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EDITORIAL

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# Presentations by young Chinese aquaculture scientists: From the 2021 China Society of Fisheries—Annual Conference of Youth Scholars

## 1 | INTRODUCTION

Young scientists are the most active force driving scientific advancement and technological innovation. Nonetheless, young scholars also face challenges such as heavy workloads, shortage of research-focused hours, high competition in grant application, and securing an academic job, among others. Mentorship from supervisors and senior peers is important to encourage and reassure the scientific endeavors of young scholars. Favorable policies and activities arranged by public agencies or academic societies are also essential for nurturing and promoting the successful establishment of young scholars. Chinese young scientists have been making great contributions to aquaculture research and applications. The China Society of Fisheries organized the Annual Conference of Youth Scholars in Shanghai on October 18, 2021. There were over 300 attendees to this meeting, which covered the topics of aquaculture techniques and equipment, biotechnologies and breeding, nutrition and feeds, diseases and quality security, aquaculture resources and conservation, and aquaculture economy and management. Here, we summarize some representative work by the attendees who were selected for this special issue, which partially reflects the recent research focus on young aquaculture scientists in China.

## 2 | NUTRITION AND FEEDS

The healthy and sustainable development of aquaculture depends heavily on research on nutritional feeds in terms of precise nutritional requirements of aquatic animals. The largemouth bass, *Micropterus salmoides*, characterized by its fast growth and delicious taste, is currently a major species of freshwater aquaculture in China. According to the China Fishery Statistical Yearbook report, the total production of farmed largemouth bass in 2020 was more than 619,500 tons, and the national demand for this fish is also increasing yearly (China Fishery Yearbook, 2021). To date, the requirement of each vitamin of the largemouth bass has its own specific and irreplaceable function, so it is necessary to investigate the optimal level of usage one by one. The requirement for fat-soluble vitamins, including vitamins A, D, E, and K, has been reported in this species (Li et al., 2018, 2020; Lian et al., 2017; Wei et al., 2021). In contrast, minimal information has been published on the nutritional requirements of water-soluble vitamins, particularly the B vitamins. Folic acid, one of the water-soluble B vitamins, which plays a role in maintaining normal hematopoiesis, facilitating growth performance and immune response of aquatic animals, is essential for growth maintenance in aquatic animals (Shiau & Huang, 2001). Hang et al. (2022) evaluated the graded dietary levels of folic acid on growth

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performance, body composition, blood biochemistry, nutritional metabolism, and antioxidant immunity of largemouth bass. They found that the growth performance, total hepatic antioxidant capacity, protein content, hemoglobin, hematocrit of whole blood cells, and plasma total protein in each folic acid supplementation group were higher than those in the control group to various degrees. Dietary supplementation with 0.5–1.5 mg/kg of folic acid significantly decreased albumin, plasma glutamic-pyruvic transaminase activity, serum malonaldehyde activity, and liver glycogen content. According to the regression analysis of growth performance and additive gradients, the optimal amount of folic acid in the feed of juvenile largemouth bass was 1.42–1.46 mg/kg diet.

Gibel carp, *Carassius auratus gibelio*, is one of the main farmed carp species in China, with a total annual production of more than 2.59 million tons (Liu et al., 2018). Given the deterioration of the aquatic aquaculture environment and degradation of germplasm resources, diseases caused by bacteria and viruses have caused large-scale mortalities of farmed gibel carp and led to enormous losses (Xu et al., 2013). Among the pathogens, Cyprinid herpesvirus 2 (CyHV-2) and *Aeromonas* spp. are the most common pathogens of carps (Sahoo et al., 2016). Thus, the use of functional feed additives that can boost the innate immune system and natural mucosal barrier of fish has attracted more attention during antibiotic-free farming. Recently, poly-β-hydroxybutyrate (PHB), as a polymer storing intracellular energy and carbon sources, has been gradually shown to have positive effects on growth, immunity, and disease resistance in aquatic animals (Duan et al., 2017). However, the efficacy and application method of PHB on gibel carp culture is still unclear. Liu et al. (2022) detected that dietary PHB supplementation could promote growth performance, upregulate the expression of immune-related genes and activities of immune-related enzymes, significantly enhance the disease resistance of fish, and strengthen the tight junction of the intestine and affect the intestinal mucosal barrier of gibel carps. These findings provide a good model to illustrate its immune-stimulatory mechanism in fish. It has played a guiding role in the sustainable culture of gibel carp, and may contribute to the green, environmental, and healthy development of the aquaculture industry.

## 3 | MECHANISM OF BIOLOGICAL PROCESSES

Phytoplankton are the primary producers in the aquatic food web and play essential roles in the biotic water environment (Zhao et al., 2022). Most phytoplankton are single-celled photosynthetic organisms that can achieve a rapid increase in number after continuous cell cycles by cell proliferation and division in suitable environments (Dewitte & Murray, 2003). Therefore, understanding the cell cycle and regulation mechanism to achieve the appropriate biomass is essential for maintaining aquatic ecosystem health. Zhao et al. (2022) summarized the current information about the eukaryotic phytoplankton cell cycle and the environmental factors that affect it. They also introduced the research methods for the phytoplankton cell cycle, highlighted the progress in understanding the molecular mechanisms of phytoplankton cell cycle regulation, and discussed future directions for phytoplankton cell cycle research. This information will strengthen our understanding of the phytoplankton cell cycle and its regulation mechanisms, inspiring further studies on maintaining aquatic and health of natural ecosystems.

There are abundant germplasm resources of freshwater pearl mussels in China. *Hyriopsis cumingii* is one of the main bivalve species used for freshwater pearl culture. It is well-known that the color of pearl production is an essential criterion for evaluating the quality of pearls and further determining their market value (Li et al., 2014). Furthermore, exogenous dietary carotenoids are considered the main factor affecting the color of the inner shell and pearl (Sun et al., 2020). Therefore, studying key enzyme genes involved in carotenoid metabolism is the vital premise of pearl quality control research. Zhang et al. (2022) successfully cloned the complete *HcStAR-like* gene and proposed that *HcStAR-like* plays a crucial role in the accumulation of carotenoids of shell or pearl pigmentation in *H. cumingii* by dsRNA interference assay. Their findings contribute to our further understanding of the shell formation mechanism of pearl color.

## 4 | STRESS RESISTANCE

Dissolved oxygen is the most important limiting factor in rearing of fish and directly affects fish health and survival. How fish adapt to hypoxia in aquaculture has been a hot topic. Fish in high-latitude regions suffer from sustained hypoxia in winter and diel-cycling hypoxia in summer. *Phoxinus lagowskii*, a high-latitude fish distributed and mainly cultured in northeast China, was chosen to determine the biochemical, physiological, and histological responses to these two conditions (Yao et al., 2022). Histological analysis revealed changes in the relative thickness of the layers in the midbrain under hypoxia. *P. lagowskii* adapts to sustained hypoxia through myocardial hypertrophy and mitochondria deformation. During diel-cycling hypoxia, the oxidative stress biomarkers, enzyme activities, and triglycerides in the heart were significantly elevated. HIF expression patterns indicated its function in diel-cycling hypoxia in the heart and sustained hypoxia in the brain. Collectively, these findings reveal that *P. lagowskii* exhibits varied adaptation strategies to the exposure of sustained and diel-cycling hypoxia.

## 5 | DISEASE RESISTANCE

Diseases have become one of the main constraints to sustainable aquaculture production and trade. Disease resistance is another most important trait for healthy aquaculture development in addition to stress resistance. Therefore, it is essential to uncover appropriate drugs for these diseases.

Singapore grouper iridovirus (SGIV-Gx) causes high mortality rates in mariculture, and effective treatments against SGIV-Gx infection are urgently required. Metformin is a famous drug for many diseases. ZUni et al. (2022) evaluated the therapeutic effect of metformin on SGIV-Gx. Results showed that metformin exerts a dose-dependent antiviral effect by disrupting SGIV-Gx particles, suggesting its great potential in dealing with SGIV-Gx infection. Li et al. (2022) assessed the in vivo antiviral effect of *Glycyrrhiza uralensis* components against SGIV infection. Results showed that the ingredients did not have significant effects against SGIV infection, whereas aqueous extract (GUF) showed significant anti-SGIV infection activity in a concentration-dependent manner, and it also destroyed the structure of virus particles, which is similar to the function of metformin.

In addition to medication, sets of gene responses to bacterial infection produce various effective proteins important for disease prevention mechanisms. Caspase genes are candidate genes because of their role in regulating apoptosis during development and inflammation. In Japanese pufferfish, 10 caspase genes were identified through bioinformatics analyses and detected in all examined tissues. The expression of 10 caspases significantly varied in a time-dependent manner after *Vibrio harveyi* infection, suggesting their roles in the antibacterial process of Japanese pufferfish (Yang et al., 2022).

It was reported that many young scientists chose a science career because of their love of the work (Pain, 2014). The China Society of Fisheries sponsors the "Young Scientist Award" and organizes the "Annual Conference of Youth Scholars" to promote the talents of young aquaculture researchers. Young scientists engaged in aquaculture studies, both applicable and theoretical, may enjoy both the "love" and productive reward from such work, because of the increasing need for technologies from the ever-expanding aquaculture industry. The Journal of the World Aquaculture Society welcomes high-quality submissions from young scholars from China or elsewhere in the world.

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## REFERENCES

China Fishery Statistical Yearbook. (2021). *Fisheries Administration of the Ministry of agriculture and rural areas* (p. 47). China Agricultural Press.

Dewitte, W., & Murray, J. A. H. (2003). The plant cell cycle. *Annual Review of Plant. Biology*, *54*, 253–264.

Duan, Y. F., Zhang, Y., Dong, H. B., Zheng, X. T., Wang, Y., Li, H., Liu, Q. S., & Zhang, J. S. (2017). Effects of dietary poly-β-hydroxybutyrate (PHB) on growth performance, intestinal health status and body composition of Pacific white shrimp (*Litopenaeus vannamei*) (Boone, 1931). *Fish & Shellfish Immunology*, *60*, 520–528.

Hang, Y., Hua, X. M., Li, X., Yi, W. T., & Cong, X. M. (2022). Effect of dietary level of folic acid on growth performance, blood biochemistry, antioxidant capacity and immunity of juvenile largemouth bass (*Micropterus salmoides*). *Journal of the World Aquaculture Society*, *53*, 836-847. https://doi.org/10.1111/jwas.12889.

Zhang, Q., Huang, Y. M., Ke, K., Li, M. M., Huang, S. S., Liao, W. Y., Li, P. F., Tong, T., Zhang, Q., & Liu, M. Z. (2022). Antiviral effect and mechanism of metformin against grouper iridovirus infection. *Journal of the World Aquaculture Society*, *53*, 879-883. https://doi.org/10.1111/jwas.12892.

Li, M. M., Liu, M. Z., Wei, H. L., Huang, L., Yu, Q., Huang, S. S., Li, J. Y., & Li, P. F. (2022). Antiviral activities of *Glycyrrhiza uralensis* components against Singapore grouper iridovirus. *Journal of the World Aquaculture Society*, *53*, 894-909. https://doi.org/10.1111/jwas.12878.

Li, S. L., Lian, X. Y., Chen, N. S., Wang, M. L., & Sang, C. Y. (2018). Effects of dietary vitamin E level on growth performance, feed utilization, antioxidant capacity and nonspecific immunity of largemouth bass, *Micropterus salmoides*. *Aquaculture Nutrition*, *24*, 1679–1688.

Li, X., Bai, Z., Luo, H., Liu, Y., Wang, G., & Li, J. (2014). Cloning, differential tissue expression of a novel hcApo gene, and its correlation with total carotenoid content in purple and white inner-shell color pearl mussel *Hyriopsis cumingii*. *Gene*, *538*, 258–265.

Li, X., Wei, X., Guo, X., Mi, S. C., Hua, X. M., Li, N., & Yao, J. (2020). Enhanced growth performance, muscle quality and liver health of largemouth bass (*Micropterus salmoides*) were related to dietary small peptides supplementation. *Aquaculture Nutrition*, *26*, 2169–2177.

Lian, X. Y., Chen, N. S., Wang, M. L., Yan, C. W., & Ding, G. T. (2017). Dietary vitamin a requirement of largemouth bass (*Micropterus salmoides*). *Chinese Journal of Animal Nutrition*, *29*, 3819–3830.

Liu, W., Wu, J. P., Li, Z., Duan, Z. Y., & Wen, H. (2018). Effects of dietary coated protease. On growth performance, feed utilization, nutrient apparent digestibility, intestinal and hepatopancreas structure in juvenile gibel carp (*Carassius auratus gibelio*). *Aquaculture Nutrition*, *24*, 47–55.

Liu, Y., Chen, P., Wang, Z. S., Lv, T. L., Li, X. X., Tian, H. Y., Zhang, Y. C., Cang, P. P., Chi, S., Sun, Y. Y., & Qiao, G. (2022). Dietary poly-β-hydroxybutyrate (PHB) supplementation can effectively improve growth, digestive enzyme activities, immune-related gene expression, disease resistance and intestinal mucosal barrier of gibel carp (*Carassius auratus gibelio*). *Journal of the World Aquaculture Society*, *53*, 816-835. https://doi.org/10.1111/jwas.12900.

Pain, E. (2014). An emerging global picture of early-career scientists. *Science Careers*, *2014*, 3–21. https://doi.org/10.1126/science.caredit.a1400023

Sahoo, T. K., Jena, P. K., Patel, A. K., & Seshadri, S. (2016). Bacteriocins and their applications of the treatment of bacterial diseases in aquaculture: A review. *Aquaculture Research*, *47*, 1013–1027.

Shiau, S. Y., & Huang, S. Y. (2001). Dietary folic acid requirement for maximal growth of juvenile tilapia, *Oreochromis niloticus* × *O. aureus*. *Fisheries Science*, *67*, 655–659.

Sun, M., Bai, Z., Fu, B., & Sun, T. (2020). Effects of β-carotene supplement in bait on. Inner shell color, tissue total carotenoids content and growth of different color strains in *Hyriopsis cumingii*. *South China Fisheries Science*, *16*, 80–86.

Wei, X., Hang, Y., Li, X., Hua, X. M., Cong, X. M., Yi, W. T., & Guo, X. (2021). Effects of dietary vitamin k3 levels on growth, coagulation, calcium content, and antioxidant capacity in largemouth bass, *Micropterus salmoide*. *Aquaculture and Fisheries*, in press. https://doi.org/10.1016/j.aaf.2021.08.004.

Xu, J., Zeng, L. B., Zhang, H., Zhou, Y., Ma, J., & Fan, Y. D. (2013). Cyprinid herpesvirus 2 infection emerged in cultured gibel carp (*Carassius auratus gibelio*) in China. *Veterinary Microbiology*, *166*, 138–144.

Yang, X., Liu, X., Yang, Z., Guan, Y. D., Zhao, R. H., Peng, H. Y., Cao, X. Y., Gao, M. H., Wang, S. H., & Jiang, C. (2022). Genome-wide characterization of caspase genes in Japanese pufferfish (*Takifugu rubripes*) and expression profiles in response to *Vibrio harveyi* infection. *Journal of the World Aquaculture Society*, *53*, 910-923. https://doi.org/10.1111/jwas.12904.

Yao, T. H., Wang, S. H., Xu, K. X., Zhang, X. P., Zhang, T. X., Wang, J., Wang, Z., & Mu, W. J. (2022). Biochemical, histological and gene expression analysis in brain and heart in *Phoxinus lagowskii* under sustained and diel-cycling hypoxia. *Journal of the World Aquaculture Society*, *53*, 860-878. https://doi.org/10.1111/JWAS.12901.

Zhang, J. P., Guo, B. Y., Zhang, M. Y., Li, J. L., & Bai, Z. Y. (2022). A StAR-like gene involved in carotenoid metabolism and inner shell color in the freshwater pearl mussel *Hyriopsis cumingii*. *Journal of the World Aquaculture Society*, *53*, 848-859. https://doi.org/10.1111/.jwas.12891.

Zhao, P. Z., Ouyang, L. L., Shen, A. L., & Wang, Y. L. (2022). The cell cycle of phytoplankton: A review. *Journal of the World Aquaculture Society*, *53*, 799-815. https://doi.org/10.1111/jwas.12916.