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Perspective

Benefits of Integrated Multi-Trophic Aquaculture Systems

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DESCRIPTION

Fishing and aquaculture remain to be significant sources of food, nutrition, income, and livelihood for hundreds of thousands of people globally. The rise of the fisheries and aquaculture industries has resulted in the development of innovative culture techniques and the enhancement of culture systems for the blue revolution. One such system is Integrated Multi-Trophic Aquaculture (IMTA). IMTA is an intensive and synergistic cultivation of many species inhabiting different trophic levels of the water column that uses water-borne nutrients and energy transfer. IMTA promotes economic viability and ecological sustainability by converting leftovers and uneaten feed from fed organisms into harvestable crops. It has also been the focus of multiple initiatives in a variety of countries. Along with rising productivity, there is a growing demand for practitioners of integrated multi-trophic aquaculture. This technique, known as Integrated Multi-Trophic Aquaculture (IMTA), is based on a natural notion in which an organism of one species always finds a feeding niche in the waste produced by organisms of another species. IMTA entails cultivating various aquatic species from different trophic levels in an integrated manner in order to boost system efficiency, reduce waste production, and deliver bio-remediation-like ecosystem services.

IMTA involves selecting, arranging, and distributing various components and/or species in the system so that both particulate and dissolved waste products created by fish farms can be absorbed and utilized. The system architecture and species used should be engineered to maximize waste product recapture. Larger organic materials, such as uneaten feed and faeces, which drop below the cage system, could be exploited and eaten by bottom feeders in the marine environment, such as sea urchins and sea cucumbers. At the same time, fine suspended particulate matter is filtered out of the water column by filter-feeding species such as oysters, mussels, and scallops. The seaweeds, which are placed in the direction of water flow, a little further away from the site, help to remove some of the inorganic dissolved nutrients from the water, such as phosphate and nitrogen. Species cultivated in IMTA should be economically viable as aquaculture products and generated at densities that optimize waste material uptake and utility throughout the production cycle. IMTA involves culturing fed aquaculture species (e.g., finfish and shrimp) with extractive species that use the system's organic (from shellfish and herbivorous fish) and inorganic (from seaweed) wastes for growth, resulting in a balance between systems for environmental sustainability (biomitigation), social acceptability with better management practices, and economic stability that provides product diversification and risk reduction.

Benefits of IMTA

Effluent bio-mitigation is the process of reducing effluents by the use of bio-filters that are appropriate for the ecological niche of the aquaculture site. This has the potential to address a number of the environmental issues raised by monoculture aquaculture.

- Effluent reduction by using bio-filters (bio-mitigation)
- An overall economic boost from utilizing the extractive powers of species at various trophic levels. Waste from integrated multi-trophic aquaculture systems is considered a resource for bio-filter culture.
- Increased employment at the local level.
- Disease prevention or reduction by some extractive species, such as seaweed, due to their antibacterial qualities against fish pathogenic bacteria.
- Profit increase by getting eco-labeling and organic certification programs.
- IMTA significantly reduces the environmental cost of aquaculture while increasing farm assimilation capacity.

The monoculture system looks to be slowing down in the current context due to high input costs, resulting in the prevalence of IMTA. The integrated multi-trophic aquaculture system is environmentally stable and poses few to no socioeconomic challenges. As all components of the system work as a resource for its appropriate niche or trophic level, IMTA provides profitability in the production system. As a result, it is correct to assert that IMTA implementation could result in increased productivity and better resource use. Stakeholders may be given greater incentives if they adopted the IMTA culture system.

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