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Editorial: Aquaculture environment regulation and system engineering

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Editorial on the Research Topic
Aquaculture environment regulation and system engineering

Aquatic products are a major source of high-quality foods for humans, and as the population grows, global fisheries and aquaculture production is expanding. Since the 1990s, capture production of fisheries has reached a bottleneck and tended to stabilize at around 90 million tons (FAO, 2022). In contrast, aquaculture production has entered a rapidly developing period, and aquaculture has now become one of the fastest-growing areas of food production. In 2020, aquaculture provided 88 million tonnes of aquatic products worldwide (FAO, 2022), significantly contributing to global food and nutrition security. Furthermore, aquaculture will play an increasing role in global aquatic product supply to fill the gap between declining capture production and increasing human demand (Zhang et al., 2022a).

To keep up with the continuous expansion of the aquaculture industry, the intensive and efficient aquaculture mode represented by indoor factory recirculating aquaculture system (RAS) is emerging and developing and gradually replacing the traditional pond culture (Campanati et al., 2022; Chen and Gao, 2023). The indoor factory RAS maximizes aquaculture efficiency by regulating various environmental factors to the optimum level (Xiao et al., 2019; Li et al., 2023). Various environmental factors can affect the growth, reproduction, and health of aquatic organisms, such as light (Ruchin, 2021; Xu et al., 2022a; Xu et al., 2022b; Xu et al., 2022c; Zhang et al., 2022b; Zhao et al., 2023a), temperature (Liu et al., 2022a; Liu et al., 2022b), salinity (Boeuf and Payan, 2001; Deane and Woo, 2009), dissolved oxygen (Waldrop et al., 2020), flow velocity (Gao et al., 2017; Zhao et al., 2023b), tank color (Shi et al., 2019; Wang et al., 2019; Ma et al., 2021; McLean, 2021), tank size (Yu et al., 2022), tank substrate (Tierney et al., 2020), etc. Many studies have demonstrated promoting aquatic organism growth by manipulating environmental factors (Li et al., 2020; Chen et al., 2021; Chen et al., 2022; Chen et al., 2023; Yu et al., 2023). Therefore, understanding the environmental demand of aquatic animals is the premise of designing an intensive aquaculture system. In this Research Topic, it has collected several research

papers on the light and temperature requirements of fish involving *Oncorhynchus mykiss* (Xu H. et al.; Xu H. et al.; Ma S. et al.; Ma Z. et al.), *Salmo salar* (Dempsey et al.), and *Takifugu rubripes* (Liu S. et al.), which provide theoretical references for the environmental settings of intensive aquaculture system.

After clarifying the environmental demands, establishing an intensive aquaculture system has become a new challenge. The establishment of an optimum system needs interdisciplinary knowledge such as hydromechanics and computer-based intelligent control technology (Hu et al., 2021; Yang et al., 2021). This Research Topic contains cutting-edge research on the engineering & design of aquaculture facilities and artificial intelligence in aquaculture, including the design of a new type of inlet pipe to improve the self-purification capacity of aquaculture tanks (Zhang et al.); the inlet layout on solid waste removal from aquaculture tanks (Hu et al.); the ability of ultrafiltration membranes to remove viruses and bacteria from aquaculture waters (Mota et al.); and commercial-scale wetland system to treat aquaculture wastewater (Li et al.). In addition, a computer vision-based study of fish appetite grading (Wei et al.) and a study of fish swimming behavior (Xiang et al.) were also collected on this Research Topic. The above studies provide a research basis for developing intensive & intelligent aquaculture facilities.

On the other hand, intensive aquaculture systems are often capital & technology-intensive. For a lot of developing countries, the extensive aquaculture system is also prevalent. Reservoirs are an important artificial water body, and aquaculture production in reservoirs is one of the important ways of inland aquaculture. This Research Topic included related studies on fish distribution in reservoirs based on hydroacoustic surveys (Mei et al.; Luo et al.), which provided an ecological theoretical basis for conducting reservoir aquaculture. In addition, microorganisms in cultured water are increasingly of interest because of their close relationship with the growth and health of the animals. Microbial composition in shrimp-crab polyculture systems (Liu H. et al.) and in offshore shellfish farming waters (Gao et al.) are also included in this Research Topic to provide new insights into the microecological environment of aquaculture systems.

In conclusion, the basic knowledge of bioengineering interfaces in aquaculture is important in designing and developing effective aquaculture systems. This Research Topic, which combines the latest research on the environmental demands of aquatic organisms, the development of aquacultural facilities & equipment and the knowledge of extensive aquaculture system, expands the horizons on aquaculture environment regulation and system engineering.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

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