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## Integrated multi trophic aquaculture (IMTA): An innovation technology for fish farming in India

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**Abstract**

The Integrated multi trophic aquaculture involving fed species with organic extractive species and Inorganic extractive species that utilize wastes from aquaculture for their growth. The IMTA concept is very easy and flexible. IMTA systems can be land-based or open-water systems such as marine or freshwater systems, and may comprise several species combinations (Neori *et al.*, 2004).

Some IMTA systems have included such combinations as shellfish/shrimp, fish/seaweed/shellfish, fish/shrimp and seaweed/shrimp (Troell *et al.*, 2003). The combination of fish/seaweed/shellfish is very important for IMTA because this combination is cover all trophic level of water bodies. To the aims of IMTA is “*To ecologically engineer system for environmental sustainability, economic sustainability and societal sustainability.*”

**Keywords:** IMTA, aquaculture, extractive species and sustainability etc.

**1. Introduction**

Populations around the world face questions of food security today on a scale that has not been seen in recent human history. The evolution of how we feed our populations and the technologies we use to do it have created a unique set of circumstances that bring with them unique challenges, and despite significant advances in food production and our knowledge of food nutrition and food safety, hunger continues to millions of people around the world. It is thought that over a billion people in the world are currently undernourished (World Food Programme, 2010).



**Fig 1**

**1.1 Integrated Multi Trophic Aquaculture**

Recent study about IMTA by Barrington (2009) <sup>[1]</sup> is the practice which combines the cultivation of fed aquaculture species (e.g. finfish/shrimp) with organic extractive aquaculture species (e.g. shellfish/herbivorous fish) and inorganic extractive aquaculture species (e.g. seaweed) to create balanced systems for environmental sustainability (biomitigation) economic stability (product diversification and risk reduction) and social acceptability (better management practices). This system is entirely different from the ‘Polyculture’.

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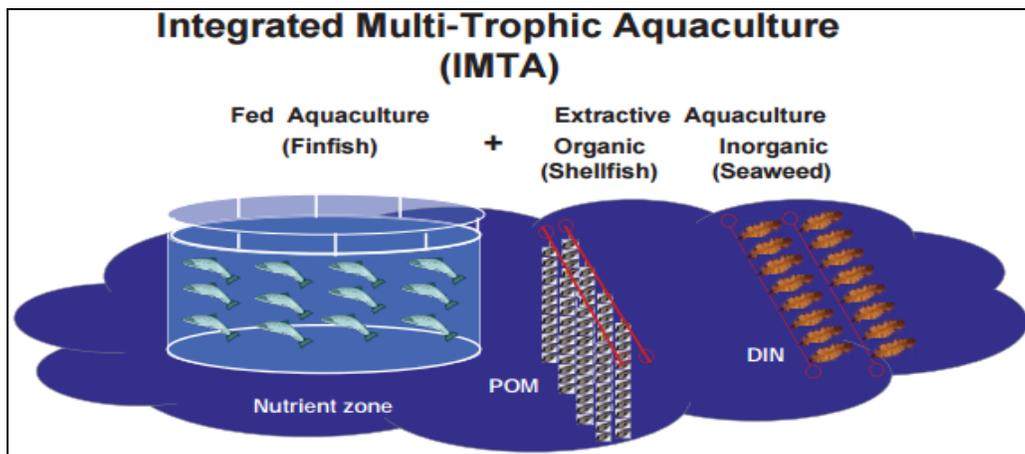
In the Polyculture system fish share the same bio and chemical process which could eventually lead to shift in ecosystem. Another way to Define of IMTA is the farming of aquaculture species from different trophic levels and with complementary ecosystem functions, in a way that allows one species' uneaten feed and wastes, nutrients and by-products to be recaptured and converted into fertilizer, feed and energy for the other crops, and to take advantage of synergistic interactions between species. IMTA is based on principle "The solution to nitrification is not dilution but extraction and conversion through diversification."

## 2 Integrated Multi Trophic Aquaculture system

### 2.1 System design

An IMTA operation needed the selection and placement of various types of components or species. The system design should be engineered to optimize the recapture of waste products. As larger organic particles, such as uneaten feed and

faeces, settle down the cage system, they are eaten by deposit feeders, like sea cucumbers and sea urchins. At the same time, the fine suspended particles are filtered out of the water column by filter-feeding animals like mussels, oysters and scallops. The seaweeds are placed a little farther away from the site in the direction of water flow so they can remove some of the inorganic dissolved nutrients from the water, like nitrogen and phosphorus. In simple meaning of this system the main component is fed aquaculture species is eat some types of food after food some uneaten food in water, this uneaten food used by organic extractive aquaculture species after that release some gases and this some gases used by inorganic extractive aquaculture species, this system is IMTA system. IMTA species should be economically viable as aquaculture products, and cultured at densities that optimize the uptake and use of waste material throughout the production cycle.



**Fig 2:** Conceptual diagram of an integrated multi-trophic aquaculture (IMTA) operation combining fed aquaculture (finfish) with organic extractive aquaculture (shellfish), taking advantage of the enrichment in particulate organic matter (POM), and inorganic extractive aquaculture (seaweeds), taking advantage of the enrichment in dissolved inorganic nutrients (DIN)

### 2.2 Criteria for selection of fish

The following important criteria for selection of fish in IMTA system.

- Adaptation to tropical environment
- Acceptance to all types of feed like natural and artificial feed
- Amiability to live together
- Compatibility
- High Market demand
- High market prices

### 2.3 Fish Feed

Fish are largely respond well to natural and commercial fish feed. Their diets need to be well balanced in terms of amino acids, proteins, fats, vitamins, minerals and carbohydrates etc. in order to achieve good growth and survivability.

## 3. Trial on Integrated Multi Trophic Aquaculture (IMTA) in a participatory mode in India

This trail is conducted at Mandapam RC in Munaikadu

Village. In this system 3 numbers of low cost cages stocked with cobia fingerlings @ 100 nos per cage (20 cm length and 50 g average weight) and also done on 720 kg seaweed was used for integrating with the cages. Cages were stocked - first week of April 2014. A total of 12 nos of seaweed rafts @ 60 kg of seaweed per raft were integrated with the cobia cages during second week of September 2014. Daily feeding of the fishes with low value fishes, maintenance of cages and the required watch and ward were done entirely by the fishermen group. The harvest was made on 30th October 2014. A total of 652 kg of cobia was harvested. The length ranged from 59 to 83 cm and weight ranged from 1.8 to 4.2 kg (average weight 3.25 kg). The farm gate price of cobia realized was Rs. 210 per kg. The total seaweed harvested was 2700 kg wet weight and harvested seaweed was used as seeding material for the next crop. It was observed that the seaweed rafts integrated with cobia cages had a better average yield of 225 kg per raft in contrast to 150 kg per raft of others which were not integrated.



**Fig 3:** Launching of cages for IMTA trial



**Fig 4:** Launching of cages near the seaweed farm



**Fig 5:** Stocking of Cobia seed inside the cages for IMTA



**Fig 6:** Harvested seaweed and cobia from IMTA

**4. Conclusion**

In this study, Few general trends and attitudes can be identified, and areas for future research. In IMTA multi tropic sub system are integrated. It refer to more inlensere cultivation of different species in proximity to each other which are linked by nutrient and energy transfer through water. The open sea IMTA in India is very recent, however, many investigation have been carried out in the beneficial Polyculture of the various mariculture species. However, many people remained unconvinced that proper management practices will be applied to any aquaculture system. According to the EU survey (Seafood Choices Alliance 2003), 76% of consumers felt they do not have enough information about the seafood available to them. The Canadians who participated in the DFO focus group study (2005) felt manipulated and misinformed because of the too dominant and negative information flow, which is noticeably uncontested.

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