EVALUATION OF THE PERFORMANCE OF SELECTED EXOTIC AND INDIGENOUS FISH SPECIES IN CULTURE-BASED FISHERIES OF VILLAGE RESERVOIRS IN SRI LANKA

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Abstract

The village reservoirs of Sri Lanka retain water for 6 to 9 months of the year and completely dry-up yearly or retain very little water for a few months. The cumulative extent of village reservoirs in the country is estimated to be around 40,000 ha and almost all of them are located in the dry zone of the country receiving <185 cm annual rainfall. These reservoirs are highly productive. These small village reservoirs can be utilized to enhance fish production, by stocking of hatchery reared fingerlings of Chinese carps, Indian major carps, cichlids and common carp in these reservoirs and subsequent harvesting after a reasonable growth period, termed as 'culture-based fisheries' (CBF). A significant proportion of the rural people living in the dry zone of Sri Lanka are below the poverty line when compared to the national level. Protein deficiency in the diets of rural people is also a serious issue. As such, development of CBF in village reservoirs of Sri Lanka is a promising means of achieving food security for rural people. This is particularly so because freshwater fish is a cheap and affordable animal protein source for rural communities.

This study was carried out in village reservoirs of five administrative districts of Sri Lanka, viz. Anuradhapura, Hambantota, Kurunegala, Monaragala and Ratnapura. Using a questionnaire survey, distributed among 500 farmers' organizations (FOs), 47 reservoirs were chosen randomly from a list that was arranged according to preliminary ranking system. The objective of the present study was to investigate the aquaculture performance of the stocked species in village reservoirs. In the culture cycle in 2002/2003, using participatory rural appraisal methods, and by attending meeting of FOs where agricultural activities during the cultivation seasons are discussed ("kanna" meeting), rural farmers were mobilized to adopt CBF activities. Of those, only 32

reservoirs could be stocked, which retained sufficient water during the period of stocking. Due to false reporting and poaching reliable data on CBF yields could be obtained only from 23 reservoirs. In addition, 11 more reservoirs stocked during the culture cycle in 2004/2005 were also used for the analysis. Consequently, the present analysis was based on the data of 34 reservoirs. As the information about the reservoir extents reported in official databases were inaccurate, actual extents of village reservoirs were estimated using Geo Positioning System (GPS) associated with Geographical Information System (GIS) software. In reservoirs where GPS-based reservoir extents could not be determined, an appropriate correction factor was used for determining reservoir extents. As reservoir area shrinks almost to zero during the dry season, the effective area was considered as 50% of the area at full supply level. Accordingly, calculation of stocking density (SD) and estimation of CBF yield were based on the effective areas of reservoirs.

There was a significant negative curvilinear relationship between the CBF yield and contribution of snakeheads in the harvest. The instantaneous mortality rates of stocked fish species in reservoirs with snakeheads were higher than those in reservoirs without snakeheads. The reservoirs were therefore grouped into two categories as those with and without snakeheads.

The CBF yield varied from 53.3 to 642.6 kg ha^{-1} with the average of 252.2 kg ha^{-1} in the reservoirs with snakeheads and from 54.6 to 1800.8 kg ha^{-1} with the average of 530.3 kg ha^{-1} in the reservoirs without snakeheads. When all the reservoirs were considered together, CBF yield varied from 53.4 to 1800.8 kg ha^{-1} with the average of 448.5 kg ha^{-1}. The optimal SD for the reservoirs with and without snakeheads were 2668 and 1310 fingerlings per ha respectively.

As reservoir area showed negative curvilinear relationships with the CBF yield and SD, smaller (<10 ha) are more suitable for the CBF development than large village reservoirs.

In reservoirs with snakeheads, GIFT strain of *Oreochromis niloticus*, *Labeo rohita* and *Catla catla* performed better than other stocked species. Resilience capacity of these species to predatory pressure by snakeheads might be the possible reason for their performance. In reservoirs without snakeheads on the other hand, *Aristichthys nobilis* , *Catla catla, Cyprinus carpio, Labeo rohita* and tilapia had positive influence on the CBF yield. This indicates that presence or absence of predatory pressure on stocked fish species by carnivorous fish species has to be taken into account in planning CBF in village reservoirs of Sri Lanka. This is important because as evident from the present analysis, performance of stocked species in the presence or absence of snakeheads in the water body is not uniform but species-specific. For example, the lowest survival rate was recorded for *A. nobilis* in reservoirs with *Channa striata*, which exhibited the highest survival rate in reservoirs without *C. striata*.

The highest specific growth rate (SGR) was recorded for *C. catla* and *A. nobilis* and the lowest was recorded for the GIFT strain of *O. niloticus.* According to the discending order, mean SGR values were 3.0, 3.0, 2.9, 2.7, 2.5 and 2.0% day $^{-1}$ for *A. nobilis*, *C. catla, C. carpio*, *C. mrigala, L. rohita* and GIFT strain of *O. niloticus* respectively. Mean stocking efficiencies (SE), measured as the % of ratio of weight of harvested fish to the weight of stocked fish, were recorded as 49.86, 48.21, 29.91 and 2.84 for *C. catla, L. rohita, C. carpio* and *A. nobilis* respectively for the village reservoirs with snakeheads. The SE of *C. carpio, A. nobilis* and *L. rohita* were 219.03, 176.34 and 59.79 respectively in the reservoirs without snakeheads. These further confirm the necessity of treating two categories of reservoirs separately for planning CBF management. The highest SE was recorded from the GIFT strain of *Oreochromis niloticus* in both types of reservoirs, possibly due to spawning of stocked fish.

The cattle and buffalo densities in the vicinity of reservoirs influence biological productivity in village reservoirs so that this feature is also important to take into account for planning CBF in village reservoirs. This is particularly so because there was a positive relationship between the cattle and buffalo density and CBF yield.

Principal Component Analysis (PCA) also revealed that GIFT strain of Nile tilapia, *C. carpio*, *C. catla* and *L. rohita* contributed positively to the CBF yield of reservoirs with snakeheads and that GIFT strain of Nile tilapia, *C. carpio, A. nobilis* and *L.* rohita were mainly responsible for CBF yield in reservoirs without snakeheads. Also PCA reveled that village reservoirs with high chlorophyll-a content, high SD, high densities of cattle and buffaloes and low percentage of aquatic plant cover are more suitable for the CBF development.