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Effects of Different Farming Systems on Growth Performance and Survival of Chinese Sea Bass (*Lateolabrax maculatus*)

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Abstract As an important commercial marine fish species for aquaculture in my country, the growth performance and survival rate of the spotted sea bass (*Lateolabrax maculatus*) depend heavily on the type of culture system and its capacity for environmental control. This paper reviews and compares the mechanisms by which pond culture, net-pen culture, and recirculating aquaculture systems (RAS) influence growth performance and survival rates. The results indicate significant differences among these systems regarding water quality stability, dissolved oxygen supply, ammonia-nitrogen accumulation, and stocking density management, leading to variations in growth rates and feed conversion ratios (FCR). Among them, RAS typically demonstrates superior growth efficiency and lower mortality due to robust water quality control and stable environmental conditions; pond systems are significantly affected by natural environmental fluctuations, resulting in less stable growth and survival; net-pen systems fall between the two but are susceptible to the effects of water exchange and seasonal changes. Comparative analysis further reveals that environmental stability and nutrient utilization efficiency are key determinants of aquaculture performance. Additionally, the incidence of disease and stress responses intensifies under high-density culture conditions. Based on this comparative analysis, the paper proposes optimized culture models and environmental management strategies to enhance the sustainability and productivity of spotted sea bass aquaculture.

Keywords Spotted sea bass; Culture system; Recirculating aquaculture system (RAS); Growth performance; Survival rate

1 Introduction

Chinese sea bass (*Lateolabrax maculatus*) has become an increasingly important aquaculture species in China over the past two decades, with the industry expanding rapidly and contributing substantially to the national fishery economy (Huang et al., 2025). This development is closely linked to the species' favorable biological characteristics, especially its rapid growth rate and strong adaptability to a range of environmental conditions, which have supported its broad culture potential and increasing industrial relevance. At the same time, progress in Chinese sea bass aquaculture has depended on advances across multiple fields, including breeding, seed production, nutrition, and disease management, indicating that further gains in production will likely require continued integration of biological and farming technologies. Despite these achievements, the industry still faces important constraints, including low profitability and insufficient risk management relative to other major farmed fish sectors, which highlights the need for research that can support higher-quality and more efficient development.

Among the major factors shaping aquaculture productivity, the choice and optimization of farming system is especially important because production environment directly influences fish growth, health status, resource use, and overall economic return (Li et al., 2023). Comparative work on Chinese sea perch culture systems has shown clear differences in ecological-economic performance among pond farming, offshore cage culture, and cage culture, with offshore cage culture identified as the most sustainable among the current main marine fish farming systems in China (Zhang et al., 2021). More broadly, research on modern recirculating aquaculture systems indicates that controlled land-based production can reduce water use, improve water quality, lower disease risk, and strengthen waste management, all of which are directly relevant to improving production efficiency and survival in intensive fish culture (Gupta et al., 2024). These findings suggest that farming-system design is not only a management issue but a central biological and economic determinant of aquaculture performance.