

husbandry spectrum. For *C. farreri*, this logic supports using low, medium, and high density treatments that are clearly separated and still relevant to suspended production systems. Methodological rigor also requires minimizing size-related bias, because variation in initial body size can distort estimates of survivorship, yield, and the apparent optimum density if groups are not comparable at the start.

Density levels should be chosen with reference to both competition mechanisms and production goals. Semi-field work on *C. farreri* showed that increasing scallop density in a limited water column depleted seston and impaired growth, so the upper gradient should be high enough to test food limitation explicitly. At the same time, some scallop studies show that the commercially useful density is not always the density that maximizes individual growth, because optimal density depends on product size, grow-out strategy, and transfer timing. This is why the gradient should be designed not only to test whether low density grows faster, but also to identify a density range that balances shell growth, soft-tissue gain, survival, and unit-area output. A stepwise or staged density concept can also be justified, since larval studies found that production efficiency improved when density was reduced as animals developed and space demand increased (Mazón-Suástegui et al., 2022).

4.2 Experimental system and culture unit configuration

The experimental system should use a standardized suspended culture unit so that density is the main intentional variable. A strong design model is the semi-in situ flow-through seawater system used for *C. farreri*, which maintained continuous exchange with natural bay water while allowing density-dependent changes in seston, filtration, and biodeposition to be measured under controlled conditions. For grow-out trials, lantern-net or disc-based suspended units are appropriate because they match commercial farming practice and have already been used successfully to compare initial densities of *C. farreri* in inshore and offshore settings (Zhang et al., 2011). Unit dimensions, mesh size, layer number, and scallop number per layer should remain constant within each treatment series so that the experiment tests density rather than enclosure design.

Configuration should also account for space occupancy and water renewal inside each unit. Sea scallop work recommends keeping low-density nets below about 33% areal coverage, because growth in such nets did not decline during summer or fall from density effects alone. In *C. farreri*, a suspended culture design of eight-layer lantern nets with 30-cm diameter and 20-cm height per layer has been used in a one-year field study, providing a realistic reference for layer-based unit construction and stocking calculations. Experimental units should therefore be configured so that the low-density treatment remains clearly below crowding thresholds, while higher treatments approach levels at which food depletion and shell contact are more likely. Replication is also essential, and density experiments in scallops commonly use triplicate or higher replication to separate treatment effects from unit-level variability (Sühnel et al., 2024).

4.3 Experimental duration and process control considerations

Experimental duration should be long enough to capture growth trajectories and delayed mortality, not just short-term acclimation. Short trials can detect acute physiological responses, but density-dependent effects on growth and survival often emerge over months; for example, a *C. farreri* offshore study ran from May 2007 to March 2008 and showed that market size was reached after 10 months, with density effects expressed across seasonal growth peaks (Zhang et al., 2011). A one-year design is especially useful for this species because summer is a critical period when high temperature coincides with lower growth and higher mortality risk. If a full annual cycle is not feasible, the experiment should at minimum include the main warm season when density stress is most likely to be amplified.

Process control should include regular monitoring of water quality and animal condition throughout the trial. Previous *C. farreri* experiments measured temperature, salinity, current speed, chlorophyll a, and total particulate material concurrently with growth and survival, which provides the environmental context needed to interpret density responses mechanistically. Dissolved oxygen deserves specific attention because exposure below 4.5 mg/L reduced survival and depressed immune responses in *C. farreri* within 21 days. Sampling should therefore include periodic measurements of shell height, soft-tissue or muscle weight, and survival, while handling frequency should be minimized because transfer and repeated measurement can themselves elevate mortality in scallop stocking