Food and Agriculture Organization of the United Nations

University of Peradeniya

POLICY BRIEF

THE UNLOCKED POTENTIAL OF INLAND FISH TO CONTRIBUTE TO IMPROVE NUTRITION IN SRI LANKA

Protein-energy malnutrition and micro-nutrient deficiencies are important public health issues in Sri Lanka. According to the 2016 Demographic & Health Survey, the prevalence of wasting among children under 5 years of age is alarmingly high at 15.1 percent in comparison to the regional prevalence of wasting in Asia of 9.7 percent. The National Micronutrient Survey conducted in 2012 revealed that 15.1 percent of children under 5 years of age were anemic. Sectoral disparities exist with the prevalence of anemia in rural areas significantly higher than the national average, with rates of up to 26.9 percent. This national survey also revealed that roughly one third of Sri Lankan women suffer from anemia, with the prevalence of anemia rising to 35.4 percent among pregnant women and 32.5 percent among non-pregnant women. In addition, zinc, vitamin A and calcium deficiencies are prevalent, particularly in several poorer rural regions across the country.

Fish are not only a source of proteins and healthy fats; they also provide a unique source of essential nutrients including long-chain omega-3 fatty acids, iodine, vitamin D and calcium. Fish plays a crucial role in nutrition and thus, promoting fish in the diet is among the strategies to alleviate protein-energy malnutrition and micro-nutrient deficiencies. This policy brief discusses the potential of introducing more inland fish to the diets of Sri Lankans, particularly vulnerable groups.

THE NUTRITIONAL VALUE OF INLAND FISH

Fish is an important source of animal protein in Sri Lankan diets. Fish is not only a source of protein but also a unique source of healthy fat and essential micro-nutrients, namely long-chain omega-3 fatty acids, iodine, vitamin D, and calcium. Consuming fish in the diet increases the amount of iron and zinc that the body absorbs from other foods. Inland fish is a low-cost source of fish for the rural poor who reside in non-coastal areas. Table 1 provides the nutritional composition of fish per 100 grams.

TABLE 1: NUTRITIONAL COMPOSITION OF FISH (100g SERVING PACK)

Type of fish	Iron-Fe (mg)	Niacin (mg)	Crude fat (g)	Protein (g)	Calcium (mg)	Energy (kcal)	Phosphorus (mg)
Sālaya (Coastal)	2.10	2.80	19.40	21.80	180.00	273.00	280.00
Tilapia (Inland – introducing)	0.40	3.10	2.80	18.80	54.00	106.00	172.00
Lūla (Inland – traditional)	0.50	0.50	2.30	16.20	140.00	94.00	95.00

Sālaya: Clupea spp.; Tilapia: Tilapia spp.; Lūla: *Ophiocephalus striatus*
Source: (Biodiversity for Food and Nutrition in Sri Lanka)

Fish are ideal options for maintaining good health and weight management as they are low in cholesterol but contain essential fatty acids including omega–3, omega-6, Docosa Hexaenoic Acid (DHA) and Eicosa Pentaenoic Acid (EPA). Hence, nutritionists recommend fish for patients with diabetes, coronary heart disease and hypertension over other animal proteins. However, there is a potential to enhance awareness of the several nutritional benefits of inland fish among vulnerable groups, particularly for the rural poor who reside in non-coastal areas.

EXPENDITURE OF INLAND FISH IN SRI LANKA

The Household Income and Expenditure Survey (HIES) of the Department of Census and Statistics, classifies fish into two groups: fresh fish and dried fish. Fresh fish can come from sea waters and fresh-waters (inland). Dried fish can also come from sea waters and fresh waters. Whilst ocean fish dominates, the average per capita monthly expenditure on dried fish in 2016 was LKR 203.37 (~USD 1.2) and out of this, only LKR 2.22 and 1.26 was spent on freshwater dried fish and smoked dried fish (fresh water) respectively.

Based on household income and expenditure, there is potential to increase the expenditure on inland fish in Sri Lanka. According to the HIES the average Sri Lankan spent only LKR 477.25 per month (~USD2.8) in 2016 on fresh fish from fresh waters (inland fish) and sea waters (Table 2).

The average expenditure incurred on freshwater fish was little over ten percent of expenditure at only LKR 51.68 (~USD 0.3) (Department of Census and Statistics, 2016).

TABLE 2: AVERAGE EXPENDITURE PER MONTH INCURRED ON FRESHWATER FISH RELATIVE TO QUANTITY IN 2016

Fresh Fish species	Average expenditure (LKR) per capita per month	Amount (grams) consumed per capita per month
Lūla	2.27	7.11
Teppili/Tilapia/Korali	42.29	155.23
Other freshwater fish	7.12	23.14

Source: (Department of Census and Statistics, 2016)

In terms of household income, expenditure on inland fish is considerably low. The average household income per month at national level was LKR 62 237 (~USD 361.3) in 2016 (Department of Census and Statistics, 2016). According to the 2016 HIES, the estimated average monthly household expenditure was LKR 54.999 (~USD 319.3), with estimated average monthly expenditure on food making up LKR 19 114 (~USD 110.9) of this expenditure (34.8 percent) (Department of Census and Statistics, 2016). Of this, 9.5 percent and 4.0 percent was spent on fresh fish and dried fish, respectively. The level of individual and household expenditure does not match the potential for inland fish necessary for increasing the nutrition status of the population due to insufficiency in local production.

PATTERN OF PRODUCTION OF INLAND FISH

Despite the potential of inland fish, availability remains an issue. Inland fish production contributed to approximately 16 percent of the total fish production in Sri Lanka in 2016 (Table 3). Tilapia is the dominant species and accounts for over 60 percent of inland fish. The second largest species is carp and it constitutes approximately 20 percent of the inland fish. A steady growth in inland fish production was observed over the period 2012-2016 primarily due to an increase in stocking of fingerlings, mainly tilapia and carp, into inland water bodies. Sri Lanka does not import inland fish, and thus relies on local production.

TABLE 3: ANNUAL FISH PRODUCTION BY FISHING SUB-SECTORS (MT) IN SRI LANKA (MINISTRY OF FISHERIES AND AQUATIC RESOURCE DEVELOPMENT, 2016)

Sector	2012	2013	2014	2015	2016
Marine capture	417 220	445 930	459 300	452 890	456 990
Coastal	257 540	267 980	278 850	269 020	274 160
Off-shore/Deep sea	156 680	177 950	180 450	183 870	182 830
Inland	68 950	66 910	75 750	67 300	73 930
Capture(Perennial water bodies)	58 680	55 020	68 820	57 060	58 410
Culture (Seasonal water bodies)	6 960	7 460	1 780	3 150	9 490
Coastal aquaculture (Shrimp)	3 310	4 430	5 150	7 090	6 030
Total Fish Production	486 170	512 840	535 050	520 190	530 920

It should be noted that of the 262 000 ha of freshwater that is available in Sri Lanka, around 7.6 percent freshwater is being used for inland fisheries and aquaculture production which suggests that there is a potential to enhance the contribution of inland fish to overall fish production.

There are thirty indigenous species belonging to 11 families and 6 orders which have the potential to populate in Sri Lanka's perennial reservoirs. Table 4 provides inland fish production by species. Important indigenous inland fish species for human consumption include Snakehead, Giant Snakehead (*Magura*), Freshwater shark (*Walaya*), *Pena walaya*, Ankuta, Stinging catfish (*Hunga*), Spine Eel (*Teliya*), Eels, *Mal koraliya*, *Rasbora dandia*, Tank Sardine (*Wewa salaya*), Puntius (*Pethiya*), Smaller carp (*Podi pethiya*), Larger carp (*Mas pethiya*), *Katu pethiya*, *Hiri kanaya*, *Dankola pethiya*, and Air breather (*Kawaiya*). Given the types of inland fish species available in the other countries, there is a potential to introduce high-performing species to the Sri Lankan water bodies.

TABLE 4: INLAND FISH PRODUCTION AND SPECIES BEING CAUGHT DURING THE PERIOD OF 2010 – 2014 (MINISTRY OF FISHERIES AND AQUATIC RESOURCE DEVELOPMENT, 2016)

Production(Mt) Species	2010	2011	2012	2013	2014
Tilapia	850	2 650	35 590	39 070	46 610
Brackish water shrimp	3 480	4 150	3 310	4 430	5 150
Freshwater Prawn	45	105	290	540	460
Common carp	807	1 115	1 371	1 824	836
Catla	1 280	964	808	2 762	2 514
Rohu	720	1 367	528	1 558	1 272
Mrigal	Na	Na	1 19	667	239
Bighead carp	285	205	55	132	158
Silver carp	205	206	48	590	78
Grass carp	Na	35	1	11	9
Labeo sp.	185	13	3	63	78
Hirikanaya	Na	Na	670	590	580
Snakehead	Na	Na	1 770	2 040	2 230
Seabass	10	9	6	15	18
Sea cucumber	Na	Na	Na	Na	213
Mud crab	18	12	10	10	10
Other wild fish	Na	Na	7 160	7 720	5 820

THERE IS MORE TO AVAILABILITY OF INLAND FISH THAN JUST PRODUCTION

Traditional fishing is practiced predominantly in three seasons: (i) just after the heavy rain when floodwaters gradually recede; (ii) post monsoon receding water level in the floodplains; and (iii) pre-monsoon drying up period where flowing and stagnant water bodies are shrinking to pools. The traditional fishing methods practiced include the use of ichthyo-toxic plants, hand picking in drying up pools, spearing and chopping by long knives. In addition, cane baskets and nets made out of various natural materials are also used to catch fish. At present, gill nets with traps have been widely practiced for catching inland fish.

Harvesting for sales is undertaken by a large number of small scale professional fishermen who land their catch at dispersed points around larger perennial reservoirs. Fishing is mainly carried out at night, with stocks being maintained alive in small wire cages or partially flooded canoes. During periods of higher production, smaller secondary catches are distributed later in the day, although most fish are sold by midday exclusively by weight. As retail opportunities decrease by mid-afternoon, surplus fish are likely to be sold at discounted rates. Very little of this production reaches urban markets due to poor physical access related to the perishable nature of fish and lack of sufficient cold chain. Other issues limiting the availability of fish in urban areas include lack of proper areas to sell fish in safe and sanitary conditions and skills of local retailers in storing and handling fish. Options for value addition of marine fish, including drying or frozen, is common in Sri Lanka. These options have yet to become available for inland fish, given the higher demand in fresh form and the lack of market development. A provision of a transport subsidy would help in distributing inland fish to a wider coverage and increasing demand of inland fish, as well as adequate storage and training for local retailers.

The size of the fish is another factor that contributes to higher marketing costs. Among the inland fish species, tilapia has the advantage with respect to size. Normally 2-3 tilapias are included in 1 kg but the average market size of carp species is approximately 5-10 kg. Slicing is required to obtain 1 kg of carp but consumers are reluctant to purchase fresh-water fish slices, unlike in the case of marine fish. Furthermore, most retailers are unwilling to portion the fish due to fears of rapid spoilage. Consumer preference and cultural issues play a role in the purchasing habits of these fish. Consumers prefer to purchase tilapia over carp and among carp species, Rohu (Labeo rohita) has a poor consumer demand compared to Golden carp due to the specific "Y" shape of the former. Given the reluctance of consumers to purchase certain fish at higher prices due to shape and size, innovative fish processing methods are needed to promote the status of marketing inland fish.

Innovative fish processing methods are also needed as there are some intrinsic qualities of inland fish that slow the growth of the industry. For example, tilapia has a mucus layer on the outer skin, which causes fish to be glued together, preventing effective refrigeration. Canning of tilapia is also not possible as tissues are soft and thus breakable. Accordingly, selling tilapia in fresh form is one of the most viable options. However, there is the possibility of vacuum packing of fried tilapia.

Finally, another challenge faced by the inland fishery industry is the release of certain exotic, ornamental, and sport fish species (tank cleaner, knife fish, and sport fish) into natural waterways. Once these fish reach marketable size, fishers catch them assuming them to be food fish. If market value of inland fish is to be further enhanced regulations are required to prohibit this activity.

CONTINUED EFFORTS BY VARIOUS GOVERNMENT AGENCIES AND COMMUNITY ORGANIZATIONS TO PROMOTE FISH

The Government of Sri Lanka recognizes the importance of inland fisheries in enhancing incomes of fish farmers in non-coastal areas and in improving nutritional status of fishers and surrounding communities. The key features of interventions are discussed below.

In the 1980s, Culture Based Fishery (CBF) development in village reservoirs was incorporated in the national fisheries development plan of the country. This programme involved the provision of fish fingerlings free-of-charge for stocking and introduction of CBF to rural agricultural communities. However, lack of a guaranteed fingerling supply resulted in under-stocking of reservoirs. Rules and regulations pertinent to CBF development in village reservoirs were not in place and the supply of under-sized and poor conditioned fingerlings resulted in low returns.

The National Fisheries Plan 1995–2000 treated inland fisheries as a venture to increase sustainable production, generate employment, uplift socioeconomic conditions among fishing communities, improve nutrition and increase foreign exchange earnings. Private-sector development and facilitation of community-based initiatives in collaboration with NGOs had been promoted.

Since 2000, the National Aquaculture Development Authority of Sri Lanka (NAQDA) breeding centres situated countrywide distribute Genetically Improved Farmed Tilapia (GIFT) for farmers and fisheries societies. GIFT is an improved strain of tilapia which shows better production performance than the tilapia which was introduced in the 1950's.

Under the 'Ten Year Development Policy Framework of the Fisheries and Aquatic Resources Sector 2007–2016' strategies to enhance inland fish production had been envisaged. Fishers' community organizations which commenced in 2010 aimed at providing assistance for fishers and their families. The Diyawara Diriya concessionary loan scheme, with a subsidy from the Ministry of Fisheries, was introduced in 2010 with the support of the Bank of Ceylon. An insurance scheme has been introduced by the Ministry of Fisheries for fishers' welfare. The Ministry of Fisheries initiated a development programme called "Wawak Samaga Gamak" for the socio-economic enhancement of the fisher community across Sri Lanka in 2016. Five lagoons were included under this programme.

Stocking fingerlings at the FAO-EU supported fingerling nursery in Mannar
©FAO/Lekha Edirisinghe

In 2012 the Food and Agriculture Organization (FAO) in Sri Lanka prepared an aquaculture sector development programme for the Northern Province, including inland fisheries and a strategy for its implementation to improve the livelihoods of rural fishers through development of small-scale aquaculture and inland fisheries.

More recently, FAO, together with other UN partners, implemented the European Union Support to District Development Programme (EU-SDDP) between 2012-2017, aimed at assisting Sri Lanka to transition from post-conflict assistance to reconstruction and development. Specific interventions included the development of value chains of inland fisheries and technical training, market linkages and exposure visits for producers on improved technologies. Inland fish processing, packing and selling were given priority and local smoked fish producers were supported to improve the quality of their products. FAO also supported to boost inland fisheries in perennial tanks by providing equipment including canoes and nets, stocking of fingerlings, training on co-management and business plan preparation and exposure visits to successful tanks in other districts across the country. Finally, the project supported community-based organizations around irrigation reservoirs so that fishers and government authorities could co-manage fisheries resources.

All in all, the programmes of the Government and non-government organizations has supported the development of culture-based fisheries in perennial reservoirs through stocking of fish fingerlings of suitable species, introduction of robust fisheries management and utilization of seasonal reservoirs for culture-based fisheries.

Despite the above programmes and projects implemented by the Government of Sri Lanka gaps still remain. There still exists a great unharnessed potential to develop the inland fish value chain and promote its consumption as an avenue to improve the nutritional status of the Sri Lankan population. Given the extent of water bodies available in the country, the natural and artificial environments within which inland fishers operate, the nature of marketing issues faced by the inland fish farmers and the awareness of consumers on the nutritional benefits of the inland fish, the following suggestions are proposed.

REALISTIC SUGGESTIONS FOR THE WAY FORWARD

Addressing value chain improvements

> Increased availability and access of inland fish in retail markets.

- Increase production and harvesting.
  - Adequate stocking of fish seeds in seasonal tanks/reservoirs/estate tanks and culture ponds with suitable fish species to use the full potential.
  - Introduction/distribution of new commercial strains/varieties.
  - Regulation of disposal of exotic species to natural waters.
- Use of innovative harvesting and post-harvest processing techniques.
  - Introduction of new technologies for harvesting of large fish species and post-harvest operations and processing such as slicing.
- Enhancement of market facilities and support on improved storage (refrigerators) at local wet markets.
- Introduction of a transport subsidy to make more refrigerated trucks available and expansion of distribution network.

Regulations

> Regulations to prohibit the release of certain exotic, ornamental, and sport fish species into natural waterways.

Awareness, cultural and social issues

> Increased awareness on the nutritional value and health benefits of inland fish consumption of the whole community with campaigns tailored to different demographic groups.

> Community-level education and widespread demonstration of culinary preparations of inland fish to the community.

> Raising awareness of the potential role of midwives, pregnant and lactating mothers, school teachers and office bearers of village level women societies as fish processors and retailers.

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