

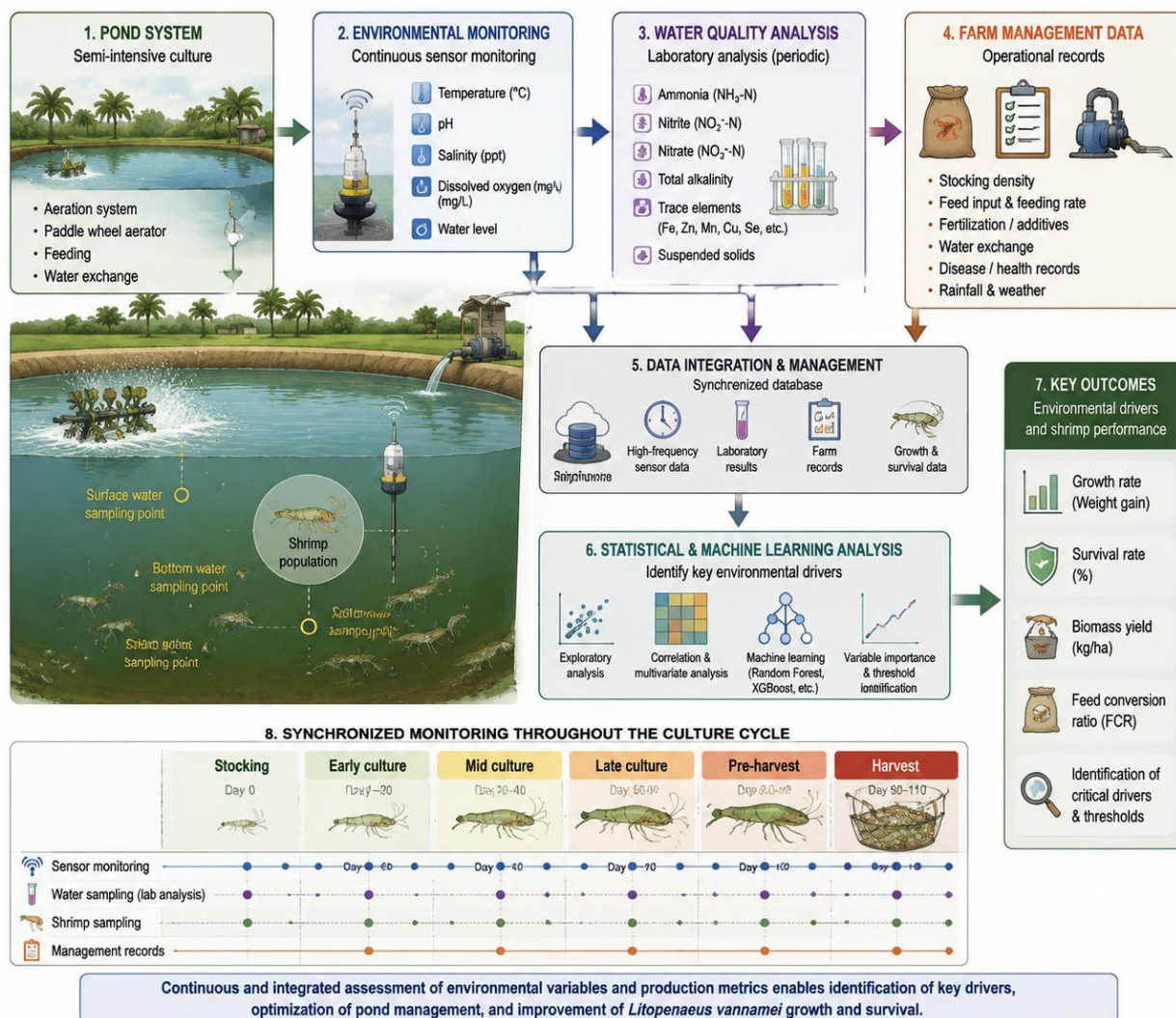


Figure 2 Integrated environmental monitoring framework for identifying environmental drivers of *Litopenaeus vannamei* growth and survival in pond aquaculture systems

6.3 Management implications derived from statistical results

The main management implication from these statistical results is that production gains depend less on any single target value than on maintaining stable, favorable water-quality conditions throughout the cycle. In commercial semi-intensive farms, dissolved oxygen showed a strong positive association with shrimp body weight and temperature showed negative correlations with survival and daily growth, while a separate regression-based sensitivity analysis found that dissolved oxygen variability had the largest effect on final production among the tested variables (Ruiz-Velazco et al., 2022). These findings support a management priority on aeration, oxygen stability, and rapid correction of thermal stress rather than relying only on feed or stocking adjustments (Srinivasan et al., 2025).

Statistical results also support broader operational decisions on stocking, water exchange, disease prevention, and long-term husbandry improvement. Water-quality suitability studies found that moderate stocking density and low-to-moderate water exchange improved shrimp productivity and water-use efficiency, while survey-based logistic regression in the Mekong region showed that disease risk was lowered by routine feed conversion calculations, training participation, and adaptive feeding responses to climatic events (Le et al., 2024). At the breeding and farm-management level, mixed-model evidence further suggests that improvements in aeration, water quality, stocking density, feed, and feeding regimes can mitigate biologically significant genotype-by-environment effects, indicating that statistical assessment should inform not only pond operations but also longer-term production strategy.