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Editorial

Editorial: Advances in Aquaculture Ecology Research

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This Special Issue describes the advances in the last decades in the research fields of individual ecology of commercial aquatic organisms, the ecology of aquaculture systems, interactions between aquaculture activities and the environment, the structure and function of the microbial community, principles of environment management in aquaculture ecosystems, etc. We collected ten valuable contributions focused on advances in aquaculture ecology research. All of the authors are from China, which is the largest aquaculture country and contributes more than 60% of global aquaculture production.

Aquaculture is one of the fastest-growing human activities, which not only provides high-quality food for human beings but can also pose a potential risk to the surrounding environment. The multiple outbreaks of golden tide caused by *Sargassum* have attracted lots of attention. Song et al. studied interactions between cultivated *Gracilariopsis lemaneiformis* and floating *Sargassum horneri* [1]. Results of the study could provide important references for mariculture management to reduce golden tide outbreaks. Wang et al. evaluated the impact of floating raft aquaculture on the hydrodynamic environment of an open sea area in Liaoning Province, China by establishing depth-averaged two-dimensional shallow water equations and three-dimensional incompressible Reynolds-averaged Navier–Stokes equations [2]. The work provides a good reference for other studies on aquaculture in open sea areas.

Much research has been performed to develop bioremediation technologies to reduce environmental influences from aquaculture and ensure the sustainability of aquaculture activities. Li et al. selected the appropriate seaweed species for bioremediation of aquaculture wastewater [3]. Results of the study demonstrated that the seaweeds *Neoporphyra haitanensis* and *N. dentata* are likely to be used as efficient and environmentally friendly remediation tools.

The bio-floc technology has been developed in the recent decade and is considered an environmentally friendly technology in aquaculture. Carbon sources are added in biofloc systems to increase the carbon-to-nitrogen ratio (C/N) and thus promote the growth of heterotrophic bacteria [4,5]. Water-soluble carbon sources such as molasses need to be applied frequently, which increases the management effort. Two collected papers investigated the production environment in biofloc systems [4,5]. The papers evaluated the effects of *Bacillus pumilus* BP-171 and different carbon sources, i.e., poly-3-hydroxybutyrate-co-3-hydroxyvalerate (PHBV) and molasses, on water quality, bacterial community and the production of *Litopenaeus vannamei* in culture systems. Both papers demonstrated that adding carbon sources or probiotics could affect the water quality and microbial community. The PHBV, which is insoluble biodegradable polymers and simple to manage, is a good alternative for a water-soluble carbon source.

Effects of various environmental factors, including temperature, carbonate alkalinity and protein levels in compound feeds on commercial aquatic species including ridgetail white prawn *(Exopalaemon carinicauda)*, juvenile mud crab *(Scylla paramamosain)* and Chinese mitten crabs *(Eriocheir sinensis)* were comprehensively investigated in three collected papers [6–8]. Yu et al. comprehensively analyzed the protein requirements of juvenile Chinese mitten crabs in a rice–crab co-culture system and provided important references for the optimization of the feeding strategy in the rice–crab co-culture system [6]. Liu et al.

Citation: Tian, X.; Li, L. Editorial: Advances in Aquaculture Ecology Research. *Water* **2023**, *15*, 1629. https://doi.org/10.3390/w15081629

Received: 12 April 2023
Accepted: 17 April 2023
Published: 21 April 2023

evaluated the optimal temperature range for juvenile mud crabs in terms of growth, molting, energy metabolism, antioxidant capacity and stress response [7]. Results of the study could provide guidance for crab management in aquaculture and support the design of recirculating aquaculture systems for the species. The saline–alkaline water areas in China is about 46 million hectares and the government encouraged the land to be reclaimed into fishponds [8]. The saline-alkaline water usually has high carbonate alkalinity and pH, which limits the growth of most aquatic species. Zhang et al. explored the effects of long-term high carbonate alkalinity stress on ovarian development and revealed the genes and pathways involved in the ovarian development of *E. carinicauda* under long-term high carbonate alkalinity stress [8]. The study demonstrated that *E. carinicauda* is an excellent candidate species for aquaculture in saline-alkaline water as this species could tolerate the saline–alkaline stress.

The *Daphniopsis tibetana* is an important food source for marine fish and shrimp during the nursery period. Zhao et al. evaluated the biology of *D. tibetana* from three lakes in Tibet or on the genetic difference between wild-type and seawater domesticated *D. tibetana*, which provides important information for the large-scale cultivation of *D. tibetana* [9].

In China, we have explored a wide diversity of polyculture applications, both marine and freshwater. It is very important to understand the underlying biological processes of various polyculture models. We collected one review paper from Yuan et al., who systematically reviewed the advances in ecology research on three major integrated rice field aquaculture models in China including rice–fish, rice–crab and rice–crayfish co-culture systems [10]. Integrated rice field aquaculture is one of the main freshwater aquaculture systems. The progress in ecology research on theories, biological studies, models and eco-engineering techniques were systematically reviewed in the paper, which could help aquaculture scientists to further study ecology in integrated aquaculture systems.

The fastest-growing aquaculture achieved high and predictable yields in the past decades; however, the industry is also facing numerous challenges in the long term, such as environmental pollution, excessive resource consumption, etc. The mission of aquaculture ecology is to lay an ecological foundation for the sustainable development of aquaculture. The Special Issue on "Advances in Aquaculture Ecology Research" is closed, but the research on aquaculture ecology is still being rapidly developed.

Author Contributions: Conceptualization, X.T. and L.L.; writing-original draft preparation, X.T. and L.L.; writing—review and editing, X.T. and L.L. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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