

Insights of Inland Aquaculture in Andaman and Nicobar, India

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Abstract

Andaman and Nicobar Islands (ANI) in the Bay of Bengal are well known for their pristine waters and tropical ecosystems. Fisheries is a major livelihood and employment generating sector in the island and are well supported by the presence of marine, brackish water and freshwater ecosystems and the associated aquatic diversity. Fresh water aquaculture gained more importance in the Islands due to the domestic market and consumer demand. Due to the steady growing demand and the inability to meet out the requirements, freshwater fishes are also imported from the mainland India for consumption as well as culture. Keeping in view of the above-mentioned, this paper briefly outlines some thrust areas which can be focused for further development of the sector. Appropriate policy directive and roadmap is essential to streamline the development activities in a coordinated manner for sector development and diversification.

Keywords: *Inland fishery, freshwater aquaculture, potential, tropical island, food security*

Introduction

Freshwater aquaculture plays a very important role in livelihood and food security of the local communities. Indian Major carps (IMCs), catfishes and freshwater prawns mainly contribute to the freshwater fish production in the islands. Some important fishes available in the local market with good demand are Indian Major Carps, Magur (*Clarius batrachus*) Singhi (*Heteropneuste sfossilis*), Koi, *Anabas testudineus*, Featherbacks (*Notopterus notopterus*.) etc.(Rajan and Sreeraj 2014; Kiruba Sankar et al 2018). In retrospective, there were various

research activities carried out such as breeding and seed production of freshwater fishes (Mustafa 1985; Sarangi *et. al.*, 1993), cryopreservation of fish milt (Sarangi *et.al.*, 2001), species diversification (Dam Roy *et al* 2013), feed based aquaculture practices (Sivaramakrishnan *et al.*, 2017), integrated farming models (Velmurugan *et al* 2018) and non- native species management (Kiruba Sankar *et al.*, 2018) etc. Over the past few years, adequate emphasis is also given on the aspects of aquatic health management and its role in better fish production in the Islands (Saravanan *et al.*, 2015; 2020).

Table 1. Minor irrigation ponds in A & N Islands used for Pisciculture practices as on 31st March 2019

Sl. No.	District / Place	Fish Farmers	Freshwater ponds (No.)	Water Spread Area (Ha)
1	South Andaman District	714	863	55.71
2	North and Middle Andaman	1860	1971	143.00
3	Nicobar District	40	46	2.76
	Grand Total (A+B+C)	2614	2880	201.69

Source: Department of Fisheries, Andaman & Nicobar Islands

Despite the potential of aquaculture sector (table 1) and its contributory role in food security the sector has been facing various issues that remain a drawback for

entrepreneurs who are willing to actively venture in the sector. Some of the important issues that were identified are,

- Unavailability of quality seed for breeding and seed production purposes
- Extensively managed ponds that doesn't support good production
- Limitations in skilled manpower
- Limitations in naturally available resources which are candidate for aquaculture
- Adverse weather conditions
- Limitations in water supply and other aquaculture-based inputs.
- Some of the areas that can be focused for sector development are outlined in the subsequent subsections.

and seed production of the endemic fishes found in the Islands. Even though the demand for endemic is low at present, the species has got good potential in future and can be popularized.

Freshwater ornamental fish culture

Freshwater ornamental industry is picking up pace in the Islands with several outlets opened in recent times focusing on marketing of ornamental fishes. Developing breeding and seed production of the candidate ornamental fishes and dissemination of such technologies can be beneficial for employed youths to adoption and income generation. At present, the freshwater ornamental business is focused on exotic ones brought from mainland India as they are most popular among the aquarium hobbyist.

Harnessing the potential of native fishes

Some of the fishes of the Island ssuch as *Mugilogobius tigrinus*, *Redigobius oyensi*, *Danio rerio*, *Rasbora* species, the endemic killifish *Apocheilus andamanicus*, *Channa roy* have got good ornamental values (Kiruba-Sankar et al 2018; Praveenraj et.al2018). Thrust can be given to harness the species that are found in the natural water bodies through breeding and seed production technologies. Focus should be on developing breeding

Recirculatory aquaculture models

One of the constraints in the freshwater aquaculture sector is the availability of water as the Island face water shortage during the period of Jan to May being the dry periods. Recirculatory system with zero water exchange models could be best suited for Islands conditions particularly for the indoor structures (Haridas et al2019). Aquaponic and biofloc units with zero water exchange can be best suited (Fig. 1).

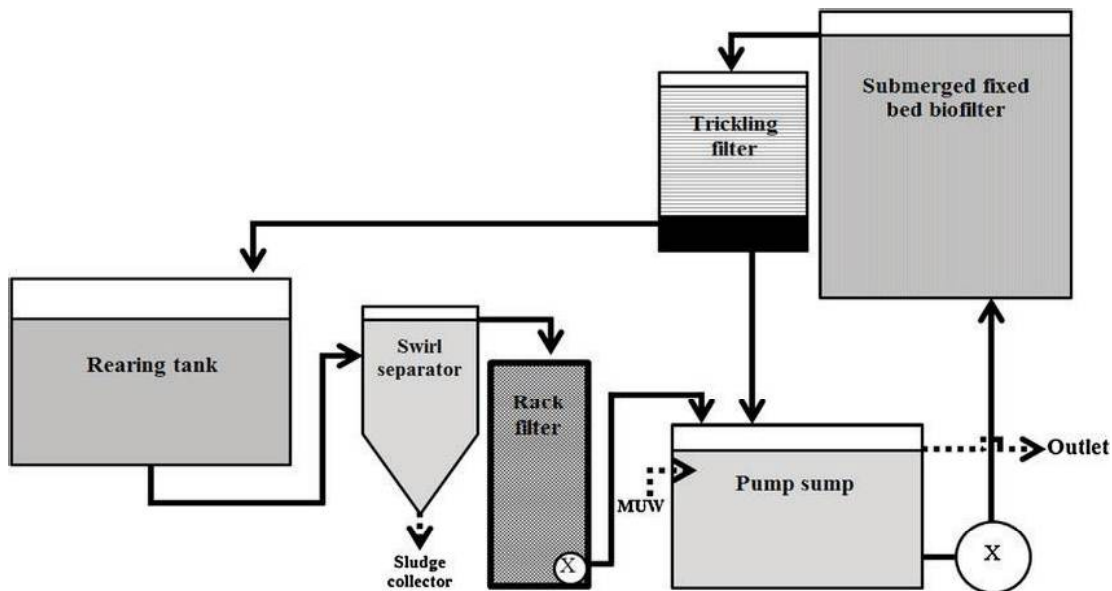


Fig. 1. Recirculatory aquaculture model

Composite fish culture

Composite fish culture with Indian Major Carp Catla, Rohu and Mrigal could give an additional income in comparison to single species culture. Amongst the technology disseminated, composite fish culture was found to have good acceptance, adoption, spread for the Islanders (Zamir Ahmed *et.al.*2017). All the species cultured in composite culture practices are having good market demand and hence the culture model is economically beneficial for the fish farmers.

Freshwater fish seed production

Breeding experiments in fresh water fish culture fishes and training to farmers in North Andaman with various aspects of induced breeding provided the scope for enlarging fish seed production. The ponds of various sizes ranging from 50x50 sq. feet to 120x 100 sq. feet are available in Andaman islands and water temperature play a crucial role. Mustafa (1985) succeeded with induced spawning of Indian Major Carps in the farmers pond of Andaman utilizing fish pituitary hormone. He achieved success in spawning of *Rohu* and *Catla*. The catching can be distributed to farmers through network or purchase by fisheries department.

Culture of Giant freshwater prawn

Fresh water prawn (*Macrobranchi umroenbergii*) along with Major carps are gaining ground particularly in North and Middle Andaman. Several culture experiments have also been done in experimental scale in the Central Agricultural Research Institute, Port Blair. Dam Roy *et.al.*, (2006), Dam Roy *et.al.*, (2007), Dam Roy *et.al.*, (2009), Sarangi *et.al.*, (2003) dealt with the scope of culture and actual experiment on freshwater prawn in the islands, which is found to be promising. Distribution of a wild fresh water prawn species *Macrobranchium lar* instreams, nullahs and river in comparatively less attended state. *Macrobranchium lar* may be a good cultivable species, because of availability of seed in wild state, fast growth, stress tolerance and palatable nature (Sarangi *et.al.*, 2001, Sethi *et.al.*, 2009)

Integrated farming options

Some of the most prudent crop + aquaculture methods and technologies suitable for tropical island condition to deal with water logging, salinity and climate change are discussed below (Fig. 2):

Agri-horticulture based fish farming system

Considering the multiple uses of different combinations under agriculture and allied component, integrated model could be productive and such systems were also demonstrated to farmers of Andaman. The agri-horticultural component is one of the most common integral components of the farming system in the Islands and can be recommended for integration with fishery component considering the high-income potential (Choudhuri *et al* 2009). Pond based Integrated Farming System (IFS) have a great potential and can also ensure steady income as well as reducing the risk of farming from any uncertain conditions.

Paddy cum fish culture system

In the coastal areas integrating aquaculture with agriculture by paddy cum fish culture assures higher productivity and year-round employment opportunities for farmers. Indian major carps such as catla, rohu and mrigal can be used in paddy cum fish culture models and the system can be helpful in generating additional income to the dependent farmers (Velmurugan *etal* 2018).

Broad bed and furrow system (Fish+vegetables)

Construction of raised beds and furrow involves excavation of deep furrows alternated with the raised beds by using excavated soils. Thus, raised bed system initiated in the low-lying waterlogged areas could improve the drainage of the beds. Such raised beds also prevented the entry of tidal and runoff water in the furrow. Indian Major carp and freshwater prawn can also be cultured in such conditions to ensure additional income benefits (Velmurugan *et.al* 2018).



Paddy-fish system



Raised bed and furrow (vegetable+fish)

Fig. 2 Fresh water fish production in integrated system**Key strategies for sector development**

Precautionary approach is essential in case of non-native species management towards aquaculture diversification (Kiruba-Sankar *et al.*, 2018). Integrated farming model should be popularized further in which fishery-based components should play a contributory role in income. Fish farmers should be more sensitized on the recent advances in the aquaculture sector and the best possible ways to adopt such technologies for adoption. Species diversification should be aimed by introducing high value, and potentially non-invasive fishes.

The sector is struck with management issues that need to be resolved for better production and productivity. The areas outlined in our paper are some of the retrospective works that were carried out in the Islands. We hereby also recommend that such activities should be continued further however, management should be proper with recent techniques. We believe that practices that integrate horticulture and agriculture components along with fisheries could be more beneficial to the dependent farmers.

Conclusion

Despite being an archipelago, due to its demographic pattern, freshwater fish culture is also very popular

amongst the settlers of the island. There is a growing demand for freshwater fishes. Research organization like ICAR-CIARI Port Blair is providing the Technological back up for last four decades. The KVKs located at three Districts of Andaman & Nicobar Islands are engaged in On-Farm Trials (OFTs), Field Level Demonstrations (FLDs) etc. Fisheries department, apart from supply of seeds of culturable freshwater fishes to the farmers of Andaman and Nicobar Islands and also implemented numerous schemes for popularization of freshwater fish culture. Subsidy for construction of nursery pond and purchase of breeding materials, including breeding hapas (outer and inner hapas), fry collection net, artificial hormones (Ovaprim / Ovatide) for induced breeding of fishes; as well as providing pelleted feed for fish culture will significantly improve the fresh water production in the islands. However, it is of prime importance that adequate bio-security measures have to be taken to ward off unwarranted invasive species and dreadful diseases, which are detrimental to the aquatic environment by establishing quarantine facilities.

References

Choudhuri, N.C., Singh, L.B., Singh, A.K., Dam Roy, S, Srivastava, R.C., Subhash Chand,, Kanaklata & Damodaran, V. (2009). Horticulture in Integral part

- of Integrated farming System. In National Workshop cum Seminar on status and future strategies of Horticulture Developed in A& N Islands. 23rd to 25th January 2009 p 187-188
- Dam Roy, S., Roy, B.C. & Kiruba Sankar, R. (2013) Towards diversification of aquaculture in Andaman and Nicobar Islands with Jayanthi Rohu (CIFA-IR-A) in the *Journal of Andaman Science Association*. 18(2):131-134.
- Harsha Haridas, Dam Roy, S., Subramani, T. Saravanan, K., Benny Varghese & Murugesan, S. (2019). Evaluation of Sustainable Aquaponics System Incorporating Fisheries and Agri-components under Island condition. Annual report of ICAR-CIARI Port Blair (2018-19) p 145.
- Kiruba Sankar, R., Praveenraj, J., Saravanan, K., Kumar, K.L., Angel, J.R.J., Velmurugan, A. & Dam Roy, S., (2018). Invasive Species in Freshwater Ecosystems - Threats to Ecosystem Services. In: Sivaperuman et al., (eds.). Biodiversity and Climate Change Adaptation in Tropical Islands. Academic Press, London, pp. 791.
- Mustaffa Arif, M, (1985) Observation on the seed production of Indian Major Carps in Andamans by hypophysation. *Journal of Andaman Science Association*. Vol.1 no.2.p 86-92.
- Praveenraj, J., Knight, J.M., Kiruba Sankar, R., Hallaluddin, B., Raymond, & R.J., Thakur, V.. (2018). *Channaroyi*, a new species of snake head from Andaman Islands. *Indian Journal of Fisheries*. 65(4):1-14.
- Rajan, P.T & Sreeraj, C.R. (2014). " Invasive freshwater fishes and its threat to the biological diversity in Andaman and Nicobar Islands." In the *Journal of the Andaman Science Association*." 19(1):88-98
- Sarangi, N., Dorairaj, K & Nagesh Ram (1993). Major carp seed production for sustained productivity in Andamans." In: Proceedings of the National Symposium "Island Ecosystem and Sustainable development" Edited by B.Gangwar and K.Chandra p 176-183.
- Sarangi, N, Tripathi, S.K, Mandal, A.B & Ahlawat, S.P.S. (2001). Fishmilt cryopreservation and improvement of genetic diversity. *Journal of the Andaman Science Association*. 17 (1&2):257-261.
- Saravanan, K., Baruah, A., Praveenraj, J., Anuraj, A., Raymond Jani Angel, J., Venkatesh R Thakur., Sivaramakrishnan, T., Lohith Kumar, K., Puneeth Kumar, P., Kiruba Sankar, R. & Dam Roy, S., 2015. Overview of Aquatic Animal Diseases in Andaman and Nicobar Islands. *Journal of Immunology and Immunopathology*, 17(1): 17-24.
- Saravanan, K., Puneeth Kumar, P., Praveenraj, J., Baruah, A., Sivaramakrishnan, T., Sathish Kumar, T., Pramod Kumar, S., Kiruba Sankar, R. & Dam Roy, S. (2017). Investigation and confirmation of white spot syndrome virus (WSSV) infection in wild caught penaeid shrimps of Andaman and Nicobar Islands, India. *Virus Disease*, 28(4): 368-372.
- Saravanan, K., Shailesh Kumar, Praveenraj, J., Meena, B.L., Kasinath, B.L., Kiruba Sankar, R. & Dam Roy, S. (2020). Molecular characterization of muscle infecting *Myxobolus* sp. causing outbreak in *Labeorohita*, Rohu: First report from Andaman Islands. *Indian Journal of Animal Research*, DOI 10.18805/ijar.B-3931
- Sivaramakrishnan, T., Shalini, B., Saravanan, K., Kiruba Sankar, R., Varghese, B. & Dam Roy, S. (2017). Developing Low-cost Fish Feeds in Andaman and Nicobar Islands. *World Aquaculture*, June 2017: 65-68.
- Velmurugan, A., Dam Roy, S., Swarnam, T.P., Subramani, T. & Jaisankar, I. (2018). Crop+ Aquaculture practices for enhancing farm production in Coastal degraded lands. *Journal of Andaman Science Association*, 23(2):124-130.
- Zamir Ahmed, S.K, Dam Roy, S, Velmurugan, A & Srivastava, A (2017). "Impact of technological intervention in Andaman." In the *Journal of the Andaman Science Association*, 22 (1).p 44-51.