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Opinion Article

Adaptive Sanitation Strategies for Bio Secure Hatcheries in Modern Aquaculture

Romi Zachut*

Department of Aquaculture and Marine Biology, University of Primorska, Koper, Slovenia

DESCRIPTION

The production of healthy aquatic animals begins long before fish or shellfish enter ponds, cages, or recirculating systems. The hatchery represents the earliest phase of cultivation, where eggs, larvae, and juvenile organisms require controlled conditions that support healthy growth while limiting the introduction and spread of infectious agents. A bio secure hatchery applies carefully organized procedures that reduce biological risks through preventive actions rather than relying solely on treatment after disease appears. This approach creates an environment where water quality, animal movement, equipment use, personnel practices, and sanitation work together to maintain healthy production. As aquaculture continues to expand in many regions, hatcheries with organized biological protection have become increasingly valuable for maintaining consistent output and reducing financial losses associated with disease events.

Brood stock management directly influences the health of future generations. Adult animals selected for reproduction are often obtained from carefully documented sources with known health histories. Before entering breeding units, they may remain in separate observation areas where health evaluations are completed. Animals displaying unusual behavior or visible signs of illness are removed from breeding populations. This preventive approach reduces the possibility of transmitting infectious organisms to eggs or larvae. Maintaining detailed breeding records further supports long-term health management by identifying recurring issues and assisting with future selection decisions.

Egg handling requires careful attention because early developmental stages possess limited natural resistance to environmental challenges. Fertilized eggs are frequently disinfected using approved solutions that decrease microbial contamination without affecting embryo development. Equipment used during collection, transport, and incubation is cleaned thoroughly before reuse. Staff members handling eggs often follow specific hygiene procedures that include clean clothing, sanitized tools, and controlled work areas. Small improvements during this phase may contribute to higher survival rates during subsequent development.

Feed management represents another important element within a bio secure hatchery. Live feeds such as rotifers and Artemia may introduce unwanted microorganisms if produced or stored improperly. Many hatcheries maintain separate culture rooms dedicated to live feed production under controlled sanitary conditions. Commercial diets are stored in dry environments protected from moisture, pests, and contamination. Storage containers remain sealed until use, reducing exposure to environmental microorganisms. Feed preparation surfaces are cleaned routinely to prevent microbial accumulation that could affect young aquatic animals.

Employee awareness influences the effectiveness of every preventive measure. Workers receive training that explains sanitation routines, disease recognition, equipment handling, and emergency procedures. Handwashing stations, footwear disinfection points, and protective clothing become regular parts of daily work rather than occasional practices. Staff members understand the reasons behind movement restrictions between production areas, making compliance more consistent. Regular refresher training helps maintain these standards even as new employees join the facility.

Equipment sharing between tanks or production rooms can contribute to disease transmission when cleaning procedures are inconsistent. Many hatcheries assign nets, buckets, siphons, and measuring devices to individual production units. Color-coded equipment simplifies identification and reduces accidental exchange between sections. After use, tools undergo washing and disinfection before storage. This organized system minimizes opportunities for microorganisms to spread throughout the facility while improving operational efficiency.

Waste management contributes significantly to maintaining sanitary conditions. Organic material removed during tank cleaning can become a source of microbial growth if left untreated. Dead animals are collected immediately and disposed of according to established procedures. Wastewater passes through treatment systems before discharge, reducing

Correspondence to: Romi Zachut, Department of Aquaculture and Marine Biology, University of Primorska, Koper, Slovenia, Email: romi.zachut@upr.si

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environmental contamination and limiting opportunities for disease organisms to circulate within surrounding aquatic environments. Clean storage areas and scheduled waste removal further improve overall facility hygiene.

CONCLUSION

Future development of bio secure hatcheries will continue to combine biological knowledge, engineering improvements, digital monitoring, and responsible operational practices. As aquaculture production expands across diverse environments, preventive health management remains an effective approach for producing healthy aquatic animals while supporting environmental responsibility and long-term productivity. Through disciplined sanitation, organized facility design, continuous observation, and informed management, bio secure hatcheries contribute to reliable juvenile production that benefits producers, researchers, and aquatic food systems across many regions of the world.