucidated. Based on this, control methods such as using polyculture with tilapia, probiotics, and bioflocs system were also tested. Several improvements in shrimp farming practices that may reduce the outbreak of the disease were also proposed.

Asian Aquaculture 'The Practical' is a quarterly magazine published by Asian Aquaculture Network (AAN). E-magazine is available free online at your convenience to view, download and print. Asian Aquaculture 'The Practical' magazine is one of our roads to reach our goal. As stated in the mission of AAN that we are aiming to help aquaculturists and farmers operate a profitable and environmentally sound business in order to sustainably feed the world affordable aquaculturists, farmers, and interested parties. Every issue of 'The Practical' includes different topics focusing on practical aquaculture knowledge written by aquaculture experts from many countries in Asia. Moreover, updated aquaculture news including Events Calendar is provided in 'The Practical'. Furthermore, we will keep you updated on the information of new technology and innovations, so you will not miss out the new trends.

The globalization of trade, monetary and fiscal policies, capital markets, and investment patterns is reshaping the world economy and is leading to new financial, commercial, and marketing structures as well as unprecedented economies of scale. Simultaneously, national and international awareness and to strengthen. There is consensus among responses to accelerating environmental degradation continue most developed countries that the rapidly evolving new economic order needs to be well integrated with policies to maintain or restore environmental quality. Many challenges remain, however, in evaluating the geo-ecological implications of economic globalization, and in formulating the appropriate management responses. In lakes and rivers, the management of water supply and quality has largely proceeded on the basis of local considerations rather than at the global scale that has been more typical of environmental management of the atmosphere and ocean. It is increasingly apparent, however, that high-quality water resources are now in critically short supply not only because of local problems such as over-irrigation and eutrophication, but also as a result of larger-scale climate effects on the hydrosphere. This magnitude of impact will increasingly require the integrated monitoring and management of water resources on a planetary scale, with world criteria for environmental assessment, restoration, and conservation strategies. The increasing extent of world trade in potable freshwater heightens the urgency for establishing international approaches, criteria, and regulations.

Intensive tilapia co-culture is the commercial production of various species of tilapia in conjunction with one or more other marketable species. Tilapia are attractive as a co-cultured fish because of their potential to improve water quality, especially in penaeid shrimp ponds, by consuming plankton and detritus and by altering pathogenic bacterial populations while increasing marketable production. Following introductory chapters covering ecological aspects of co-culture, tilapia feeding habits, historical use, and new models, *Tilapia in Intensive Co-Culture* is divided into co-culture in freshwater and marine environments. Co-culture core information is presented on *Vibrio* control, high-rate aquaculture processes, aquaponics, tilapia nutrient profile, and tilapia niche economics and marketing in the U.S, and with carp, catfish, freshwater and marine shrimp in the Americas, the Middle East, and Asia. *Tilapia in Intensive Co-Culture* is the latest book in the prestigious World Aquaculture Society (WAS) Series, published for WAS by Wiley Blackwell. It will be of great use and interest to researchers, producers, investors and policy makers considering tilapia co-culture in terms of environmental and economic sustainability.

Marek's disease virus (MDV) is a herpesvirus which causes a lymphoproliferative disorder of the domestic chicken worldwide. This serious economical problem caused by MDV was mostly solved by development of an effective vaccine against MDV. The development of live vaccines against the disease is remarkable as it has led to the first example of a commercially available vaccine against cancer as well as against diseases caused by herpesviruses. This volume gives an overview on many aspects of MDV research and summarizes recent advances in the field. The topics include the history, biology, and molecular biology of MDV, pathogenesis, vaccinal immunity, immune response, genetic resistance and development of recombinant polyvalent vaccines. It is hoped that this volume will make an important contribution towards the control of infectious diseases.

This book offers insights into the recent research focusing on green solutions to address environmental pollution and its impacts.

Bioremediation is a vast area that encompasses numerous innovative and cost-effective experimental and research methods involving numerous technologies, such as biotechnological, biochemical, microbial, marine, chemical and engineering approaches. Featuring original research and review articles by leading experts, the book explores potential solutions to the growing issues of waste management and environmental pollution and their impacts, and suggests future research directions. As such, it is a valuable resource for professionals and general readers alike.

The impact of pollution on fisheries and the potential health implications of eating contaminated fish are areas of considerable concern for the fishing and aquaculture communities, government bodies and the general public. Pollution, as well as over fishing, may well be contributory to

recent serious declines in global fish stocks. *Effects of Pollution on Fish* brings together the work of many international experts each of whom have examined the literature on marine and freshwater fish and, where appropriate, invertebrates, to produce comprehensive chapters covering all major aspects of the impacts of pollution on fish and fisheries. The book describes these impacts in detail, from the molecular and sub-cellular level, through organism to population and community levels, and subsequently to socio-economic implications. The editors of this thorough and timely book have drawn together contributions encompassing molecular genetics, biochemistry, physiology, population and community biology, and fishery economics. As such, this important book will be of great use and interest to students and professionals studying and teaching in all those subject areas. Fish biologists, environmental scientists and ecotoxicologists, marine and freshwater ecologists, fisheries managers, aquaculture personnel and fish farmers, as well as fish veterinarians will all find much of great value within this book. Libraries in universities and research establishments concerned with these areas should all have copies of this book on their shelves.

Siddharth Kara is a tireless chronicler of the human cost of slavery around the world. He has documented the dark realities of modern slavery in order to reveal the degrading and dehumanizing systems that strip people of their dignity for the sake of profit—and to link the suffering of the enslaved to the day-to-day lives of consumers in the West. In *Modern Slavery*, Kara draws on his many years of expertise to demonstrate the astonishing scope of slavery and offer a concrete path toward its abolition. From labor trafficking in the U.S. agricultural sector to sex trafficking in Nigeria to debt bondage in the Southeast Asian construction sector to forced labor in the Thai seafood industry, Kara depicts the myriad faces and forms of slavery, providing a comprehensive grounding in the realities of modern-day servitude. Drawing on sixteen years of field research in more than fifty countries around the globe—including revelatory interviews with both the enslaved and their oppressors—Kara sets out the key manifestations of modern slavery and how it is embedded in global supply chains. Slavery offers immense profits at minimal risk through the exploitation of vulnerable subclasses whose brutalization is tacitly accepted by the current global economic order. Kara has developed a business and economic analysis of slavery based on metrics and data that attest to the enormous scale and functioning of these systems of exploitation. Beyond this data-driven approach, *Modern Slavery* unflinchingly portrays the torments endured by the powerless. This searing exposé documents one of humanity's greatest wrongs and lays out the framework for a comprehensive plan to eradicate it. *Thiazoles: Advances in Research and Application: 2011 Edition* is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Thiazoles. The editors have built *Thiazoles: Advances in Research and Application: 2011 Edition* on the vast information databases of ScholarlyNews.™ You can expect the information about Thiazoles in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of *Thiazoles: Advances in Research and Application: 2011 Edition* has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

Aiming to build regional capacity in aquaculture governance in Asia-Pacific, FAO and NACA jointly implemented a regional consultation in collaboration with NACA member governments to assess the status of aquaculture governance in Asia, share experiences and lessons learned in aquaculture governance among countries, and recommend strategies and actions for further improvement. The consultation consisted of two major activities: country assessment studies and a regional consultative workshop. The country assessment studies were carried out by seven national experts in seven selected countries including Cambodia, China, India, Indonesia, Malaysia, Thailand, and Viet Nam. The consultative workshop was conducted in 5-6 November 2019 in Bangkok, attended by 33 participants including experts and government officers from 15 Asian countries and representatives from FAO, NACA and the Asian Institute of Technology. The findings of the assessment studies were presented to the workshop, and participants then worked on identifying gaps, constraints, and challenges in aquaculture governance in the region and put forward recommendations for further improvement. This publication presents the seven country assessment studies and the outputs of the workshop, including the summary of the status of aquaculture governance in the region, challenges and issues in governing process, and recommendations for further strengthening aquaculture governance in the region.

Fullst.tit. Nordic Research Cooperation on Reproductive Disturbances in Fish. Undertit.: report from the Redfish project. Engelsk tekst.

A rapidly growing interdisciplinary field, disease ecology merges key ideas from ecology, medicine, genetics, immunology, and epidemiology to study how hosts and pathogens interact in populations, communities, and entire ecosystems. Bringing together contributions from leading international experts on the ecology of diseases among invertebrate species, this book provides a comprehensive assessment of the current state of the field. Beginning with an introductory overview of general principles and methodologies, the book continues with in-depth discussions of a range of critical issues concerning invertebrate disease epidemiology, molecular biology, vectors, and pathogens. Topics covered in detail include: Methods for studying the ecology of invertebrate diseases and pathogens Invertebrate pathogen ecology and the ecology of pathogen groups Applied ecology of invertebrate pathogens Leveraging the ecology of invertebrate pathogens in microbial control Prevention and management of infectious diseases of aquatic invertebrates *Ecology of Invertebrate Diseases* is a necessary and long overdue addition to the world literature on this vitally important subject. This volume belongs on the reference shelves of all those involved in the environmental sciences, genetics, microbiology, marine biology, immunology, epidemiology, fisheries and wildlife science, and related disciplines.

Issues in Global Environment—Biodiversity, Resources, and Conservation: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Additional Research. The editors have built *Issues in Global Environment—Biodiversity, Resources, and Conservation: 2013 Edition* on the vast information databases of ScholarlyNews.™ You can expect the information about Additional Research in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of *Issues in Global Environment—Biodiversity, Resources, and Conservation: 2013 Edition* has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

The Workshop recognized that complacency in the shrimp aquaculture sector resulting in that laxity, during a period of relatively trouble-free shrimp production, led to vulnerability of the sector to any newly emerging pathogen that might arise unexpectedly, as is the case of EMS/AHPNS. Poor management practices, weak compliance with standard, good biosecurity and good aquaculture practices both at farm and hatchery facilities were evident. It is now clear that shrimp aquaculture needs to improve and continue to develop into a sector that implements responsible and science-based farming practices.

This book is about important relevant recent research topics in sustainable aquaculture practices. A critical assessment of the sustainable fishing methods and the aspect of sustainable aquaculture feed is presented in this volume. A special focus has been given to socio-economic and environmental assessment of aquaculture practices and analysis of carbon footprint under an intensive aquaculture regime. Aquaponics as a niche for sustainable modern aquaculture has been highlighted. The effect of use of pharmaceuticals to prevent fish disease on the surrounding marine environment is an emerging area of concern, and a critical discussion on this aspect is included in the book. The spread of organic waste and nutrients released by fish farms to natural water bodies has raised considerable concerns. Therefore the methods to prevent their dispersion and removal (treatment) have been comprehensively covered in this book. This book is an essential read

for academician, researchers, and policy makers in the field of aquaculture.

Sustainable Biofloc Systems for Marine Shrimp describes the biofloc-dominated aquaculture systems developed over 20 years of research at Texas A&M AgriLife Research Mariculture Laboratory for the nursery and grow-out production of the Pacific White Shrimp, *Litopenaeus vannamei*. The book is useful for all stakeholders, with special attention given to entrepreneurs interested in building a pilot biofloc-dominated system. In addition to the content of its 15 chapters that cover topics on design, operation and economic analysis, the book includes appendices that expand on relevant topics, links to Excel sheets that assist in calculations, and video links that illustrate important operations tasks. Presents the most recent trials on nursery & gross-out of *L. vannamei* Includes a discussion of site selection, equipment options and water sources Provides a step-by-step guides from tank preparation, to feeding and harvest

As the expansion in world aquaculture continues at a very high rate, so does the need for information on feeding of cultivated fish and shellfish. In the larval and juvenile phases of many species, the use of manufactured feed is not possible. This important book covers in detail the biology and culture of the main live prey and microalgae used as feeds in the aquaculture of major commercial species including shrimps, sea bass, halibut, cod and bivalves. Contents include comprehensive details of the status of marine aquaculture in relation to live prey, and chapters covering the biology, production, harvesting, processing and nutritional value of microalgae and the main prey species: rotifers, *Artemia* and copepods. The editors have drawn together an impressive international team of contributors, providing a work that is set to become the standard reference and practical guide on the subject for many years to come. Live Feeds in Marine Aquaculture is an essential purchase for anyone involved in marine aquaculture, including fish farmers, researchers, and personnel in feed and equipment companies supplying the aquaculture trade. An extremely valuable tool as a reference and practical manual for students and professionals alike; libraries in all universities and research establishments where biological and aquatic sciences and aquaculture are studied and taught, should have copies available on their shelves.

Aquafeed Formulation is the only resource that provides summaries with examples and formulation techniques specifically to meet the needs of anyone in the aquaculture industry. As feed is the largest single cost item in aquaculture production, and formulating aquaculture feed requires many combinations of several ingredients and nutrient requirements, this book takes a clear-and-concise approach, providing essential information on formulation and covering relevant available software, feed nutrients, and additives such as enzymes and phytase and conjugated fatty acids, as well as best industry practices to improve aquafeed production. Users will find this to be a one-stop resource for anyone interested or involved in, the global aquaculture industry. Includes the latest software evaluation for calculating protein and amino acid sources, trace minerals, and vitamins for aquaculture diets Provides essential information on formulation, covering feed nutrients and additives such as enzymes and phytase and conjugated fatty acids Presents factors affecting nutrient recommendations for aquaculture diets and nutritional effects on aquaculture nutrient excretion and water quality Covers a broad range of techniques to understand the nutrient recommendations in the NRC guide

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Viet Nam is one of the top producers and exporters of farmed shrimp. More than 80 percent of the total production comes from small intensive farms, which occupy less than 10 percent of the land area devoted to shrimp farming. It is the main source of income for many rural households in the Mekong Delta provinces. This study examines the characteristics of small intensive shrimp farms and socio-economic status of the farm households, and farming practices and performance that are associated with the strategies and preferences for managing production risks. The analysis was based on primary data from a survey of farms raising the whiteleg shrimp (*Penaeus vannamei*) conducted in Bac Lieu, Ben Tre and Ca Mau provinces from September 2017 to February 2018.

The regional workshop "Development of Aquaculture Insurance System for Small-scale Farmers" 20–21 September 2016, Bangkok, was joined by participants from China, Philippines, Thailand and Viet Nam. It contains two parts. The first aimed at answering the question, "What would make insurance available for and accessible to small-scale farmers?" The second was focused on exploring potential shrimp insurance schemes. The Workshop achieved the following outcomes: (1) made farmers, farmer advisers, researchers and academics more familiar with the business and technical requirements of insurers, (2) made insurers become more familiar with the circumstances and needs of farmers, (3) confirmed that insurers continue to view aquaculture as a high-risk industry, (4) highlighted the need to incorporate risk assessment and management in the development of better farm management practices in line with the requirements of insurance, and (5) confirmed the usefulness of bundling financial products in the development of institutional services for farmers.

Regulating Safety of Traditional and Ethnic Foods, a compilation from a team of experts in food safety, nutrition, and regulatory affairs, examines a variety of traditional foods from around the world, their risks and benefits, and how regulatory steps may assist in establishing safe parameters for these foods without reducing their cultural or nutritive value. Many traditional foods provide excellent nutrition from sustainable resources, with some containing nutraceutical properties that make them not only a source of cultural and traditional value, but also valuable options for addressing the growing need for food resources. This book discusses these ideas and concepts in a comprehensive and scientific manner. Addresses the need for balance in safety regulation and retaining traditional food options Includes case studies from around the world to provide practical insight and guidance Presents suggestions for developing appropriate global safety standards

Acute hepatopancreatic necrosis disease (AHPND), also known as early mortality syndrome (EMS), is caused by strains of *Vibrio parahaemolyticus* containing the PirAB toxin and has been devastating to shrimp aquaculture globally. Current methods for prevention rely on the use of antibiotics that leads to the development of antibiotic-resistant bacteria. In vitro, *Bacillus subtilis* strain T1 was found to possess antagonistic activity against EMS-causing *V. parahaemolyticus* strain D4 and is a candidate for use as a probiotic in the aquaculture industry. Competitive growth experiments examined the effect of T1 on D4 growth. Using qPCR to assess T1 and D4 growth, these studies showed that T1 was capable of inhibiting D4 growth in a density-dependent manner, with complete inhibition occurring when the T1 starting density was 104-fold higher than D4. Using a mariner-based transposon system, T1 mutants were generated to identify genes involved in D4-inhibitory activity. Of over 3,000 colonies screened using an overlay-based assay, 17 were identified as having either complete or partial loss of activity. Eleven mutants contained insertions

within an ~30-kb DNA cluster that included lipopeptide and polyketide biosynthesis genes. One of these mutants, A3-41, which contained an insertion within a non-ribosomal peptide synthetase gene utilized for lipopeptide biosynthesis, was found to have lost the ability to inhibit D4 growth in coculture experiments. Two mutants were found to contain insertions within stationary phase regulators, spo0A (sporulation gene regulator) and oppA (first gene of the oligopeptide transporter system operon) suggesting that D4 inhibitory activity is associated with a stationary phase product. Consistent with the mutagenesis results, supernatant fractions prepared from stationary phase cultures of T1 were found to inhibit D4 growth in a dose-dependent manner while culture supernatants prepared from mutant A3-41 were not inhibitory. These results indicate that T1 produces and excretes a stationary phase metabolite(s) that has inhibitory activity against D4 and has implications for the use of T1 as a probiotic in shrimp aquaculture.

Salmonid populations in the Great Lakes experienced a decline in the early twentieth century, presumably due to over-fishing combined with the introduction of exotic parasites such as the sea lamprey. Despite intensive rehabilitation and stocking programs, today significant natural reproduction exists only in Lake Superior. Dioxin-like contaminants (i.e., PHHs) are known to cause adverse effects in early life stage lake trout, and results indicate that even the low levels currently present in Lake Michigan can result in sublethal physical lesions or behavioral alterations such as diminished C-start response. 2,3,7,8-TCDD caused significant adverse effects of both C-start behavior and feeding in rainbow trout and lake trout young. In addition to the presence of contaminants, a nutritional thiamin deficiency has been shown to cause high mortality, termed Early Mortality Syndrome (EMS), in Great Lakes swim-up fry. In the current study, fry eventually succumbing to EMS exhibited reduced embryo C-start behavior. It appears that neither the presence of PHHs nor EMS mortality can fully account for the total lack of lake trout recruitment in the lower Great Lakes. However, it is possible that an interaction between the two stressors can result in greater than expected effects on fry health and survival.

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