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Technical note

Community based fish nurseries at Kirawana and Rajawewa in the Ampara district, Sri Lanka: A success story

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Abstract

Under the Aquatic Resource Development and Quality Improvement project (ARDQIP) of the Ministry of Fisheries and Aquatic Resources Development of Sri Lanka, 25 community-based mini-nurseries involving community groups were established in 10 districts of Sri Lanka. Of these, two were established at Kirawana and Rajawewa in the Ampara district in 2006. Each fish nursery established on lands with an extent of 0.8 ha, consisted of 10 mud ponds with water area of around 4,500 m^2. Fish fry of Nile tilapia, catla, rohu, mrigal and common carp were reared upto fingerling stage in these mini-nurseries. In general, 3 culture cycles (range from 45-70 days) have been carried-out per annum. Average number of fish fingerlings produced per culture cycle during 2013-2014 were 242,301 (Kirawana) and 262,935 (Rajawewa). Average survival rates from fry to fingerling stage achieved in Kirawana and Rajawewa mini-nurseries were 71.8% and 79.2% respectively. Production cost per fingerling was Rs. 0.69 and Rs. 0.76 respectively for Kirawana and Rajawewa. Net profit obtained per annum was Rs. 953,085.00 in Kirawana and Rs. 974,643.00 in Rajawewa [In May 2016, 1 USD ≈ Rs. 146.9]. Net profits earned by operating mini-nurseries were seven times higher, when compared with the profits generated through paddy cultivation on a land of similar extent. During 2009-2014 period, these mini-nurseries collectively made a contribution of 20.3% to the total fish fingerlings stocked in the Ampara district. Rearing of fish fry to fingerling stage is a very profitable enterprise for rural communities and well-managed fish nurseries can play an important role in meeting the fingerling requirement to develop culture-based fisheries in inland reservoirs of the country.

Keywords: Fry-to-fingerling rearing; Indian carps; mini-nurseries; Nile tilapia; rural aquaculture

Introduction

Aquatic Resource Development and Quality Improvement project (ARDQIP) of the Ministry of Fisheries and Aquatic Resources Development of Sri Lanka, which was in operation during 2003-2010 period, implemented several activities aimed at enhancing fish seed production of the country. These activities included increasing fish seed production capacity of National Aquaculture Development Authority of Sri Lanka (NAQDA) through expanding hatchery capacities, increasing broodstock, nursery and rearing capacities, provision of new and improved brood-stocks, implementation of genetic improvement programmes and introduction of cryopreservation technology, establishment of community-based fish nurseries and promotion of small-scale fish nurseries managed by the private sector.

Under ARDQIP, 25 community-based mini-nurseries were established in 10 districts during 2004-2007 period (ARDQIP 2010), to demonstrate profitability of fish seed production and to motivate rural communities to get involved in fry-to-fingerling rearing apart from meeting the fingerling requirement especially for the development of culture-based fisheries. Accordingly, two mini-nurseries were also established at Kirawana and Rajawewa in the Ampara district of the Eastern province of Sri Lanka.

This paper discusses the contribution made by these two nurseries towards supplying fish seed requirements of the Ampara district, mode of operation, economics and profitability of two mini-nurseries. Further, comparison of economics of these mini-nurseries with paddy cultivation is presented.

Establishment of mini-nurseries

Programme for the establishment of mini-nurseries was implemented by ARDQIP with the cooperation of NAQDA. Sites for the establishment of mini-nurseries at Kirawana and Rajawewa were identified by District Aquaculture Extension Officer (AEO) of NAQDA and the ARDQIP technical staff. Kirawana mini-nursery was established on a 0.8 ha land adjoining the Kirawana wewa, a minor perennial irrigation reservoir in the Padiyathalawa Divisional Secretariat area, while the Rajawewa mini-nursery was established on a 0.8 ha land adjoining Rajawewa, a minor perennial irrigation reservoir in the Ampara Divisional Secretariat area. These two reservoirs and adjoining land areas selected for establishment of mini-nurseries come under the jurisdiction of Department of Agrarian Development. Based on a request made by the Ministry of Fisheries and Aquatic Resources Development, Department of Agrarian Development released relevant lands to NAQDA and also gave their concurrence to obtain water for mini-nurseries from respective reservoirs.

ARDQIP and NAQDA officials consulted agricultural farmers' organizations and inland fisher societies of two reservoirs to select the management teams of the mini-nurseries. The management team in Rajawewa functioned as a sub-committee of the inland fisher society whereas in Kirawana it was a sub-committee of the farmers' organization. Prior to the commencement of construction,

NAQDA entered into an agreement with relevant organizations on the construction and operation of respective mini-nurseries. One of the conditions stipulated in the agreement was that the relevant community organization was required to pay back to NAQDA in 60 instalments the costs incurred by ARDQIP. Selected community teams were provided with the training in fish seed production, nursing and rearing activities and the management of the fish nurseries including maintenance of records.

ARDQIP technical staff provided technical advice during construction. ARDQIP hired heavy machinery required for construction of mud ponds and provided all the construction materials such as cement, sand, pipes, gate valves, pumps etc. Mini-nursery management team provided manual labour during construction. The Kirawana nursery consisted of 10 mud ponds of even size with a total water area of 4,500 m^2 for fish fingerling rearing and 5 cement tanks (each 7 m^2) for conditioning of fish fingerlings prior to sale. The Rajawewa nursery consisted of 12 mud ponds (range in size from 307-500 m^2) with a total water area of 4,477 m^2 and a cement tank (11.0 m^2). Total costs of construction of Kirawana and Rajawewa mini-nurseries were Rs. 555,000.00 and Rs. 650,700.00 respectively. [In May 2016, 1 USD ≈ Rs. 146.9.]

Operation of mini-nurseries

Two mini-nurseries under consideration commenced production activities in 2006. Fish fry (2.0-2.5 cm in length) of selected species were reared upto fingerling stage (5-7 cm in length). In later years, post larvae (PL) were also stocked during certain culture cycles in Rajawewa mini-nursery and reared upto fingerling stage. Commonly reared fish species were Nile tilapia (*Oreochromis niloticus)*, catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*), and common carp (*Cyprinus carpio*). Mini-nursery management teams obtained fish fry from Aquaculture Development Centres of NAQDA.

Members of the mini-nursery team took turns in attending day-to-day activities such as feeding, water management etc. Whole team participated in fingerling harvesting activities and where necessary, hired labour was used for certain activities.

It was observed that both mini-nurseries adopted similar culture practices. Pre-stocking practices included application of bleaching powder and liming of ponds. Stocking densities ranged from 65 to 85 m^{-2}. Fish fry were fed with rice bran and poultry grower feed. Rearing periods ranged from 45 to 70 days. Generally, there were 3 culture cycles per annum, except for certain years with 4 culture cycles. During the culture cycles in 2013 and 2014, average survival rate from fry-to-fingerling stage in Kirawana mini-nursery was 71.8% (range: 59.0% - 89.8%) and 79.2% (range: 43.9% - 92.0%) in Rajawewa mini–nursery.

Economics

Average number of fish fingerlings produced per culture cycle during 2013-2014 were 242,301 (range: 168,700 to 255,800) in Kirawana and 262,935 (range: 151,920 to 392,530) in Rajawewa. Details of cost and returns for a culture cycle in two mini-nurseries, based on the information from the records maintained by respective mini-nursery teams pertaining to six culture cycles carried out during 2013 and 2014, are given in Table 1.

Table 1. Costs and returns from Kirawana and Rajawewa mini-nurseries per culture cycle during 2013 and 2014.

Item	Kirawana	Rajawewa
Returns		
Average number of fish fingerlings produced per cycle.	242,301	262,935
Income from sale of fish fingerlings (Rs.)*	484,602.00	525,870.00
Operational costs (Rs.)		
Chemicals (lime , bleaching powder, weedicides)	6,070.00	12,365.00
Maintenance of the facility	3,234.00	9,089.00
Fish fry	112,933.00 (67.6%)	134,050.00 (66.7%)
Feed ingredients	17,800.00 (10.7%)	18,600.00 (9.3%)
Hired labour /services	5,042.00	3,775.00
Transport cost	13,104.00 (7.8%)	15,118.00 (7.5%)
Refreshments	5,024.00	5,500.00
Miscellaneous	3,700.00	2,492.00
Total operation cost (Rs.)	166,907.00	200,989.00
Net profit over operational cost (Rs.)	317,695.00	324,881.00
Production cost per fingerling (Rs.)	0.69	0.76

* Selling price of a fingerling: Rs. 2.00.
Three main cost items as a percentage of total operational cost are given within brackets.

Major cost components in the operation of Kirawana and Rajawewa mini-nurseries were for fish fry (67.6%, 66.7%), feed ingredients (10.7%, 9.3%) and transport (7.8%, 7.5%). Production cost per fingerling was Rs.0.69 and Rs 0.76 respectively for Kirawana and Rajawewa. Net profit obtained for an annum was Rs. 953,085.00 and Rs. 974,643.00 in Kirawana and Rajawewa respectively.

Community group involved in managing the Kirawana mini-nursery consisted of 4 members, while that of Rajawewa consisted of 8 members. These members are primarily involved in paddy cultivation or inland fishing and their involvement in respective mini-nurseries is on part-time basis. Based on the profits obtained during 2013 and 2014, each member in Kirawana received Rs. 238,270.00

as share and the share of each member in Rajawewa was around Rs. 121,830.00 annually. As per the agreement entered into with NAQDA, mini-nursery operators paid back to NAQDA within the stipulated time period the costs incurred by ARDQIP.

Contribution towards fish seed stocking

Details of total stocking in the district of Ampara during 2009-2014 period and the contribution made by Kirawana and Rajawewa mini-nurseries are given in Table 2. Contribution of two mini-nurseries towards total stocking of Ampara district ranged from 14.0% in 2013 to 30.0% in 2014 with an average contribution of 20.6% during above period. This shows the important role played by these two nurseries in the supply of fish seed required for the development of culture-based fisheries in the Ampara district.

Table 2. Details of stocking of fish fingerlings in the Ampara district and the contribution made by two mini-nurseries from 2009-2014.

Year	Total fingerlings stocked ($x10^6$)	No. of fingerlings produced in two mini-nurseries ($x10^6$)	Contribution of two mini-nurseries towards total fingerlings stocking (%)
2009	4.11	1.16	28.2
2010	4.64	1.32	28.4
2011	6.71	1.05	15.6
2012	6.52	1.01	15.5
2013	8.44	1.18	14.0
2014	5.66	1.70	30.0
Total for the period	36.08	7.42	20.6

Paddy cultivation as an alternative land use

Land area allocated for two mini-nurseries under consideration were 0.8 ha each. Ampara is a leading agricultural district with paddy as the major crop. Hence, most popular alternative land use is paddy cultivation. According to the officially published costs and returns of paddy cultivation for '*maha*' cultivation cycle 2012/2013, profit from cultivation of paddy in the Ampara district was Rs. 34,118.00 per 0.4 ha (Department of Agriculture 2014). Assuming that the similar profit is obtainable during '*yala*' cultivation season, anticipated annual profit from paddy farming on a 0.8 ha land was Rs. 136,472.00. Average annual profit obtained from the operation of each mini-nursery was therefore seven times higher than that of paddy cultivation.

Conclusion

Rearing of fish post larvae or fish fry to fingerling stage is a very profitable enterprise, which can be a promising full time or part time occupation for rural communities. Success of mini-nurseries was mainly due to the team-working spirit of the community groups, their commitment, good management and close coordination with AEOs of NAQDA. Fingerling production and profits can be further augmented by increasing number of culture cycles to 5 per annum. Availability of PL or fish fry of fish species in demand for culture-based fisheries such as catla, rohu and mrigal is not consistent throughout the year as maturation of brood fish and spawning are seasonal and are dependent on rainfall patterns (Balasuriya et al. 1983, Tennakoon et al. 1988). Furthermore, for diversification of fish species in the inland fishery of Sri Lanka, which is mainly dependent on the exotic cichlid species (Amarasinghe et al. 1989; Amarasinghe 2002), mini-nurseries of Indian major carp species can play a major role.

Proper planning and execution of culture cycles in accordance with the availability of PL and fish fry may facilitate to increase number of culture cycles. In addition, timely harvesting and marketing of fish fingerlings upon reaching the fingerling stage, in close coordination with fisher societies of reservoirs (i.e., recipients of fingerlings) will provide opportunities to increase number of culture cycles.

Government of Sri Lanka has given high priority to develop culture-based fisheries in reservoirs, both in seasonal and perennial reservoirs. It has been estimated that over 200 million fish fingerlings would be required annually to meet the requirements of the envisaged inland fisheries enhancement strategies. Performance of above two mini-nurseries and their contribution towards meeting the fish fingerling requirements of the district showed that well-managed fish nurseries, operated by community groups or individuals can play an important role in meeting the fingerlings requirement of the country. A concerted effort should be made to increase the efficiency and profitability of all existing mini-nurseries falling under the purview of NAQDA, Provincial Councils or small-scale fish farming groups.

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References

Amarasinghe U.S. 2002. The Fishery and population dynamics of *Oreochromis mossambicus* and *Oreochromis niloticus* (Osteichthyes, Cichlidae) in a shallow irrigation reservoir in Sri Lanka. Asian Fisheries Science 15(1): 7-20.

Amarasinghe U.S., S.S. De Silva & J. Moreau 1989. Spatial changes in growth and mortality and effects on the fishery of *Oreochromis mossambicus* (Pisces, Cichlidae) in a man-made lake in Sri Lanka. Asian Fisheries Science 3: 57-68.

ARDQIP 2010. Project completion Report. Aquatic resource Development and Quality Improvement Project. Ministry of fisheries and Aquatic Resources, Sri Lanka.

Balasuriya L.K.S.W., C.R. Tilak, W.S.A.A.L. Kumarasiri & H.K.G. Sirisena 1983. Induced breeding of Indian major carps in Sri Lanka. Journal of Inland Fisheries, Sri Lanka 2: 63-67.

Department of Agriculture 2014. Cost of cultivation of agricultural crops. 2012/13 MAHA. Socio-Economic and Planning Center, Department of Agriculture, Peradeniya, Sri Lanka.

Tennakoon K.S.B., H.K.G. Sirisena & P.P.R. Seneviratne 1988. Some observations on the seasonality of production of seed of Chinese and Indian major carps in Sri Lanka. Journal of Inland Fisheries, Sri Lanka 4: 43-61.