

6.3 Evaluation of application effects and summary of experiences

The application effects of these measures can be evaluated from the perspectives of water stability, physiological protection, and production performance. Ammonia management is especially important, because environmentally relevant ammonia exposure suppresses energy metabolism, increases oxidative damage, and impairs reproduction in the hepatopancreas of female swimming crab, while long-term exposure above 15 mg/L for 15 days causes severe hepatopancreatic damage and depressed cellular stress responses (Meng et al., 2021; Lu et al., 2022). These findings indicate that health management is effective when it prevents the combined rise of temperature and ammonia rather than treating them as separate hazards.

Experience from related aquaculture systems suggests that integrated monitoring and timely correction can produce clear management benefits, but outcomes still depend on keeping heat exposure within the species' physiological tolerance window. Predictive IoT-ML systems in tropical ponds maintained survival above 90% through continuous monitoring and repeated corrective interventions, and postharvest temperature-control studies in swimming crab products similarly show that low-temperature handling suppresses microbial growth and quality deterioration (Chen et al., 2023; Baena-Navarro et al., 2025). Overall, the main practical lessons are to monitor key water variables continuously, reduce organic and ammonia loading before stress accumulates, combine ecological regulation with animal-level stress mitigation, and respond early once pond temperature approaches 30°C-31°C, because risk rises sharply beyond that range (He et al., 2022; Lu et al., 2025) (Figure 2).

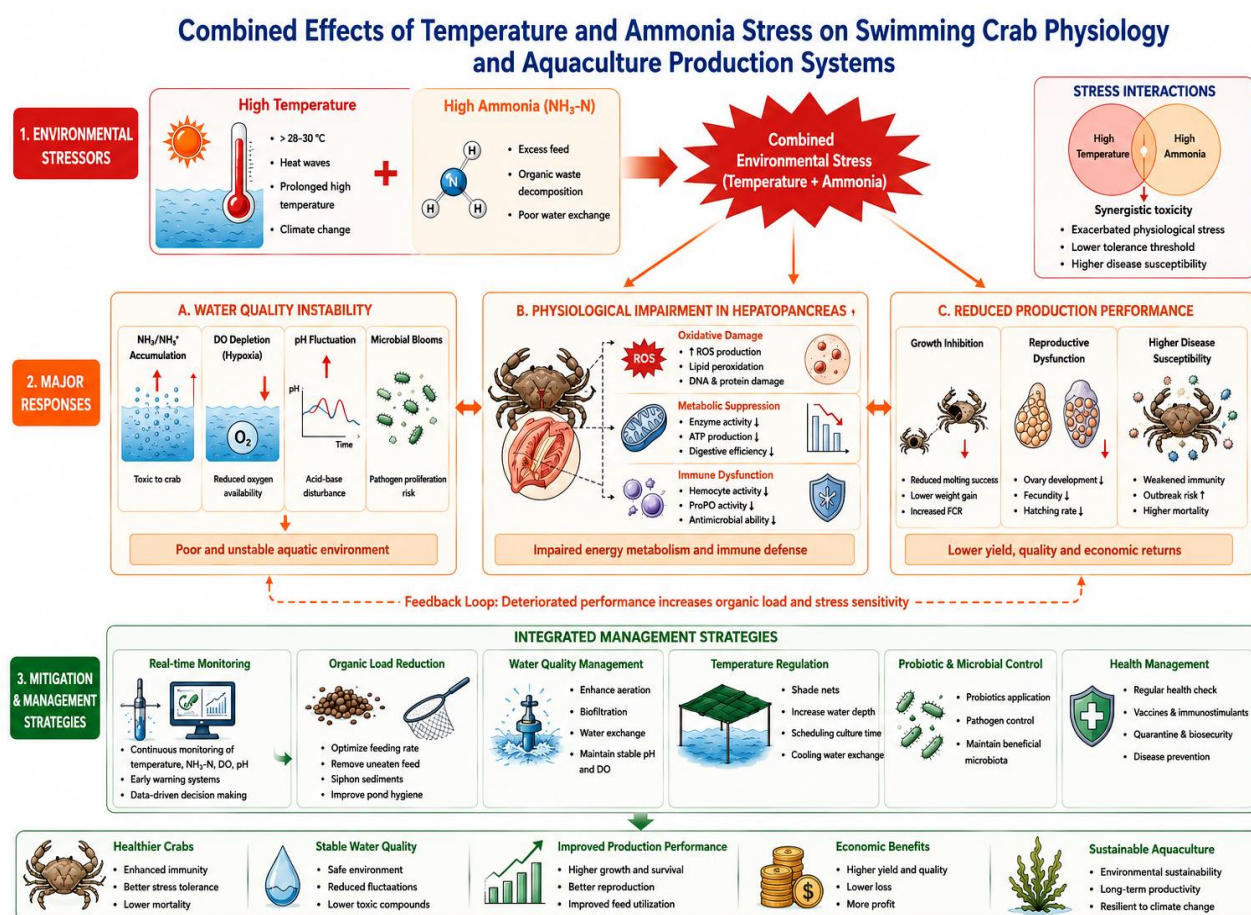


Figure 2 Environmental threshold levels and associated physiological risks in swimming crab aquaculture

7 Challenges in Health Management Under High Temperature

7.1 Management pressures arising from frequent extreme high-temperature events

Frequent extreme high-temperature events intensify the difficulty of maintaining the physiological stability of swimming crab culture systems because temperature directly affects crustacean metabolism, growth, moulting,