Food and Agriculture Organization of the United Nations

TECHNICAL BRIEF

FISHERIES AND AQUACULTURE

INTRODUCTION & IMPORTANCE

As an island with a territorial sea of 21,500 km2 and a coastline of 1,340 km, Sri Lanka has a rich supply of fish and seafood throughout the year. It is estimated that the per capita fish consumption in Sri Lanka stood at 11.8 kg in 2017 (Fisheries Statistics, 2018). The fishing industry plays a crucial role in the economy of Sri Lanka and the country is home to a large fisheries community residing along the coastline. Fish plays a very ubiquitous role in nutrition on account of its high quality protein and omega-3 fatty acids, iron, calcium, magnesium, zinc, iodine selenium and other minerals as well as vitamin D and riboflavin. In 2017, the total exports of Sri Lankan marine fishery products was 25,000 MT which was valued at LKR 37,000 million (Fisheries statistics, 2018).

Health benefits of seafood consumption have primarily been associated with protective effects against cardiovascular diseases (CVD) and tissue inflammation due to omega-3-fatty acids. Omega-3-fatty acids in fatty fish are attributed to reduce CVD and their risk factors, rheumatoid arthritis, cancer, Alzheimer's disease, dementia and age related macular degeneration, and promote neurodevelopment of the foetus and infant. The health promoting effects of seafood have chiefly been attributed to the long-chain omega -3 polyunsaturated fatty acids (omega-3 PUFA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). DHA in fish also plays a pivotal role in the brain development of the foetus during the window of the first 1,000 days of life. Moreover, seafood proteins and other seafood derived components also contribute to these health effects.

Fish play a crucial role in global food and nutrition security as it represents an important and nutrient-dense animal source to especially many low- and middle-income countries. Compared to animal source foods from land animals, fish have a high edible portion relatively cheap, and little wastage. Small fish varieties are nutritionally superior (calcium, iron, magnesium, potassium, zinc, copper, selenium, vitamin A, -B12, -D, and EPA and DHA) compared to the larger varieties. Further, small fish varieties often have a significantly lower price than larger varieties. Therefore, promotion of small varieties for human consumption is vital and sustainable strategy to achieve food and nutrition security in all levels.

In addition to ocean fish, the country is blessed with 262,000 hectares of inland water bodies. Freshwater fish culture in seasonal village tanks which was initiated in 1979 by the Ministry of Fisheries, has been carried out in 23 tanks in the country's dry zone using Tilapia and carp (FAO, 2004). Inland fisheries has been reported to be 90,580 MT in 2019. The total contribution of inland fisheries and freshwater aquaculture is nearly 18% of the total fish production in the country (www.naqda.gov.lk). Inland fisheries contribute to food and nutritional security in rural areas of the country, while a significant proportion accounts for inland shrimp which is oriented for export market. The highest contribution to inland fisheries is reported in Anuradhapura, Ampara, Hambantota, Polonnaruwa, Puttalam and Trincomalee districts (Fisheries Statistics, 2018).

Tilapia is the dominant species and accounts for over 60% of inland fish. The second largest species is the common carp, which constitutes approximately 20%. In addition there are nearly 30 different indigenous fish species in the country. Snakehead, Giant snakehead, freshwater shark, stinging catfish, spine eel, Mal Koraliya, Wew saalaya, Puntius, Rasbora Dandia, Hiri Kanaya, Dankola Pethiya and Kavaiya are some of them (FAO, Policy Brief-Inland Fish, Sri Lanka, 2019). A steady growth in inland fish production has been observed during the last decade, primarily due to an increase in the stocking of fingerlings. Inland fish production has nearly doubled during the period 2009-2018 (Central Bank Statistics, 2019). In 2019 the total coastal and inland fish production were 249,020 MT and 87,690 MT respectively, whereas 35,000 MT of dried fish and 49,000 MT of other fish products, mainly canned fish were imported into the country. The value of total imports stood at SLR 31,947 million. The quantity of fish and fishery products imported in 2016 is reported to be as high as seven times that of exports in the same year.

Table 1. Protein, fat, dry matter, PUFA and omega-3-fatty acid content (%) of common fish in Sri Lanka

Scientific name	Sinhala Name	Protein	Fat	Dry Matter	PUFA	Omega- 3
Amblygaster sirm	Hurulla	21	2.6	25.8	0.761	0.652
Auxis thazard	Alagoduwa	20	2.2	25	0.707	0.606
Decapterus marcrosoma	Linna	18	2.0	24.3	0.432	0.329
Encrasicholina devsi	Halmessa	19	2.4	23.8	0.633	0.527
Equuliteus elongatus	Karalla	18	2.5	23.0	0.677	0.538
Leiognathus dussumieri	Karalla	17	2.2	26.3	0.714	0.482
Photopectoralis bindus	Karalla	19	1.6	24.3	0.698	0.509
Rasrelliger kanaguta	Kumbalawa	19	3.0	24.6	0.96	0.784
Carangoides fulvoguttatus	Thumba Parawa	22	1.3	23.4	0.153	0.100
Diagramma pictum	Godaya	20	0.5	21.5	0.085	0.0663
Lethrinus olivaceus	Uru Hota	21	1.1	22.5	0.174	0.045
Selar crumenophthalmus	Bolla	22	1.0	26.3	0.612	0.489
Sphyraena jello	Seelava	21	0.51	21.7	0.121	0.089

Reksten et al. (2020)

Table 2. Mineral content (per 100 g) of common fish in Sri Lanka.

Scientific name	Sinhala Name	Ca mg	Fe mg	I µg	Mg mg	P mg	K mg	Se µg
Amblygaster sirm	Hurulla	500	3.0	280	63	540	390	110
Auxis thazard	Alagoduwa	550	3.4	39	43	540	350	83
Decapterus marcrosoma	Linna	1100	5.8	54	63	740	370	230
Encrasicholina devsi	Halmessa	550	1.7	177	83	510	300	56
Equuliteus elongatus	Karalla	640	2.1	84	55	560	390	46
Leiognathus dussumieri	Karalla	2300	10	360	75	1200	310	88
Photopectoralis bindus	Karalla	1300	1.7	74	66	910	400	38
Rasrelliger kanaguta	Kumbalawa	490	3.2	95	49	520	420	53
Carangoides fulvoguttatus	Thumba Parawa	17	0.81	39	36	310	530	37
Diagramma pictum	Godaya	23	0.45	103	29	250	470	46
Lethrinus olivaceus	Uru Hota	42	0.22	75	31	280	510	44
Selar crumenophthalmus	Bolla	53	1.1	26	36	280	430	77
Sphyraena jello	Seelava	79	0.21	22	34	270	490	44

Reksten et al. (2020)

MAIN PROBLEMS IDENTIFIED

- Despite the presence of large freshwater and brackish water bodies, only marine shrimp aquaculture is carried out at the moment. Due to low production and export market oriented nature, the prices of shrimp has been high in the country.
- Poor quality of fish available for sale. Due to the lack of proper chilling facilities onboard, low availability of ice, poor transport and insanitary handling, fish and shellfish available for sale in the local market are of a poor quality. High histamine levels and high E coli counts are reported frequently.
- Less availability and high market prices of fresh fish in the areas away from the coastal belt. Due to difficulties in transport and the high cost of transport, the availability of fresh fish in mid country areas is limited. As a result, consumers tend to use alternative products such as canned and dried fish.
- There are nearly 262,000 ha of inland water available. One of the major problems associated with inland fishery (CBF) is the drawbacks of commonly available fish such as muscle texture, flavour and poor consumer preference in addition to socio cultural issues. The sensory attributes of cooked Tilapia, the main inland fish, is poor compared to those of ocean fish. As a result, many consumers prefer marine fish over inland fish. Due to the soft nature of the flesh, it is difficult to can Tilapia. Low availability of fish seed is another major issue faced by inland fishers.
- High market prices of canned fish. Currently, locally canned fish is not commonly available in the country. Canned fish is imported mainly from China nowadays and the prices range from LKR 200-350 per can of 425 g. Moreover, the quality of canned fish is sometimes questionable. There are speculations of contamination of canned fish with heavy metals, radioactive materials, chemical toxicants and parasites. As a result, some customers are worried over the consumption of canned fish.
- Multi-day boats used in the country do not have chilling facilities despite the fact that they continue fishing for 3-6 weeks in the deep sea. Currently, ice is used for chilling which is not an efficient way of chilling the catch, and as a result the quality of fish landed at the end of the journey tends to be of poor quality.

- Poor quality of dried fish available in the local market. Preparing dried fish is a proven method of fish preservation at a minimal cost using no chemical preservatives. At present, fish used for making dried fish is the spoilt fish that cannot be sold as fresh fish. Partially spoilt fish at the time of landing and fish rejects from the market end up in the making of dried fish. As a result, most of the dried fish produced in the country is of poor quality and contain histamine produced due to bacterial action. Moreover, currently the dried fish manufacturers still use conventional sun drying on the shore, which leads to a poor quality final product contaminated with sand, grits, dust and various other extraneous matter. Furthermore, in order to gain undue profits, some manufacturers do not drive off moisture completely. As the half-dried product becomes mouldy, salt is added making the final product excessively salty. In addition, some traders use illegal chemical agents such as Malathion to avoid spoilage (Rajanayake, 2020). Imported fish tainted with formaldehyde is commonly observed in Sri Lanka (Somapala, 2020).

- Poor quality of Maldive fish (Umbalakada). The Maldive fish making process is also very primitive, leading to poor quality final products with many contaminants such as plasticisers, grits, sand, dust, substances generated during smoking such as polyaromatic hydrocarbons and dioxins, faecal matter and urine of animals, and other extraneous matter.

- Low capacity of ice plants. There is a need for more ice for chilling fish in boats and for traders.

- The use of unpermitted substances to increase the retention of the quality of fish. The use of formaldehyde on fish has been reported quite frequently (Somapala, 2020). Formaldehyde is a toxic substance which is not permitted above 5 ppm in fish. As a result, the safety of fish is compromised.

- Compromised safety of fish and consumer concerns over inland fish. Due to the heavy use of agro-chemicals, industrial discharge and dumping of solid waste into reservoirs, the sediments in inland water tanks are polluted with As, Cd, Pb and other toxic metals and toxicants. Therefore, health conscious consumers are reluctant to consume inland fish from natural reservoirs.

- Ocean, lagoon, tank and waterway pollution. As a result of solid waste dumping in large quantities, micro plastics and polythene, waste oil from boats, industrial discharge, sewer discharge from dwellings and hotels, agro-chemicals, industrial chemicals and other wastes that are channelled to water bodies, ocean and inland water bodies have become polluted. As a result frequent fish kills are reported. Moreover, the breeding grounds are seriously affected and consequently there is an eminent threat of dwindling fish stock. This invariably reduces fish harvests and compromises the safety of table fish. The country is already faced with the impact of the pollution of water bodies.

- High cost of fishing gears, equipment, boats and fuel prices.

- Low availability and high cost of fish feed for inland cultured fish.

- Release of exotic, ornamental, sports and invasive fish species such as tank cleaners and knife fish used in home aquaria into water bodies. These fish species compete with table fish.

- The religious and cultural taboos and beliefs against culture based fishery (CBF).

- Low availability of fingerlings has hindered inland CBF.

SUGGESTIONS TO IMPROVE THE FISHERIES SECTOR IN SRI LANKA

- Increasing the availability and accessibility of fish in retail markets countrywide. Currently, due to the use of substandard transportation and handling methods, the quality of fish delivered to most of the inland areas is poor.
- Ceylon Fisheries Corporation is the main cold storage facilitator for fish in Sri Lanka, with different freezing methods such as blast freezing, plate freezing and conventional frozen and chill storage facilities. However, the chilling capacity provided is inadequate. Therefore, it is essential to raise the chilling facilities countrywide in order to increase the quality of fish.
- Promotion of freshwater and brackish water shrimp farming. Currently, shrimp farming is mostly carried out in marine and brackish waters. However, there is a high potential of culturing them in freshwater bodies.
- Promotion of inland fisheries. Currently, breeding centres are maintained by the National Aquatic Development Authority of Sri Lanka (NAQDA) across the country. It is important to boost the capacity of NAQDA breeding centres. It is also important to research on improved commercial table fish such as Genetically Improved Farmed Tilapia (GIFT) and introduce them to fishing communities. Distribution of GIFT has already been carried out by NAQDA and this programme should be further strengthened.
- Increased awareness on the nutritional value of inland fish consumption through community-level awareness programmes and cooking demonstrations.

- Development of novel fish processing methods for inland fish. Inland fish such as Tilapia has a mucus layer on the skin leading to gluing of fish together. This affects effective refrigeration. Canning of Tilapia is also not possible as tissues are soft and therefore flesh is smashed during pressure cooking. Therefore, currently inland fish is mostly sold fresh.

- Regulation of importation, breeding, raring and release of exotic aquatic flora and fauna most of which are detrimental to inland fish.

- Development of fishing gears locally and deploying Fishing Aggregate Devices (FAD) and Fishing Enhancement Devices (FED) which can increase fish production. Deployment of FADs and FEDs especially helps small fishermen to enhance production.

- Habitat enhancement. As a result of pollution of ocean and water bodies, fish habitats deplete at a fast rate. Dwindling habitats leads to low fish production. Therefore, it is essential to implement habitat enhancement programmes.

- Prevention of the use of illegal fishing methods such as the use of explosives and unpermitted devices. The use of fishing gears that catch fingerlings and small fish poses a serious threat to the fishing industry, as it reduces young fish stock in water bodies.

- Monitoring the ocean for hazardous algal blooms which compromise the safety of fish and can potentially lead to fish kills. Ocean monitoring can be performed using satellite imageries and information can be provided to fisher folks.

- Monitoring water quality frequently. It is important to monitor water quality so that the safety of fish can be guaranteed.

- Promotion of the consumption of small fish such as Saalaya, Linna, Herring, Karalla and sprats. Many consumers prefer to consume large fish such as tuna, skipjack and shark. However, from the stand points of nutrition as well as safety, small fish is recommended for human consumption. On the other hand small fish consumption is economical. Making them available as cleaned, cut & wrapped fresh fish packs in super market chains and other fish oultlets is essential to promote consumption.

- Promotion of the production of canned fish locally. The ocean around Sri Lanka is relatively less polluted. Thus, fish caught from around the country is of better quality compared to fish from elsewhere. Therefore, it is important for the country to promote canned fish production locally. A number of canning facilities were established in Beruwala, Galle, Peliyagoda and Chilaw area for canning fish within the last five years, some as public-private partnerships. However, they still operate at a very low scale. The major problem these operators face is the lack of fish in off season. Therefore, they find it difficult to maintain a continuous supply to the market.

- Promotion of production and consumption of frozen fish and frozen fish fillets. Excess catch of fish during the seasons can be cleaned and frozen as fish fillets or dressed whole fish so that they can be kept for long. Traders do not practice freezing fish due to heavy electricity cost and lack of chilling facilities. If installation of chilling facilities can be financially assisted by the government, frozen fish production can be promoted in the country.

- Improving chilling facilities in multi-day boats. Multi-day boats used in the country do not have chilling facilities despite the fact that they continue fishing for 3-5 weeks in the deep sea. Currently, ice is used for chilling which is not an efficient way of chilling the catch. As a result, the quality of fish landed at the end of the journey tends to be of poor quality.

- Improving the quality of dried fish. Enhancing the quality of dried fish is of paramount importance as many in the country depend on dried fish. Consumers use dried fish as a convenient food item as good quality dried fish can be stored for over one year under ambient conditions. Therefore, many especially from areas away from the coastal belt, opt for dried fish as an alternative to fresh fish. The quality of dried fish can be improved by introducing solar driers that can dry over 1,000 kg fish at a time. The use of solar driers which can simply be assembled locally can be produced at a minimal cost.

- Improving the quality of Maldive fish. Maldive fish is prepared using only a few selected fish species. Introduction of modern processing technologies such as dehydration, smoking and packaging are extremely important to uplift the quality of Maldive fish.

- Construction of fishery harbours, anchorages, cold storage facilities and ice plants as required to facilitate the fisheries industry.

- Decentralising the fish distribution network. Currently, fish caught from faraway places are first transported to a few central locations such as the Peliyagoda fish market and then redistributed. This significantly increases the duration of time in transport, leading to poor quality fish as microbial growth takes place with time.

- Promotion of construction of boats, fishing gears and other equipment locally by providing technical and financial assistance.

- Construction of boats and small ships for the fishing industry. Providing facilities for the repairs and maintenance of fishing boats is also important.

SUMMARY

Fish is a rich source of many nutrients including protein, omega-3-fatty acids, vitamin D and minerals such as iron, calcium, zinc, iodine and selenium. Omega-3-fatty acids in fatty fish are attributed to reduce cardiovascular diseases and their risk factors, rheumatoid arthritis, cancer, Alzheimer's disease, dementia, and age related macular degeneration and promote neurodevelopment of the foetus and infant. The per capita fish consumption in Sri Lanka stands at 11.7 kg. Despite the fact that the country is surrounded by the ocean and blessed with a large area of inland water bodies, a large quantity of fish products is imported in the form of canned and dried fish into the country. Consumers in areas away from the coastal belt mostly receive substandard fish at relatively higher prices. As a result, many consume canned and dried fish as a convenient form of fish. The storability of these products too has contributed to heavy consumption of these products. There is a high potential to develop freshwater culture based fisheries in the country.

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