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## Emerging boost in Sri Lankan reservoir fish production: a case of adoption of past research findings

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### Background

Sri Lanka is well renowned for its irrigational reservoir construction dating back to at least 2,000 years. There are also stone inscriptions indicating the levy of taxes on reservoir fishery landings dating back to first century A.D.<sup>1</sup>. However, in the modern era, the Sri Lankan inland fishery is almost totally confined to the large number of reservoirs in the country and is known to be characterized by three features, viz. (a) it is primarily based on the exotic cichlids (mainly *Oreochromis mossambicus* and *O. niloticus*), (b) it is an artisanal fishery using non-motorized canoes with an outrigger, and (c) the gear is uniform, consisting of gill nets of 8.5 – 12.7 cm mesh<sup>2</sup>. The Sri Lanka reservoir fishery is also perhaps one of the best documented in the region<sup>2,3,4</sup>.

The observations that the reservoirs contain sizeable populations of many small sized indigenous, cyprinid (minor) species, that grow to a maximum size of about 8-10 cm led to research on the possibilities of harnessing these resources for human benefit. The research was conducted by three independent groups<sup>5,6,7,8,9,10</sup> to estimate fishery potential of minor cyprinids in Sri Lankan reservoirs. All these studies demonstrated that the minor cyprinid stocks in perennial reservoirs could be harnessed using small meshed gillnets resulting in significant catch per unit effort, and that such a fishery will not directly and or indirectly impact on the existing fishery, the mainstay, for exotic cichlids. The researchers

showed that the recruitment of cichlids is not impacted upon as the young inhabit the littoral and sub-littoral areas, as opposed to the fully grown minor cyprinids that inhabit the open waters, as much as the adult exotic cichlids. Based on the biomass and total biological production, it was found that there is scope for an approximately a 100% increase of the total yield in Sri Lankan reservoirs through introduction of a subsidiary gillnet fishery for minor cyprinids<sup>11</sup>.

Mass-balance trophic models have shown that exploitation of minor cyprinids in Sri Lankan reservoirs is advantageous to the existing cichlid fisheries through relaxing competition for plankton food resources in juvenile cichlids<sup>12</sup>. Also on global scale, the exploitation of untapped fishery resources in reservoirs such as minor cyprinids is recognized as a potential avenue for intensification of reservoir fisheries, especially in tropical and sub-tropical countries<sup>13</sup>.



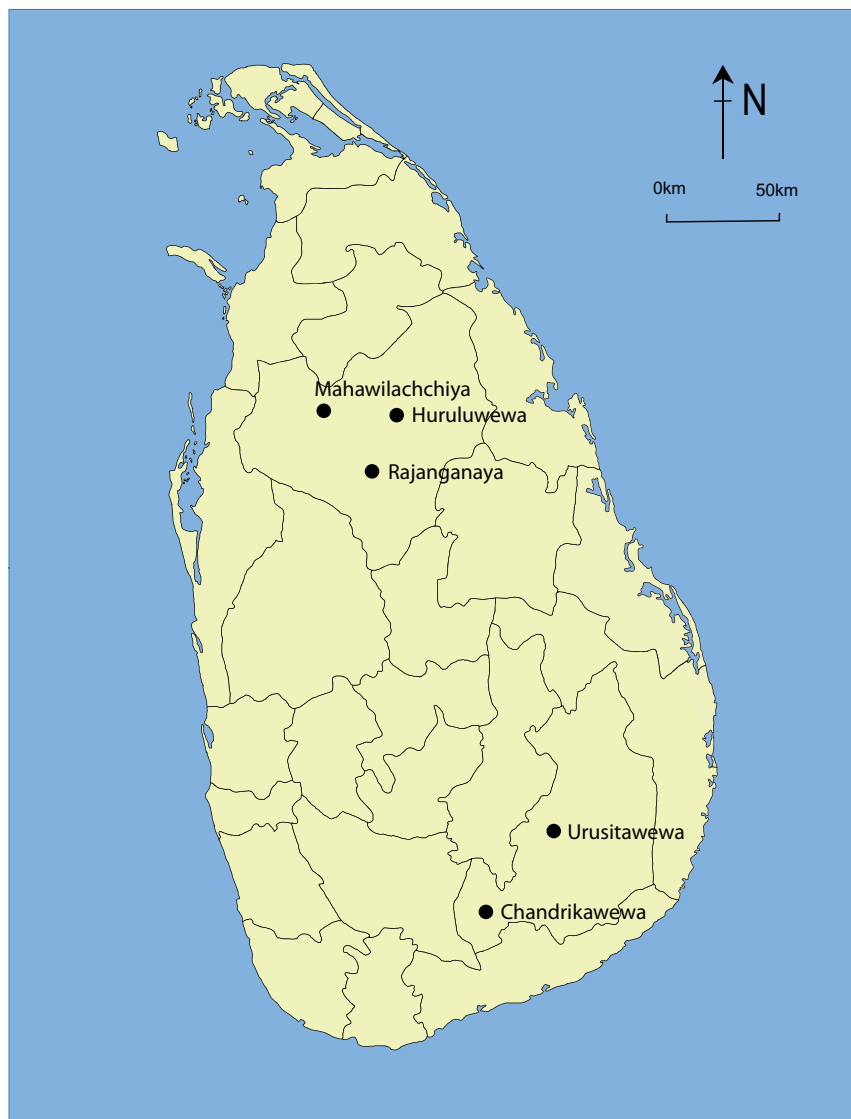
Dislodging the catch from the nets, a tedious task.

## Progress in implementation of research findings

The research described above was not translated into practice for nearly 20 years, primarily because the implementing authorities were reluctant to change the existing mesh regulations permitting the introduction of a small meshed gear, and the general reluctance to “take a risk”. In the recent past the researchers have started working in conjunction with newly created implementing agencies, such as the National Aquaculture Development Authority of Sri Lanka (NAQDA) with responsibility for inland fisheries development and the National Aquatic Resources Research and Development Agency (NARA), the research arm of the Ministry of Fisheries and Aquatic Resources in Sri Lanka. At the regional meeting conducted by NACA, in January 2008, under the auspices of the project “Development of Asian Reservoir Fisheries” funded by the Icelandic International Developmental Agency (ICEIDA) consensus was reached that the issue of harnessing of small fish resources is of regional importance and that Sri Lanka is best fitted to “test” the past research findings. Evidence is found in other south Asian countries such as Bangladesh that small indigenous fish species have a significant potential for contributing to human nutrition, especially since some species such as *Amblypharyngodon mola* are found to be rich in vitamin A<sup>14</sup>.

Accordingly, the University of Kelaniya in conjunction with NAQDA and NARA, undertook research in three reservoirs in the North Central Province, i.e. Rajanganaya, Mahawilachchiya and Huruluwewa; one reservoir in Uva Province, Urusitawewa; and one reservoir in Sabaragamuwa Province, Chandrikawewa (Figure 1). In order to enable this activity to proceed the implementing authority, NAQDA, permitted the use of gillnets of 15-37 mm mesh sizes. Not surprisingly, as the trial got under way, it became apparent at least in three reservoirs that fishers have been harnessing (illegally) this resource for nearly 6 to 8 years using 25 mm mesh size gillnets, with 8 to 20 net panels of approximately 25 m x 3.5 m. These fishers, numbering 10 to 20 in each of the reservoirs caught on average 15 to 200 kg of minor cyprinids

Figure 1. Map of Sri Lanka showing locations of reservoirs where minor cyprinids are exploited (base image obtained from Wikimedia Commons <http://commons.wikimedia.org>, derivative is issued under a Creative Commons Attribution ShareAlike 2.5 license).



per day (mean 46 kg/fisher/day), and on the most productive days the catch could exceed 200 kg/fisher.

### The minor cyprinid fishery

The main minor cyprinid species caught in this fishery, in order of abundance are *Amblypharyngodon melettinus*, *Puntius chola*, *P. filamentosus*, *P. dorsalis*, *Rasbora daniconius* amongst others. The ongoing limited fishery activities suggest that this is not a fishery that is favoured by many; it is rather labour intensive because of the time taken to dislodge the fish from the nets and consequently almost always women

folk are involved in the activity. About 10 percent of the daily catch is sold fresh at Rs. 50/kg (approximately US\$ 0.50) to local vendors, who in turn keep a profit of ten percent at the point of selling to the consumers. The rest is sun-dried and sold in bulk at Rs. 150-200/kg. To prepare fish for drying, the landings are washed, de-scaled and gutted using an efficient method developed by fishers, where landings are mixed with coarse sand, loaded into a fibre-glass canoe and crushed partially by foot covered with a canvass shoe. Subsequently, they are soaked in brine for a few hours before sun-drying.

Assuming that twenty and ten fishers are permitted to enter this fishery in each of the major (> 1,000 ha) and

medium (300-1,000 ha) perennial reservoirs in Sri Lanka, respectively and each fisher would land 25 kg/day, the total yearly (300 days of fishing) landing per fisher would be 7.5 tonnes/year. It is recorded that there are 73 (70,850 ha) and 160 (17,001 ha) of large and medium scale perennial reservoirs in Sri Lanka. Accordingly, the total potential landings from this fishery per year approximate to 10,950 tonnes and 12,000 tonnes from large and medium sized reservoirs, respectively. This will be a significant addition to the current fishery which is estimated at 33,000 tonnes/year. In the original research findings it was estimated that the fishery potential of minor cyprinids in major and medium perennial reservoirs of Sri Lanka is about 250 kg/ha/year<sup>11</sup>, which is about 22,000 tonnes of fish.

## What is next?

Although it has been technically proven from the above data that there is a potential minor cyprinid fishery in large and medium perennial reservoirs, due to the small sized mesh nets used for harvesting, a considerable amount of awareness will have to be made among the stakeholders and policy makers to convince them that there is a need to change the current legislation to accommodate the use of small gill mesh nets for harvesting. At present small mesh (< 8.5 cm stretched mesh) gill nets are banned, on the premise that these could destroy the resource when small fish of the cichlid fishery are caught. This was especially so, when small meshed drag nets and 6.4 to 7.6 cm stretched mesh gillnets were used to catch juvenile cichlids, during the early 90s when there was no government patronage for inland fisheries. However, as mentioned earlier, since the minor cyprinid fishery is concentrated in the deeper areas, the damage to small cichlids will be negligible. Under the NACA-ICEIDA funded project "Development of Asian Reservoir Fisheries", small mesh (15 to 37 mm stretched mesh) gillnets were provided to selected fishers in some reservoirs on a pilot scale study. Eventually, NAQDA will take necessary steps to introduce a fishery for minor cyprinids in large and medium sized reservoirs in Sri Lanka as this is a promising means of increasing inland capture fisheries production in large and medium scale reservoirs which is an important mandate of NAQDA. However, this is not a straightforward task. Initially, the implementing authority will have to consult with the individual reservoir fishers associations/societies and impress upon them the advantages of introduction of such a fishery, and more importantly, that such an introduction will not harm the existing fishery. On reaching consensus and agreement, the existing mesh regulations need to be amended and together with the fisher societies determine the number of people permitted to enter such a fishery. As this new fishery will be introduced to a selected number of people in each reservoir, this strategy will involve a new group of fishers, in addition to those exploiting cichlids. Hence, it is necessary to put in place the appropriate management measures to avoid any form of conflict between the two groups.

## Remaining research questions

As there is evidence that minor cyprinids have exploited in some reservoirs for at least the last eight years, the minor cyprinid resources are considered to be able to support a sustainable fishery. However, once a full-scale exploitation of this untapped fishery resource begins, the stocks are



*Catch being washed and de-scaled before sun drying.*



*Minor cyprinid catch being taken for preparation for drying.*

expected to reach a new equilibrium. Therefore, estimation of the optimal exploitation levels of this fishery resource has to be done through close monitoring after commercial scale fisheries begin.

Research on postharvest technology for this untapped fishery resource is also needed to improve consumer acceptance. Minor cyprinids can also be used to prepare feeds in aquaculture systems and livestock industry<sup>15</sup>. Determination of the nutritive values of minor cyprinid-based fish meal is therefore an important research area.

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*Often the whole family is involved in post-catch preparations.*