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Sitti Raehanah Muhamad Shaleh *Editors*

Essentials of Aquaculture Practices

 Springer

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Editors

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Preface

Aquaculture is expanding in response to the increasing demand for animal protein, significantly contributing to food security and socioeconomic livelihoods. *Essentials of Aquaculture Practices* is a comprehensive book that delves into the fundamental principles and advanced techniques for successful aquaculture operations.

This book covers a broad range of topics, from the basics of aquaculture systems and nutrition to the latest advancements in disease management and genetic improvement. Expert authors provide in-depth insights into critical areas such as the importance of live feeds, the nutritional requirements of marine finfish, and the role of feeding stimulants in boosting aquaculture productivity.

The readers will also find valuable information on the challenges and solutions related to vibriosis, a common disease in aquaculture, and the vital importance of biosecurity in maintaining healthy and sustainable aquaculture communities. In addition, this book explores the social and economic dimensions of aquaculture, emphasizing the need for resilient communities and the potential of bioactive compounds from marine sources.

By addressing both technical and practical aspects, *Essentials of Aquaculture Practices* serves as an indispensable guide for cultivating a sustainable and prosperous future in aquatic food production. It is a valuable reference for students, researchers, policymakers, practitioners, and aquaculture operators.

We extend our heartfelt gratitude to the staff of the Borneo Marine Research Institute at Universiti Malaysia Sabah for their unwavering support and cooperation during the preparation of this book. We also want to thank the management team at Universiti Malaysia Sabah for their assistance in making this book a reality.

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About Editors



Norfazreena Mohd Faudzi is a senior lecturer at the Borneo Marine Research Institute, Universiti Malaysia Sabah (UMS) in Malaysia. Her academic journey includes the successful completion of an MSc and a PhD in Aquaculture from the Borneo Marine Research Institute, UMS, in 2013 and 2019, respectively. Recognized for her outstanding contributions to research and innovation, Dr. Norfazreena has been honored with numerous accolades. She has received one silver medal and two bronze medals from UMS, highlighting her exceptional work in these areas. She has been an active participant in both national and international conferences since 2009. Her passion for knowledge sharing has led her to be involved in various community works. By disseminating her research findings and expertise, Dr. Norfazreena contributes to the advancement of the scientific community and fosters meaningful collaborations across borders. Furthermore, Dr. Norfazreena's research work has been published in reputable journals.



Muhammad Dawood Shah is a senior lecturer at the Borneo Marine Research Institute, Universiti Malaysia Sabah (UMS), Malaysia. Dr. Dawood earned his MSc and PhD in Biotechnology from the Biotechnology Research Institute, UMS, in 2011 and 2016, respectively. In 2011, he received the excellence award for his MSc outstanding research work and best postgraduate student. From 2014 to 2024, he received 5 gold and 4 silver medals for his research work. In 2021, he was the winner of the Malaysian-Croatia Technology Exchange and Malaysia Technology Expo 2021 awards for his

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Nurzafirah Mazlan is a senior lecturer at the Borneo Marine Research Institute, UMS. She obtained her PhD in Health Science from International Islamic University Malaysia (IIUM). She also holds a MSc in Industrial Biotechnology (UPM) and a BSc in Biomedical Science (Hons) from IIUM. Prior to joining UMS in 2021, she had worked at public and private academic institutions for 10 years and held various administrative positions. She performed research in a multidisciplinary area with core research in sea cucumber aquaculture, microbiology, and industrial biotechnology. She has won several accolades in local and international research competitions for her sea cucumber research. Her current interests are postharvest processing, sea cucumber product development, sea cucumber aquaculture, marine animal diseases, microplastic contamination, as well as lactic acid bacteria isolated from marine animals. She has supervised 12 postgraduate students and more than 30 undergraduates. She holds several local and industry grants and has established collaborations with local and international collaborators from Turkey, the UK, and Australia. She is also actively involved in marine conservation and passionate about building a sustainable future.



Sitti Raehanah Muhamad Shaleh is a researcher and lecturer at the Borneo Marine Research Institute (BMRI), Universiti Malaysia Sabah. Her journey in academia began with her pursuit of a Bachelor's degree in Fisheries Science, which she accomplished in 1994 from Universiti Pertanian Malaysia (UPM). Recognizing her potential as a budding scientist, she delved further into academia, embarking on a remarkable journey to attain a PhD in Aquatic Ecosystem Management from the same university. Her research interest is aquaculture with specific areas of live feed propagation (microalgae and zooplankton), sea cucumber breeding, and fish/

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Feeding Stimulants in Finfish Aquaculture

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Abstract

Aquaculture is a fast-growing industry in the world, and finfish culture has been accounted for the largest share of it. Feed cost in fish farming is very high; hence, the strategy for preventing feed wastage is crucial. Uneaten feed or feed rejection is one of the causes to feed wastage in finfish culture, while this phenomenon can

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be due to poor feed palatability. Therefore, dietary inclusion of feeding stimulant, the taste substance that can promote ingestion in fish, is necessary to enhance fish intake and minimize uneaten feed. This chapter aimed to provide an overview on the types of taste substances that have been commonly used as feeding stimulants in finfish aquaculture. Generally, amino acids, betaine, organic acids, and nucleotides have been reported as the functional feeding stimulants for fish. However, fish taste preference for these substances is species-specific. Therefore, before the taste substance was used as the feeding stimulant, a preliminary confirmation of the fish preference for it through behavioral assay is strongly recommended.

Keywords

Feeding stimulants · Taste substances · Nucleotides · Amino acids

5.1 Introduction

Aquaculture is a fast-growing industry in the world, and it has been identified as an efficient protein generator in the grand challenge of feeding more than nine billion people by 2050 (Godfray et al. 2010; FAO 2022). In 2020, the global total aquaculture production has reached approximately 122 million tons (worth about USD 265 billion), while finfish has been accounted for the largest share of it (FAO 2022). In finfish aquaculture, feed cost is very high as it can reach up to more than 60% of the total operational expenses (Sathishkumar et al. 2021). To prevent feed wastage, feed palatability is an important criterion to be taken seriously (feed will be rejected by fish and wasted otherwise) (Coloso 2014). In the present time, however, alternative protein sources, especially plant proteins, are commonly used to replace fishmeal protein in fish diets for cost reduction, and such practice often deteriorates the feed palatability and leads to feed wastage. The impact of waste products from aquaculture, including feed wastage, has raised public concern and threatens the sustainability of aquaculture practices (Dauda et al. 2019). Feeding stimulant (FS) is, therefore, needed in the feed formulation to improve its palatability and promote fish ingestion (Dias et al. 1997; Kubitzka et al. 1997; Papatryphon and Soares 2000a, b; Lim et al. 2015a, b). FS is defined as the substance that promotes ingestion in fish (Kasumyan and Døving 2003). In other words, FS is the substance that suits the fish taste preference. As the taste preference in fish is species specific (Kasumyan and Døving 2003), the knowledge of using the suitable FS for effective feeding in fish farming is essential. This chapter aimed to provide a comprehensive overview on the feeding stimulants that are commonly used in finfish aquaculture. Although there are studies reported on the utilization of marine- and terrestrial animal-based ingredients or extracts as an effective FS in finfish farming (Kubitzka et al. 1997; Kikuchi and Furuta 2009; Tusche et al. 2011), the chemical compositions of these ingredients can vary when they are obtained from different sources and/or been processed by different methods. This circumstance may cause variants in the