

Trade-off Between Stocking Density, Individual Growth, and Total Biomass Yield in Manila Clam Culture

Increasing stocking density reduces individual growth but increases total biomass yield up to a saturation point

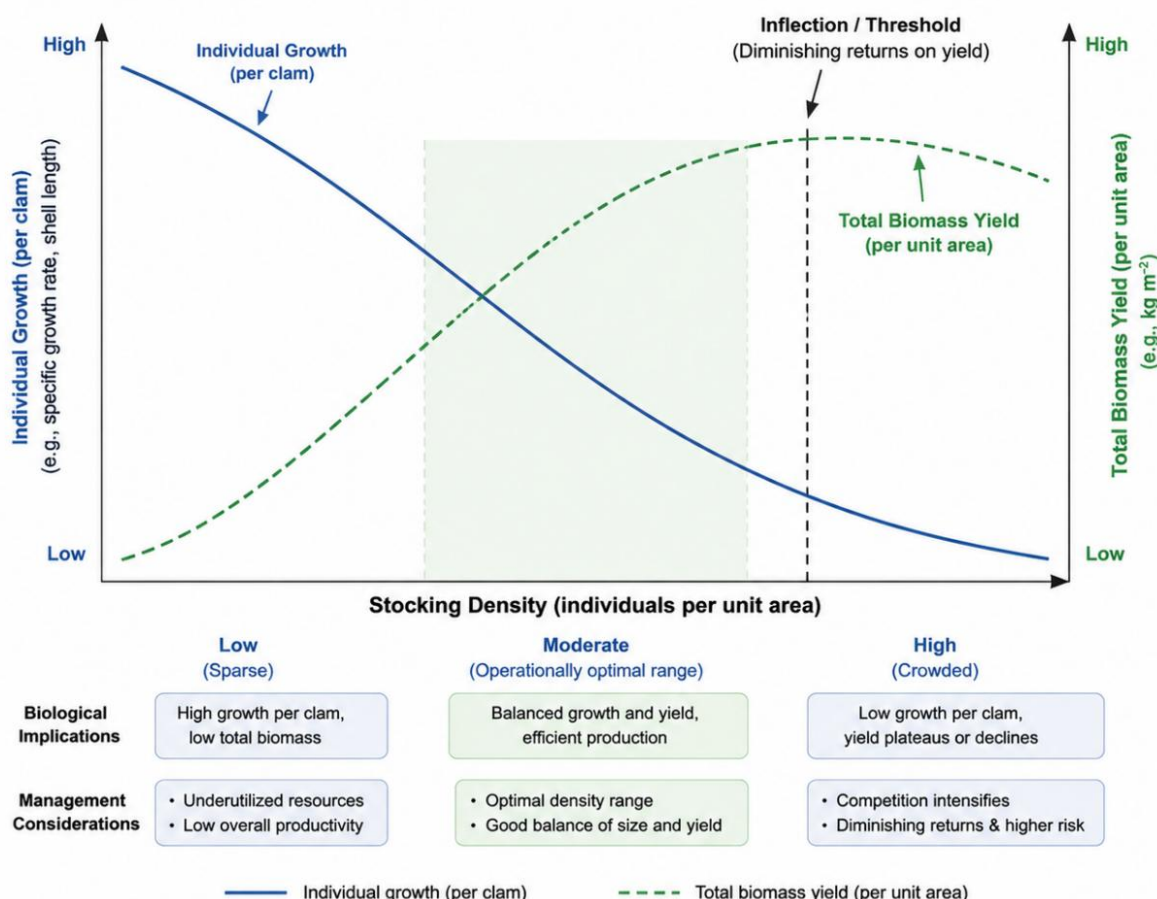


Figure 2 Conceptual trade-off between stocking density, individual growth, and total biomass yield in Manila clam culture systems

At the broader farming scale, excessive density reduces efficiency because stocked biomass can exceed local carrying capacity and convert added seed into mortality rather than harvest. In Jiaozhou Bay, ecological modeling indicated that current Manila clam culture was saturated, and that seeding at $2,500 \text{ ind} \cdot \text{m}^{-2}$ did not significantly improve output but instead increased mortality, reduced individual quality and fatness, and raised production costs (Liu et al., 2021). Long-term field analysis from Tokyo Bay reached a similar management conclusion: introducing juvenile clams beyond the biological productivity of the culture area did not sustain harvestable biomass, so economically feasible production requires matching seeding pressure to expected future stock contribution (Toba et al., 2020).

4.3 Analysis of density thresholds for optimal yield production

The evidence indicates that optimal density is stage-specific rather than universal. For larvae, the best range is low to moderate: $5\text{--}10 \text{ larvae} \cdot \text{mL}^{-1}$ supported normal growth in one hatchery study, whereas another study found that $10\text{--}15 \text{ larvae} \cdot \text{mL}^{-1}$ best balanced growth and survival across $5\text{--}20 \text{ larvae} \cdot \text{mL}^{-1}$. For early pre-fattening in controlled systems, growth remained satisfactory when water flow exceeded about $15 \text{ mL} \cdot \text{min}^{-1} \cdot \text{g}^{-1}$ fresh weight, showing that usable density thresholds depend partly on how much flow is available per unit biomass (Zanella et al., 2025).

For juvenile and grow-out phases, the most productive threshold is generally intermediate rather than extreme. In suspended lantern culture, $30,000 \text{ clams} \cdot \text{m}^{-2}$ was recommended because it maintained good percentages of sowable