

Dynamic regulation should also minimize the amplitude and rate of salinity change, because rapid shifts can impose physiological costs even in tolerant species. Machine-learning and sensor-integrated water-quality platforms now allow abnormal trends to be detected early and can automate interventions before water conditions become harmful. Pilot smart-aquaculture systems have shown that digital salinity controllers can stabilize estuarine ponds and accurately track real-time salinity shifts, supporting their use as practical management tools in variable environments (Prasetia et al., 2025). For yellowfin seabream, this means salinity management should aim not only to stay within a safe range, but also to maintain a stable trajectory that avoids repeated acute acclimation events.

7.2 Nutritional enhancement and health management strategies

Nutritional enhancement is a practical way to improve yellowfin seabream resilience when salinity cannot be held perfectly stable. Broad aquaculture evidence shows that dietary interventions can strengthen immunocompetence and stress resistance under environmental challenge, and that nutrient requirements often increase under stressful conditions. Functional nutrition is especially relevant under salinity fluctuation because vitamins, minerals, and amino acids influence mucosal integrity, antioxidant defense, cytokine activity, and immune-cell development, all of which are involved in salinity-linked health outcomes (Kari, 2025). These mechanisms are consistent with yellowfin seabream evidence showing that salinity shifts alter gut microbiota and activate either metabolic or immune-redox pathways depending on the rearing salinity.

More specific dietary strategies from related euryhaline fishes suggest how feeds could be optimized for yellowfin seabream culture. In black seabream, dietary cholesterol under low salinity improved ion reabsorption and osmoregulatory gene expression while reducing oxidative and inflammatory stress, indicating that membrane-related nutrients can directly support acclimation (Bao et al., 2022). In other salinity-stressed fishes, supplements such as myo-inositol and glutamine improved growth, antioxidant capacity, and ion-transport regulation, while selenium nanoparticles enhanced survival and immune performance during low-salinity stress and bacterial challenge. Therefore, health management in yellowfin seabream should combine salinity control with functional feeds targeted at osmoregulation, oxidative balance, and disease resistance rather than relying on environmental adjustment alone (Dildar et al., 2025).

7.3 Ecological aquaculture models and environmental adaptation strategies

Ecological aquaculture strategies under salinity variation should prioritize systems that match the natural adaptive capacity of yellowfin seabream. Because euryhaline species are inherently more suitable for variable-salinity production environments, they provide farmers with greater operational flexibility under climate-driven salinity instability. Recent work in juvenile yellowfin seabream also suggests that brackish-water culture can be advantageous, as 10 ppt conditions favored *Cetobacterium* enrichment and metabolic gene expression, whereas seawater conditions were associated with *Vibrio* enrichment and stronger immune-redox activation (Peng et al., 2025). This supports ecological models that use moderate brackish water as the baseline grow-out environment wherever local hydrology permits.

At the farm scale, environmental adaptation strategies should combine species selection, system diversification, and resilient infrastructure. Reviews of aquaculture under global change argue that cultivating euryhaline or native salinity-tolerant species is a key pathway for maintaining productivity in salinity-affected coastal and inland regions. More generally, farming euryhaline fish has been proposed as a climate-resilience strategy because these species can be reared successfully across different salinities without major loss of basic production capacity (Cusimano et al., 2025). For yellowfin seabream, an ecological aquaculture model should therefore integrate moderate-salinity water sourcing, real-time monitoring, gradual water exchange, and locally adapted production design so that environmental variability is buffered rather than simply endured. In yellowfin seabream aquaculture, the most effective environmental regulation strategy is to link real-time salinity control with targeted nutritional support and brackish-adapted ecological system design. This integrated approach is more consistent with the evidence than treating salinity, feeding, and health management as separate problems.