

DFM Working Paper

A Preliminary Analysis of the Social Economy of Dried Fish in Sri Lanka

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Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada

This work draws on research supported by the Social Sciences and Humanities Research Council.

The social economy of dried fish in Sri Lanka, an island located at the crossroads of maritime trade between Europe, East Africa, South and Southeast Asia, has a long history. Dried fish has not only been an important commodity traded within the island and among neighbouring countries, but it has also played a significant nutritional and cultural role in the Sri Lankan diet. Although a greater proportion of the total fish production is iced, traded, and consumed as fresh fish, it is estimated that 14 percent of the catch is preserved using simple techniques such as sun drying, salting, smoking, and fermentation, collectively referred to as “dried fish.” In Sri Lankan cuisine, dried fish is consumed as a main dish, as well as a condiment to enhance the flavour of vegetable dishes and rice.

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Introduction

The social economy of dried fish in Sri Lanka, an island located at the crossroads of maritime trade between Europe, East Africa, South and Southeast Asia, has a long history. Dried fish has not only been an important commodity traded within the island and among neighbouring countries, but it has also played a significant nutritional and cultural role in the Sri Lankan diet. Although a greater proportion of the total fish production is iced, traded, and consumed as fresh fish, it is estimated that 14 percent of the catch is preserved using simple techniques such as sun drying, salting, smoking and fermentation, collectively referred to as “dried fish.” In Sri Lankan cuisine, dried fish is consumed as a main dish, as well as a condiment to enhance the flavour of vegetable dishes and rice.

Dried fish has been produced in Sri Lanka for centuries, as seen in British colonial records dating back to the 19th century.¹ British administrators monitored dried fish production on the west and northeast coasts, as well as trading of the commodity into larger coastal and interior towns in the Dry Zone and hill-country for the purpose of taxation of fish, as well as salt, an important ingredient in processing. There are also records of dried fish produced on the island being traded in South India² and being imported from India.³ The fish and salt taxes levied by the colonial state, as well as the growth of the fresh fish industry, were attributed to a decline in the dried fish industry since the British period.⁴

Before 1940 when ice was not yet conveniently available, beach seining, which was the predominant form of fish production, was conducted at near subsistence level with 40% of the catch consumed by the community, and around half of the catch dried and sold to interior villages.⁵ After 1940 with the introduction of ice and improved communications, the consumption of fresh fish grew rapidly between 1940-1960, becoming the predominant form

1. SLNA 1867 -1887

2. *Asiatic Journal*, “The Political Condition of Ceylon”.

3. SLNA 1883:4/161, 83A

4. SLNA 1883: Sessional paper 15

5. Alexander, “Sea Tenure in Southern Sri Lanka”.

6. DCS, "Household Income and Expenditure Survey 2012-13".

7. DCS, "Household Income and Expenditure Survey 2016".

8. DCS, "Household Income and Expenditure Survey 2016".

of animal protein consumed by Sri Lankans by the early 1980s.⁶ Nonetheless, dried fish remained the second-highest meat and fish product consumed per capita nationally, after fresh fish until 2012, after which it has been relegated to third place.⁷ Per capita consumption of dried fish, which dropped during 2009-2012, returned to 2006 levels by 2016, while the contribution of dried fish to the household food expenditure basket has remained relatively constant between 3.5 - 4.5% since 1980/81. It is especially important as a source of animal protein for low-income households in the island's rural regions.⁸

Dried fish value chains constitute intricate networks of backward and forward linkages, employing thousands of women and men in fish production, sorting, processing, and trading nationally. However, very little data and research are available on the structure and dynamics of these value chains, the exact quantities of fish dried, or the proportion of fishers and fish workers employed within the industry, in contrast to the fisheries sector as a whole. This review attempts to take stock of the scattered literature available on the dried fish industry to provide an overview of its social economy in Sri Lanka while also identifying existing knowledge gaps that the project needs to address.

The literature review is structured as follows; Section 2 provides the key secondary sources available on the dried fish industry, history, and social relations. Next, a brief overview of the fisheries sector, which provides the raw material for the dried fish industry, is given in Section 3. Then the history of the social economy of dried fish is presented in Section 4. Section 5 focuses on dried fish production in Sri Lanka, paying attention to both the marine and inland sectors. Section 6 relates to dried fish trade, including demand and supply, while local consumption is addressed in Section 7, and nutrition in Section 8. Research gaps and scoping priorities for the project are identified in Section 9.

Sources of data

Published and unpublished data were gathered from various sources, including state universities, research centres, and graduate and postgraduate dissertations. Annual reports and statistics of the Central Bank of Sri Lanka, Ministry of Fisheries and Aquatic Resources Development (MFARD), National Aquatic Resources Research and Development Agency (NARA), National Aquaculture Development Authority (NAqDA), Department of Census and Statistics, and Ceylon Chamber of Commerce, were also reviewed. Historical information was collected from administrative reports and sessional papers available at National Archives, in addition to accounts published by early British administrators and travellers. Secondary data on prices and imported dried fish varieties were available from the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) and the Customs Department of Sri Lanka. Data and analysis of socio-cultural relations were accessed through sociological studies and ethnographies of fishing communities.

The fisheries sector in Sri Lanka

Endowed with a coastal belt of 1700 km, 517,000 km² of Exclusive Economic Zone (EEZ), and 260,000 ha worth of freshwater bodies, the fisheries sector in Sri Lanka consists of two main sub-sectors: marine and inland fisheries. The marine fisheries sub-sector is again divided into coastal (near-shore) and deep-sea (off-shore) fisheries. The major share of fisheries production comes from the marine sector, while inland fisheries remain marginal, accounting for 0.1% of the GDP and 15.4% of the country's total fish production. In contrast, the marine fisheries sector: (i) accounts for 1.3% of the national GDP, (ii) produces 439,370 MT in fresh fish and 63,807 MT as fully or partially processed fish, (iii) provides 582,000 employment opportunities directly and indirectly, (iv) supplies 60% of the animal protein requirement of the population, and (v) earns 295 million USD foreign exchange through exports (27,998 MT). The marine sector's contribution to the national economy in the period 2014-2018 is shown in Table 1.

Table 1: Marine fisheries-related statistics in Sri Lanka (2014-2018)

Factor	Units	2014	2015	2016	2017	2018
Annual fish production	Mt.	459,300	452,890	456,990	449,440	439,370
Total marine fishing fleet	Numbers	53,988	50,338	50,669	46,890	50,591
Marine fishing households	Numbers	190,780	190,960	188,690	183,650	181,880
Marine fishers (men and women)	Number	221,350	221,560	218,830	220,870	218,130
Fisher organizations	Number	925	927	802	808	977
Members in fisher organizations	Number	85,323	86,410	85,208	86,347	83,518
Fish processing plants	Number	121	104	101	122	-
Packing centres	Number	-	-	-	16	-
Annual import expenditure	Rs. Mn.	18,860	30,729	35,172	33,969	32,726
Annual export earnings	Rs. Mn.	34,797	24,716	26,802	39,230	47,948

(Source: MFARD 2019)

The fisheries sector provides animal protein in various forms such as fresh fish, dried fish, maldive (smoked) fish, and jaadi (fermented fish). The sector is constituted of backward and forward linkages with enormous value additions at different nodes of multiple value chains, offering incomes for both men and women who are engaged as actors in these chains. Dried fish, as an important fisheries-based commodity produced and consumed for centuries, has distinct value chains in relation to fresh fish. Dried fish production, similarly to fresh fish production, is significant for the Sri Lankan economy as a source of animal protein, livelihoods and foreign exchange. It also helps to reduce post-harvest losses of fresh fish and constitutes value addition to fresh fish.⁹ The next section outlines the contours of the history of the dried fish industry in Sri Lanka.

9. Central Bank, "Annual Report 2018".

History of the dried fish industry in Sri Lanka

Dried fish has been produced in Sri Lanka for centuries, with the first written records of its trade appearing during the colonial period. Knox, a young British sailor who was "imprisoned" by the Sinhalese king and permitted to wander the confines of the Kandyan kingdom as a trader during the Dutch period in the 17th century, referred to Moor and Tamil traders, who brought "salt fish" and salt from the coast into the interior mountains by bullock cart, while taking back betel (areca) nuts,¹⁰ which was a major export commodity from the Kandyan kingdom to South India historically.¹¹

Dried fish production and trading were sporadically documented in British colonial records dating back to the 19th century, without much statistical information as provided for fresh fish production.¹² Dried fish was predominately produced on the west (Negombo), northwest (Chilaw), north (Jaffna), northeast (Mulaitivu) and east (Trincomalee) coasts.¹³ Dried fish production in the south is only recorded in Hambantota, as large-scale and with the patronage of the Government Agent.¹⁴ The salt tax had a negative impact on dried fish processing, as explained in a letter by Mr. F. Day, Inspector General of Fisheries, to the Secretary to the Government of India, dated, 25th of June, 1883, "*The salt tax acts injuriously on the fish curing industry*".¹⁵ British administrators closely monitored the trade of dried fish into larger coastal and interior towns in the Dry Zone and hill-country, as both fish and salt, which was used in processing fish, were products which brought in considerable tax revenues for the colonial economy. While taxes

10. Knox, *An Historical Relation of the Island Ceylon (1681)*, 99.

11. Knox, *An Historical Relation of the Island Ceylon (1681)*, 49.

12. SLNA 1833-1907

13. SLNA 1883: 134/A

14. SLNA 1883: 534

15. SLNA 1883: 134/A

16. Tennent, *Ceylon: An Account of the Island: Physical, Historical and Topographical*, 650-651, 681.

17. Tennent, *Ceylon: An Account of the Island: Physical, Historical and Topographical*, 650-651.

18. *Asiatic Journal*, "The Political Condition of Ceylon".

19. SLNA 42/43

20. SLNA 1874, 1884, 1885, 1888, 1893, 1915

21. SLNA 1884, 1914, 1917

22. SLNA 42/60

23. Byrde 1884

24. Anonymous, n.d.

on fish and salt commenced with Portuguese conquest of the Maritime Provinces in the 16th century, these were continued under the Dutch and British colonial administrations into the 19th century.¹⁶ The fish tax, which amounted to a quarter of the catch under the Portuguese, was progressively reduced over the years by the British to a tenth of the catch in 1837 until it was abolished in 1840.¹⁷ There are also records of dried fish produced in the island being traded in South India.¹⁸ Dried fish produced in Udappu, Puttalam, and Karaitivu, along the west coast, was sent to Colombo markets.¹⁹ Dried fish from the Eastern province, especially Trincomalee and Mullaitivu districts, reached the interior Anuradhapura, Matale, Kandy, Kurunegala and Badulla districts, in addition to Negombo and Colombo.²⁰ Mannar on the northwest coast was also a source of dried fish for Negombo and Colombo, as well as other regions.²¹ The commencement of dried fish processing as a large-scale commercial industry in Hambantota by an Englishman called Harris is evidence for the profitability of the industry and government patronage.²²

Negombo was reputed as a hub of dried fish production and trading from times immemorial, and traders there are reported to have purchased dried fish from Mannar, Trincomalee, as well as importing from India.²³ Fishers who migrated seasonally from Negombo to Mannar, Trincomalee, Batticaloa, Jaffna and Udappankare (Puttalam district) returned with boatloads of dried and salted fermented fish (jaadi) (*ibid.*). Further, the long tradition of dried fish processing in Negombo is revealed in this lyrical verse from a traditional folk song, which refers to the strong odour of dried fish emanating from Negombo beach.

Handhapane narakadha meegamu yanna
Ema paane narakadha veladam ganna
Be raale karawala gandha uhu lanna
Mathu waare nopathan meegamu yanna

(Is it not bad to go to Negombo in the moon light and engage in trading? Dear friend! I cannot bear the odour of dried fish. I would not wish to come to Negombo again.)²⁴

Dried fish was traded in Kurunegala, Kandy, Matale and rural areas, particularly in Uva province and in certain places bartered for grain. Most of the dried fish traded in North Central province originated from Puttalam, Mannar and Trincomalee districts. Records also reveal that itinerant Moor dried fish traders in the Eastern province bartered dried fish for kurakkan (finger millet) with traders in the Uva Province.²⁵ Although Europeans did not consume dried fish, it was used as a condiment rather than a dish by the local rural population²⁶ while fresh fish was preferred to dried fish in coastal communities. People in the Western province consumed dried fish as a "curry stuff" and it was therefore available in almost all grocery shops.²⁷ Salting, drying, and pickling were the common preservation practices used in Northern and Southern provinces. A small quantity of fish was pickled with vinegar or potted with a condiment, commonly tamarind fruit.²⁸

25. SLNA 1868

26. SLNA 1883: 47/A

27. SLNA 1883: 69/A

28. SLNA 1868: 113

Table 2: Dried fish imports to Ceylon 1872-1881

Year	Quantity cwts	Total Rs.
1872	88,761	887,610
1873	107,699	1,076,990
1874	98,643	986,430
1875	86,106	861,060
1876	86,667	866,670
1877	92,250	922,500
1878	84,429	844,290
1879	74,283	742,830
1880	89,936	899,360
1881	90,659	906,590

(Source: SLNA -Sessional Paper 15, 1883)

Dried fish was mainly imported for the urban and plantation populations together with rice from India during the British period.²⁹ Imported quantities of dried fish from 1872 to 1881 (Table 2) were reported in colonial Sessional Papers.³⁰

However, in the absence of statistics of locally produced dried fish in colonial records of the same years, the magnitude of imports, or the proportion of dried fish imports to local production or exports remains unclear.

29. SLNA 1883: Q/1/17

30. SLNA 1883

31. Alexander, "Sea Tenure in Southern Sri Lanka".

The ethnographic work of Alexander³¹ indicates that an estimated half of the fish catch of the beach seine industry (which produced the biggest proportion of the fish harvest in the country in the past) went into dried fish, and around 40% was consumed as fresh fish by coastal producing communities, prior to 1940. However, with the availability of ice, this pattern changed, and consumption of fresh fish rose rapidly, with fresh fish prices rising fivefold during 1940-1960.³² This was accompanied by changes in fortune and social relations in the beach seine industry, which had declined previously in the 1930s.³³ Access to ice and the development of

32. Alexander, "Sea Tenure in Southern Sri Lanka".

33. Alexander, "Sea Tenure in Southern Sri Lanka".

transport and communications systems eventually led to fresh fish becoming the major animal protein consumed by the Sri Lankan population by the early 1980s.³⁴

34. DCS, “Household Income and Expenditure Survey 2012-13”.

Archival sources of colonial records from the 19th century to early 20th century, as well as accounts of European travellers and colonial administrators from the 17th century onwards, point to the existence of a thriving dried fish industry in Sri Lanka, and its importance as a component of the larger fisheries industry in the social economy of the island, including its function as a source of revenue within the colonial economy. However, it appears that the industry declined during the colonial period primarily due to the taxes on fish and salt, and dried fish needed to be imported in relatively large quantities from neighbouring India to meet local consumption needs. Ethnographic accounts reveal that the national transition from dried to fresh fish consumption, which began in the pre-Independence period of the early 1940s, was consolidated during the 1970s.

Dried fish production

Dried fish production in Sri Lanka has increased from 12,000 Mt in 1995 to 61, 250 Mt in 2018, accounting for 5.1 percent of total fish production in 1995 and 13.94 percent of total marine fish production in 2018.³⁵ The lowest national production was recorded in 2005, following the devastation of the December 2004 tsunami. However, since then, the production of dried fish increased substantially until 2014, and reached a plateau by 2017 (Figure 5.1). Apart from the destruction caused to the fisheries industry, which drastically reduced fish production overall in 2005, coastal people are reported to have refrained from consuming fresh fish for some time after the tsunami, believing that fish preyed on dead human bodies.³⁶ A possible reason for the sharp increase in dried fish production during 2005-2013 might be post-tsunami and post-war donor investment in fishing (extensive donations of craft and gear) and fish processing. Both events – the war and tsunami – resulted in the marginalization and vulnerability of widows.³⁷ Dried fish processing-related livelihoods were chosen by donors for investment in the absence of opportunities for women in fishing operations. Dried fish production fluctuated from 2015, following a similar pattern as marine fish production (Figure 5.1). The production volumes of total marine fish, dried fish and share of dried fish to marine fish are given in Annex 1.

35. MFARD, “Fisheries Statistics 2018”.

36. Personal communication by lead author with research participants in Matara and Tangalle fisheries districts.

37. Quist, “Widows’ Struggles in Post-War Sri Lanka”; JAICA, “Dried Fish Business Empowers Women in Sri Lanka”.

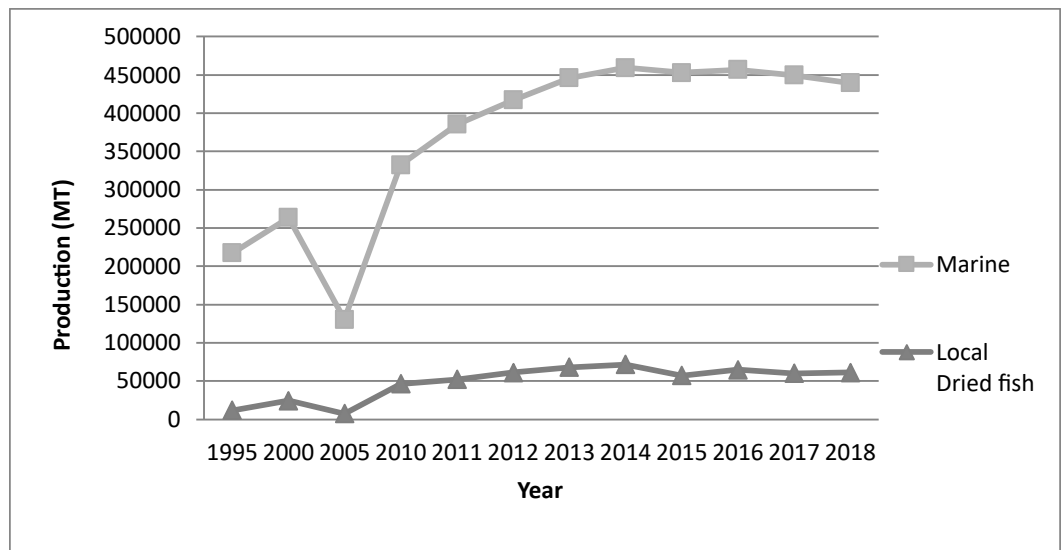


Figure 5.1. Local dried fish production from 1995-2018 (Source: MFARD 2019)

There are two major geographical variations in dried fish production – marine and inland. As in the case of the fisheries sector as a whole, marine dried fish production far outpaces inland production – with little research on inland dried fish production, it is not yet clear by how much.

Marine dried fish production



Map 1. Marine dried fish producing areas in Sri Lanka (Source: NARA 2017)

Marine dried fish is produced extensively along the coastal belt, especially in areas such as Jaffna, Mullaitivu, Kilinochchi, Mannar, Puttalam, Chilaw, Negombo, Kalutura, Galle, Hambantota, Am-

para, Batticaloa and Trincomalee (Map 1) at different scales of production. Jaffna and Mannar are the main dried sprat producing fisheries districts.³⁸ Around 70% of dried fish production in the country comes from the Northern and Eastern provinces.³⁹

Few micro- or meso-level studies exist on marine dried fish production, mainly in Matara and Galle districts on the south coast⁴⁰ and Trincomalee district on the east coast.⁴¹ These discuss the species dried, sources of supply, scale of operation, contribution to household livelihoods and incomes, and social/gender relations of production and constraints and challenges in the industry. However, there are also ethnographic studies, which are focused on other substantive areas in relation to coastal fishing communities but provide accounts of and/or data on dried fish production and trading.⁴²

Marine fish species used for drying

A wide range of marine pelagic, from coastal forage fish, such as anchovies and sardinella to oceanic predator fish, such as tuna and shark, as well as crustaceans, such as shrimp, are used for dried fish production in Sri Lanka (see Annex 2). Two studies conducted in two small coastal towns, Kottegoda and Dondra in Matara district on the south coast,⁴³ both of which produce Maldive fish (see Annex 3), found that the main varieties used were Skipjack tuna, Indian scad and Frigate tuna. Dondra additionally produced the more common dried/salted fish as well, with a wider range of species, including Yellow fin tuna, pothubari (*Sufflamen fraenatus*), wannao and lelavo. A detailed list of the main varieties of marine fish, which are dried, is provided in Annex 2.

Inland dried fish production

Inland dried fish processing is popular in areas of perennial reservoirs in the dry zone of Sri Lanka.⁴⁴ Dried inland fish is produced in Anuradhapura, Polonnaruwa, Minneriya, and Moneragala districts, based on natural reservoirs and tanks.⁴⁵ However, the quantity of inland dried fish production is marginal and poorly documented. The few studies⁴⁶ provide basic data on types of fish, processing techniques, supply and demand, and fish prices. Small

38. NARA, “Fisheries Industry Outlook 2016”.

39. MFARD, “Fisheries Statistics 2013”.

40. Peiris, “The Impact of Technology in Maldive Fish and Dried Fish Industry in Southern Province”; Gunawardena, “Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka”; Korlagama and Bandara, “Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka”.

41. Yuganthan et al., “Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka”.

42. Alexander, “Risks, Rewards and Uncertainty: Fishermen of Southern Sri Lanka”; Alexander, “Sea Tenure in Southern Sri Lanka”; Stirrat, *On the Beach: Fishermen, Fishwives and Fishtraders in Post-Colonial Lanka*.; Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”.

43. Gunawardena, “Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka”; Peiris, “The Impact of Technology in Maldive Fish and Dried Fish Industry in Southern Province”.

44. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”.

45. Sugathapala, Suntharabarathy, and Edirisinghe, “Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka”.

46. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”; Sugathapala, Suntharabarathy, and Edirisinghe, “Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka”.

47. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

48. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

49. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

50. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

51. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

52. Sugathapala, Suntharabarathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka".

fish varieties of 6.875 - 8.75 cm and damaged fish are mostly used for processing in inland production in the Minneriya Reservoir.⁴⁷ Many local freshwater fish fetch low prices because they are small and have a high proportion of bones and are therefore used for drying.⁴⁸ Processing techniques employed to extend the shelf life of freshwater fish are mainly salting or sun-drying.⁴⁹ The fish is mixed with salt in a ratio of 1:3 (Salt:fish) and stacked in a bucket for 2-3 days and then sun-dried. The approximate carcass recovery rate is 33.3%. Inland dried fish producers earn a profit of 255 Rs/kg with a producer market margin of 72.9%.⁵⁰ Fresh water dried fish from Minneriya Reservoir is sold in the nearby market towns of Minneriya and Dambulla, where cultural and religious barriers to consumption of meat and unavailability of other sources of animal protein ensure a demand for dried fish.⁵¹ While Sugathapala et al.⁵² do not elaborate on the cultural dimensions of dried fish consumption, this would be a worthwhile area to examine in the Sri Lankan component of the study.

Inland species used for drying

The varieties of freshwater fish dried are not as extensive as marine fish. Among the common varieties of inland fish that are dried include Filamented barb, Pearl spot cichlid, Tilapia, and catfish. A list of the main freshwater fish species used for processing is indicated in detail in Annex 2.

Fish drying and processing methods in Sri Lanka

Four methods of fish processing are recorded in the Trincomalee Administrative Report of 1883:

- **Dried fish:** the fish is opened by its back or side – generally by the back – entrails taken out and the body sliced inside lightly, and then washed in salt or sea water. Salt powdered into dust is applied inside, thickly to the incised parts, and the fish so prepared, after being kept in tubs or baskets, is taken out next day, unfolded and spread out in the sun until thoroughly dry.

- **Salt fish:** the fish is cleared of entrails, sliced and washed as above, double the quantity of salt used for dried fish is applied – and packed, spread in barrels, and is not exposed to the sun to dry.
- **Tamarind fish:** the fish is cleaned and washed as above, spread out in a tub or other receptacle, and powdered salt mixed in tamarind juice water is thickly applied, the process being repeated over every layer or row of fish so spread.
- **Goraka fish:** the same process as tamarind fish is followed in all respects, except that goraka (dried Gamboge fruit, *Garcinia cambogia*) is used with salt to preserve the fish.⁵³

53. SLNA 1883: No 376/19/11. The text of the original Administration Report has been retained.

Current drying and processing methods are similar to those described in the past, except fermenting, the fish with tamarind or gamboge for the preparation of *jaadi* is not as common as in the past. Both tamarind and gamboge fruit are acidic and are likely to prevent mould, as well as provide a distinct flavour, although these attributes have not been indicated in the literature. The reason for the decline of fermented fish in the form of *jaadi* needs to be further examined in the Sri Lankan study.

Commonly used current methods are:

- **Sun drying:** the rudimentary method of fish drying. Fish is dried under the hot sun without adding salt. Normally, multi-day boats produce sun-dried fish, locally known as *bottu karawala* (boat dried fish) with the first few catches on their fishing trips.'
- **Salting and sun drying:** cleaned fish are slit in parallel lines down the fleshy parts, into which pounded salt is well rubbed. They are then put into barrels and kept for 12 hours, undergoing a second cleaning in salt-water, and exposed to dry in the hot sun for 4-5 days on raised stick platforms, so as to keep them free of sand.
- **Jaadi:** a wet form of fish processing method, also known as fish curing or pickling. Here, fish is cleaned, salted, and packed in brine with small pieces of goraka (*Garcinia cambogia*) using wooden barrels or glazed earthenware jars. Acid in the goraka causes fermentation and tones down the salty taste of fish. Species like herring, sardine, and mackerel are used in pickling. Preparation methods vary based on geographical areas and takes about 2-3 weeks for the curing process, which does not require sunlight.

54. Peiris, "The Impact of Technology in Maldivian Fish and Dried Fish Industry in Southern Province".

- **Maldivian fish processing:** several techniques are practiced for Maldivian fish processing. Peiris⁵⁴ has investigated three Maldivian fish processing methods and four dried fish processing methods in Southern Sri Lanka (Annex 3). While traditional processing of Maldivian fish, which is recommended by the Industrial Development Board in Sri Lanka, is based on smoking the fish, the method described substitutes the process of smoking with smearing the fish with wood ash prior to sun drying.

The methods discussed so far are mainly applicable for curing and preserving large fish, whereas small fish is simply dried in the sun without being salted. Methods used for dried fish processing do not vary much between marine and inland fisheries as well as by region.

Relations of production

55. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka"; Yuganthan et al., "Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka"; Bandara, "Supply Chain Analysis of Selected Marine Dried Fish Varieties in Matara District"; Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka"; Stirrat, *On the Beach: Fishermen, Fishwives and Fishtraders in Post-Colonial Lanka*.

56. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

57. Koralagamage, "Small-Scale Fisher Migration, Conflict and Wellbeing A Case Study from Sri Lanka".

58. Koralagamage, "Small-Scale Fisher Migration, Conflict and Wellbeing A Case Study from Sri Lanka".

59. Piyasiri, Amarasinghe, and De Silva, "Gender Dimension in Small Scale Fisheries Development: Issues in Gender Equity and Equality: A Research Study Carried out in Gandara, Southern Sri Lanka"; Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka"; Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

There are several studies that outline the social relations of dried fish production at the micro-level of fishing communities.⁵⁵ These indicate that the main suppliers of raw fish for dried fish processors, many of whom are women, are their fisher husbands, other fishers or boat owners who are kin or neighbours from the community, relatives working as crew members, fishers from nearby villages and fish landing sites, and traders from other areas. Moreover, low-quality fish is obtained for processing from multiday boats at nearby fisheries harbours at lower prices.⁵⁶ The fish thus used is referred to as *dawal malu* (afternoon fish) brought in by boats which land late or *yata malu* (the fish at the bottom of the net), which is considered low quality.⁵⁷ Some small-scale fishers in Negombo, specialised in operating their one-day boats, migrate to Mannar (northwest) and Batticaloa (east) during the off-season, to catch fish specifically targeting for drying. These fishing households operate small-scale dried fish processing enterprises with the support of hired local labour.⁵⁸

The centrality of women in dried fish processing is emphasized by Amarasinghe et al., who note that dried fish processing is done by wives of fishers and crew members as a supplementary livelihood activity, as well as by women and men who specialized in operating micro/small fish processing enterprises.⁵⁹ As a supplementary

livelihood for women in fishing communities, fish processing remains an important source of additional income for fishing households;⁶⁰ it is critical for smoothening inter-temporal fluctuations in daily fishing incomes brought in by their menfolk.⁶¹ Family-based micro-scale production units and small-scale enterprises in Matara district on the south coast operate with 5-8 employees.⁶² In two fishing communities in Puttalam district on the west coast, small-scale dried fish processing enterprises employed up to 6-10 women for sorting, cleaning, and processing fish, as well as several men for carrying and washing the fish.⁶³ Wages were paid partially in cash and kind. All together, around 16% of women from fishing households were engaged in micro or small dried fish processing enterprises in these two communities.⁶⁴ The partners and employees of such enterprises are often female family members, relatives, friends, and neighbours.⁶⁵ Owners of micro-scale dried fish processing enterprises are most often women, while owners of small-scale enterprises can be men or women in fishing villages in Puttalam district.⁶⁶

Dried fish production in Matara District is seasonal. The peak season is the period of the south-west monsoon from May to September due to excess fish supply and lower fish prices.⁶⁷ However, a few families who process dried fish as a family-based enterprise continue throughout the year. In the two study villages in Puttalam district, where around 75% of men from fishing households migrate seasonally to the east/northeast coasts during the south-west monsoon, dried fish processing is done in home villages from October to March.⁶⁸ Around 25% of women who accompany their husbands to the east/northeast coasts continue processing dried fish in host locations from March to September. Women migrants indicated dried fish processing as a significant motivation and benefit of seasonal migration.⁶⁹

The main obstacles to dried fish processing indicated by respondents in Matara district were high labour costs, inadequate fish supply for processing, especially during the off-season, uncertain weather, and poor storage facilities.⁷⁰ Moreover, accessibility to fresh fish (input), beach (place), market (revenue), finance (decision making), as well as lack of social recognition and powerlessness, were highlighted as constraints by women fish processors in Matara district.⁷¹ According to Elapata and Silva,⁷² maldivian fish

60. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka"; Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka"; Siason et al., "Women in Fisheries in Asia"; Murray, Kodithuwakku, and Little, "Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development".

61. Piyasiri, Amarasinghe, and De Silva, "Gender Dimension in Small Scale Fisheries Development: Issues in Gender Equity and Equality: A Research Study Carried out in Gandara, Southern Sri Lanka".

62. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

63. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

64. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

65. Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka"; Bandara, "Supply Chain Analysis of Selected Marine Dried Fish Varieties in Matara District".

66. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

67. Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka".

68. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

69. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka"; Koralagamage, "Small-Scale Fisher Migration, Conflict and Wellbeing A Case Study from Sri Lanka".

70. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

71. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

72. Elapata and De Silva, "Women's Position in Blue Economy".

73. Quisumbing et al., “Gender, Assets, and Market-Oriented Agriculture”

74. Mutua, Njuki, and Waithanji, “Review of Gender and Value Chain Analysis, Development and Evaluation Toolkits”; Ingram et al., “Gender Implications of Forest Product Value Chains in the Congo Basin”

75. Elapata and De Silva, “Women’s Position in Blue Economy”.

76. Amarasinghe and Piyasiri, “Post-Harvest Losses, Processing and Gender Issues in Fisheries: Is There a Way Out”.

77. Amarasinghe and Piyasiri, “Post-Harvest Losses, Processing and Gender Issues in Fisheries: Is There a Way Out”.

78. Yuganthan et al., “Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka”.

79. Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”; Yuganthan et al., “Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka”.

80. Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”.

processing is predominantly done by women. However, the decision making, especially on pricing and investment plans, are taken by male counterparts, which appears to be different from other dried fish processing, most likely as maldive fish is a higher value product. The gender literature on value chains shows that men control the more profitable nodes of value chains⁷³ and/or tend to take over ‘women’s products’ when returns from these products become high.⁷⁴ Excessive involvement of middlemen keeps female fish processors away from markets, contributing to feelings of isolation and demoralization among female processors.⁷⁵ Amarasinghe and Piyasiri⁷⁶ estimate post-harvest losses of around 40-60% of the fresh fish catch in Sri Lanka and identifies fish processing as one means of reducing such losses. They indicate such losses as due to the use of destructive gear and fishing techniques, inadequate on-board handling of fish and unsuitable conditions at landing sites, leading to the low quality of fish available to fish processors. The need for value addition (based on good health standards, new product lines and marketing), additional research, innovation, and training in fish processing, as well as better organization in producer groups to improve the industry and wellbeing of women processors and their families, are emphasized.⁷⁷

The work of Yuganthan et al.⁷⁸ on dried fish production in Trincomalee district on the east coast reveals multiple inter and intra community relationships, which are established for knowledge sharing, sourcing of fresh fish, work assistance and marketing mechanisms by processors. Knowledge and experience of dried fish processing are mainly passed down from parents to children. The importance of external relationships is revealed by the fact that most producers sell through wholesalers. However, formal institutional support for dried fish processing is lacking in all of these sites for which data are available.

The available studies also indicate ethnic differences in gender relations in dried fish processing. For example, women’s engagement in dried fish processing is lowest in Muslim fishing communities in Trincomalee district, with women family members sporadically supporting men, who are both owners and employees of processing enterprises.⁷⁹ Women’s engagement in dried fish processing appears to be highest in Sinhala Catholic and Tamil Hindu fishing communities in Puttalam district.⁸⁰ Sinhala

Buddhist fishing communities in Matara district fall somewhere in between in terms of women's participation.⁸¹ An increasing trend in women's engagement in dried fish processing is observed particularly in Gandara, on the south coast of Sri Lanka.⁸²

The literature available on dried fish production provides a relatively well-rounded picture of this segment of dried fish value chains, both at the macro and local levels. However, more research on levels of employment in dried fish processing, wages, profit margins, labour conditions, gendered relations, and governance is necessary for a better understanding of how processing is linked to other segments of dried fish value chains, such as procuring raw materials, trading of processed fish and consumption.

81. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka"; Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka".

82. Piyasiri, Amarasinghe, and De Silva, "Gender Dimension in Small Scale Fisheries Development: Issues in Gender Equity and Equality: A Research Study Carried out in Gandara, Southern Sri Lanka".

Dried fish trade

The largest share of dried fish produced in Sri Lanka is traded within the island. Small proportions are used for subsistence by producers and a very small quantity is exported. Around 65% of the national demand is produced locally, while the remainder is imported mainly from South and Southeast Asian neighbours.⁸³ The main trading partners for dried fish imports included Pakistan, India, Indonesia, Thailand, United Arab Emirates, and the Maldives in 2004⁸⁴ and in 2011⁸⁵ but China appears to have also become a source of imported dried fish in the last decade.⁸⁶ Dried fish trading occurs at domestic (internal) and international (external) levels.

83. MFARD, “Fisheries Statistics 2015”.

84. Tissera, “Dry Fish Market Research”

85. NARA, “Fisheries Industry Outlook 2011”

86. NARA, “Fisheries Industry Outlook 2011”

Internal trade

Statistics and studies which would provide a macro-level analysis of the internal trade of dried fish in Sri Lanka are conspicuous by their absence. What little can be gleaned is from passing references to dried fish in research centred on marketing of fresh fish, as in the work of Murray et al..⁸⁷ Local dried fish value chains encompass producers, processors and traders connected to local, regional, and national markets. Dried fish purchased from producers and processors are mainly sold by the processors themselves or traders in local fairs (polas)⁸⁸ or small general stores (kades) scattered throughout villages and towns on the island.⁸⁹ On certain occasions, collectors connect producers/processors to wholesalers or to retail markets. Specialized wholesale traders move between processors in coastal communities, local markets, and the central market in Colombo, moving the bulk of the marine dried fish supply within the country.⁹⁰ The small-scale traders, who operate at the local level, many of whom are women, sell small, low-cost varieties of dried fish (Siason et al. 2012). There is a seasonal

87. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”.

88. Siason et al., “Women in Fisheries in Asia”

89. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”.

90. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”.

91. Murray, Koddithuwakku, and Little, “Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development”.

variation in these local markets with increases in marine dried fish trading during the dry season and in inland dried fish trading in the rainy season.⁹¹ The extent to which marketing has changed in the last two decades, especially the role of wholesalers and expansion of supermarket chains within the country and potential trends towards concentration within the trading segment of the value chain, needs to be assessed.

External trade

In contrast to internal trade, external trade in dried fish is well-documented, and longitudinal data available from several sources (MFARD; HARTI, Customs Department). Thirty-five percent of dried fish (excluding maldive fish) consumed in Sri Lanka, amounting to 32,176 Mt in 2018, was imported to meet domestic demand.⁹² This was a significant decline from 1995, when 78.9% of dried fish (excluding maldive fish) consumed in Sri Lanka was imported (ibid.). Of all dried fish (including sprats and maldive fish) imported, 50% came from Pakistan, 18% from Indonesia, 16% from India, 9% from the United Arab Emirates and 7% from the Maldives in 2004.⁹³

92. MFARD, “Fisheries Statistics 2018”

93. Tissera, “Dry Fish Market Research”

Canned fish, dried fish, and maldive fish are the main processed fish products imported to Sri Lanka (Figure 6.1). Canned fish imports increased gradually from 2009 to 2014 and then showed an exponential rise from 2014 to 2015. Since 2015 canned fish has overtaken dried fish as the main imported processed fish product.

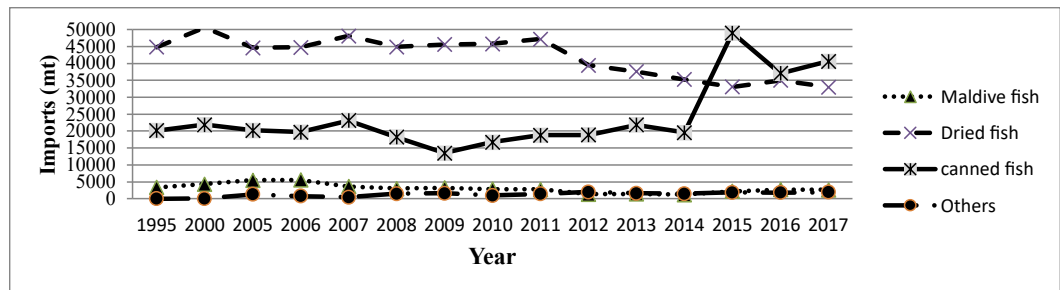


Figure 6.1 Different types of imported processed fish and fisheries products (Source: MFARD 2019)

94. MFARD, “Fisheries Statistics 2018”

95. Tissera, “Dry Fish Market Research”.

96. Tissera, “Dry Fish Market Research”

Sprats (anchovies) account for 70 percent of total imports of dried fish.⁹⁴ Thailand is the major supplier of dried sprats, which accounted for 78 percent of imported sprats in 2004.⁹⁵ Pakistan supplied 43% of other imported fish in 2004.⁹⁶ In spite of the declin-

ing trend in dried fish imports from 2011 (Figure 6.2), sprat imports remained unchanged at around 25,000 Mt during 2012-2018.⁹⁷ Compared to sprats, other dried fish imports reached a peak of 50,000 Mt in 2000 and have since declined by around 35% in 2018.

97. MFARD, “Fisheries Statistics 2018”.

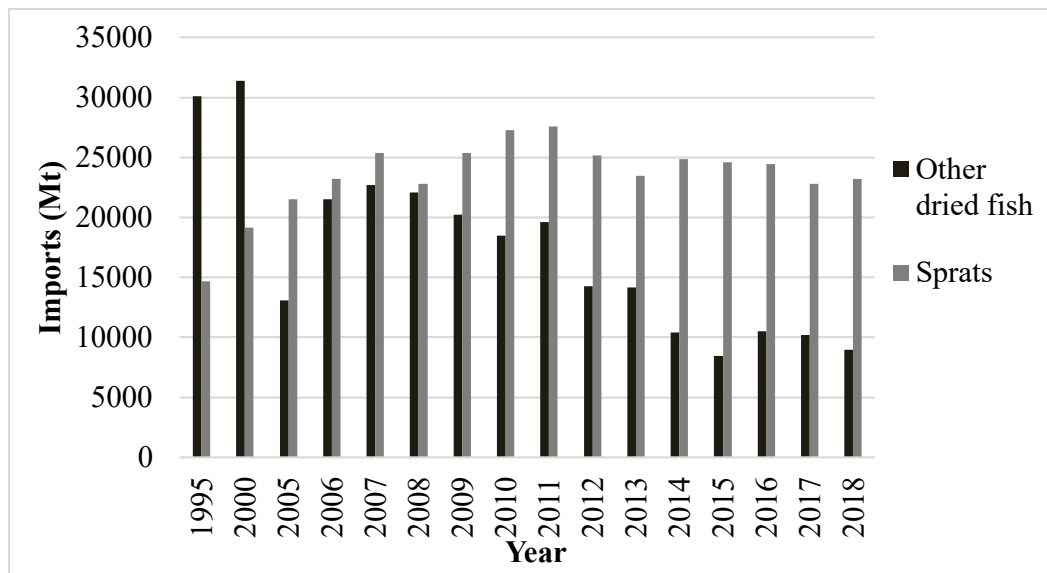


Figure 6.2. Imports: Quantity of sprats and other dried fish (Source: MFARD 2019)

Although the quantities are far lower than other imported dried fish items, maldive fish shows a declining trend from 2008 to 2018 (Figure 6.1). Yet, it is used widely as a condiment in vegetable curries. It has also become popular as a preparation of 'maldive fish sambol', which is consumed at celebrations and as a bottled 'ready-to-eat' commodity. Maldive fish accounts for 8% of the total processed fish imports.⁹⁸

98. MFARD, “Fisheries Statistics 2018”.

Exports of dried fish in relatively smaller quantities in comparison to imports, go to countries such as Canada, Singapore, Middle-East, and Australia, where there is a demand for this commodity among Sri Lankan diaspora communities. Sri Lankan anchovy, Spanish mackerel, and queen fish (katta) are popular exported dried fish varieties.⁹⁹

99. Weerahewa and Kodithuwakku, “Market Analysis of Dried Aquatic Products in Sri Lanka”.

Market relations in dried fish value chains

Trading is a core component of dried fish value chains, linking producers/processors with consumers. Trading of dried fish occurs at the levels of collecting, wholesaling, and retailing. The engagement of women in micro/small-scale dried fish trading at the local level is well documented¹⁰⁰. Apart from selling dried fish that they themselves have processed, women traders in fishing communities purchase dried fish from relatives, friends and neighbours and sell these door-to-door or at local markets in neighbouring villages and towns. Siason et al.¹⁰¹ elaborates this as follows:

Substantial numbers of vendors are involved in retailing dried fish at the weekly markets known as “Pola” in Sinhala...vendors in Galgamuwa and Anamaduwa of the North-western province... come from nearby coastal areas to inland areas to sell the smallest dried 'trash' component of their husband's catch, which they process themselves. An alternate strategy adopted by many women vendors involved the purchasing of some or all of their stocks from wholesale traders. For most of the women vendors, this is a part-time occupation, which is highly seasonal” (page 33).

Women traders in a fishing community in Puttalam district, on the west coast, organized to travel together in hired vehicles or public transport to fishing communities on the east/northeast coast to purchase dried fish from processors there, and bring stocks back to sell in west coast villages and towns.¹⁰² In analyzing the monthly earnings of dried fish traders, it was found that there was no difference in earnings between male and female traders in two fishing communities in the Puttalam district, indicating gender equity within this activity at the local level. However, in two fishing villages in Trincomalee district, male traders received around 88% of earnings and female traders merely 24% of earnings of dried fish traders (women and men) in the two Puttalam fishing villages.¹⁰³ This reveals the prevailing inequalities based on gender and region within micro dried fish trading in the country.

100. Stirrat, *On the Beach: Fishermen, Fishwives and Fishtraders in Post-Colonial Lanka*.; De Silva, Bjorndal, and Lem, “Role of Gender in Global Fishery Value Chains”; Siason et al., “Women in Fisheries in Asia”; Koralagama and Bandara, “Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka”; Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”.

101. Siason et al., “Women in Fisheries in Asia”.

102. Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”.

103. Weeratunge et al., “On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka”.

Despite women's extensive participation in dried fish processing¹⁰⁴ and micro-small trading activities, men predominate in large-scale marketing of processed fish.¹⁰⁵ As indicated by Murray et al.,¹⁰⁶ wholesalers travel between dried fish processing communities, local markets, regional and national markets, moving the bulk of the dried fish stock within the island. Dried fish processors in fishing villages in Matara and Puttalam districts sell their products to door-to-door vendors, collectors, and wholesalers who visit their villages.¹⁰⁷ In Trincomalee district, male wholesalers are predominant in purchasing from processors,¹⁰⁸ while small quantities are also sold within communities by women traders.¹⁰⁹ Similar observations are reported in Jaffna, where the most prevalent dried fish value chain is, selling through producer, collector, wholesaler, and retailer. Selling dried fish at any of these nodes is differentiated mainly by quantity. However, women's participation is predominant at the processing level, rather than wholesaling and retailing in Jaffna town.¹¹⁰ De Silva et al.¹¹¹ explains men's dominant roles at the higher end of value chains, such as commercial fish processing, wholesale business and markets, as due to the necessity for high levels of investment, which in turn bring in higher returns. In contrast, women's participation at the lower levels of value chains, as well as value chains with fewer nodes, is attributed to cultural practices and poor literacy.¹¹² Siason et al.¹¹³ maintain that the scale of dried fish marketing is dependent on volume, species composition, gender, spatial and temporal aspects.

Constraints encountered by women dried fish traders are discussed by Koralagama and Bandara.¹¹⁴ Women are restricted from buying fresh fish and selling dried fish due to cultural taboos - for example, they are not permitted to go to the beach. This is more evident in Sinhala Buddhist, Tamil Hindu and Muslim, than in Sinhala/Tamil Christian fishing communities.¹¹⁵ For example, in two Tamil Hindu fishing communities in Puttalam and Trincomalee districts respectively, women's access to the beach was constrained not only by taboos preventing women from touching the boats and fishing gear, but by male ideological notions that it was their role to earn money for women.¹¹⁶ Moreover, women traders demonstrated less bargaining power in negotiating with male dried fish buyers.¹¹⁷

104. Piyasiri, Amarasinghe, and De Silva, "Gender Dimension in Small Scale Fisheries Development: Issues in Gender Equity and Equality: A Research Study Carried out in Gandara, Southern Sri Lanka".

105. De Silva, Bjorndal, and Lem, "Role of Gender in Global Fishery Value Chains".

106. Murray, Koddithuwakku, and Little, "Fisheries Marketing Systems in Sri Lanka and Their Relevance to Local Reservoir Fishery Development".

107. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka"; Gunawardena, "Gender Equity and Equality in Dry Fish Processing: A Case of Southern Coastal Region in Sri Lanka"; Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

108. Yuganthan et al., "Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka".

109. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

110. Sobiga and Koralagama, "Market Margin Analysis of Selected Dried Fish Varieties along the Dried Fish Value Chain - a Case Study in Jaffna District".

111. De Silva, Bjorndal, and Lem, "Role of Gender in Global Fishery Value Chains".

112. De Silva, Bjorndal, and Lem, "Role of Gender in Global Fishery Value Chains".

113. Siason et al., "Women in Fisheries in Asia".

114. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

115. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka".

116. Weeratunge et al., "On the Move: Gender, Migration and Wellbeing in Four Fishing Communities in Sri Lanka"; Yuganthan et al., "Social Relationships of Dried Fish Producers in Trincomalee District, Sri Lanka".

117. Koralagama and Bandara, "Socio-Economic Issues of Women Dried Fish Processors in Southern Sri Lanka".

118. Amarasinghe, “Profitability of New Fish-Catching Technology in the South of Sri Lanka”; Siason et al., “Women in Fisheries in Asia”; Korlagama, “Idiosyncratic Shocks among Small Scale Marine Fishers in Southern Sri Lanka”; Wickramasinghe and Bavinck, “Institutional Landscapes Affecting Small-Scale Fishing in Southern Sri Lanka-Legal Pluralism and Its Socio-Economic Effects”.

119. Korlagamage, “Small-Scale Fisher Migration, Conflict and Wellbeing A Case Study from Sri Lanka”.

Although institutions and access to credit facilities are relatively well-established for fishers,¹¹⁸ there is a lack of data on institutions that support or provide services to the dried fish industry. However, in the absence of formal financial institutions, some dried fish processors and traders obtain credit from informal sources, such as boat owners, large-scale traders, money lenders and wholesalers, often leading to indebtedness.¹¹⁹ The extent of the role played by formal vs. informal sources of credit in the dried fish industry needs to be explored in the study.

In contrast to that of the dried fish production segment, the literature on the internal dried fish trade is sketchy at best. The quantities that are traded internally in comparison to subsistence use, the numbers employed in dried fish trading, the major regional market hubs, exchange relations among collectors, wholesalers and retailers, gender relations, as well as the structure and dynamics of governance within this sector, are little known.

Dried fish consumption

With 83% of the population professing a Buddhist or Hindu religious affiliation, there is a strong cultural preference for fish over other animal protein sources in Sri Lanka.¹²⁰ Sri Lankans prefer fish to meat, which is evident from Figure 7.1 and Figure 7.2, where the consumption of fish shows a continuous increase from 2006 to 2016. Fish remains by far the highest consumed meat or fish product by households (Figure 7.1), with fresh and dried fish together amounting to 2.5 times over the monthly average consumption of all other meat products combined in 2016. While fresh fish consumption has remained relatively constant during 2006-2016, chicken has gradually overtaken dried fish by 2012, to become the second-highest consumed meat and fish product by households after fresh fish. Figure 7.1 also shows a declining trend in dried fish consumption from 2006, decreasing from second to third place in 2012. The gap between chicken and dried fish consumption has widened from 2012 onwards. However, dried fish consumption remained at an important third place in 2016.

120. Jayantha and Hideki, “An Analysis of the Post Tsunami Domestic Fish Marketing and Consumption Trends in Sri Lanka”.

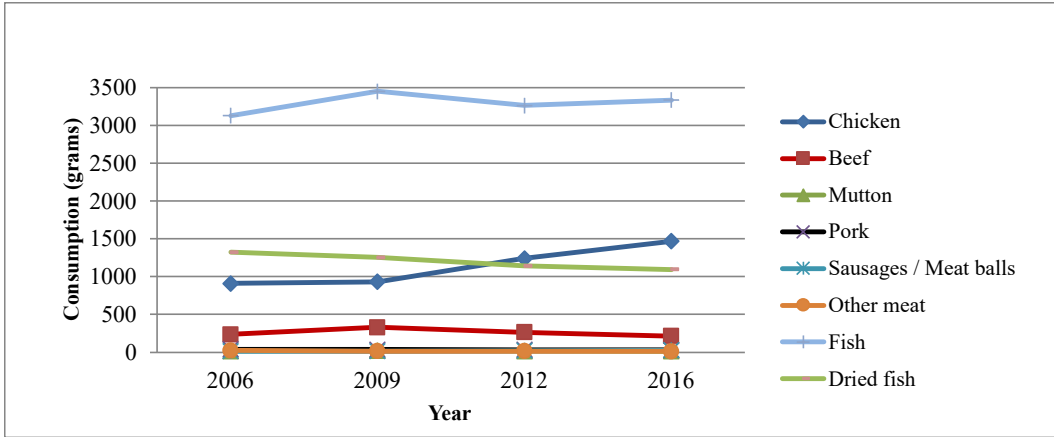


Figure 7.1 Average monthly household animal protein consumption (excluding egg and milk) (Source: DCS 2016)

There is a lack of research on the cultural preferences for meat consumption in Sri Lanka and why fish or chicken might be preferred over other meats. Religious taboos prevalent for the four religions practiced in the country – Buddhism, Hinduism, Islam and Christianity – as well as regional preferences would need to be explored to understand these changes within the consumption segment of the value chain.

121. DCS, “Household Income and Expenditure Survey 2016”.

The average monthly consumption of dried fish per household was about 1.1 kg, whereas fresh fish consumption was 4.1 kg in 2016.¹²¹ Thus, there was a threefold demand for fresh fish over dried fish. However, if the conversion of dried fish into the wet weight were taken into account, dried fish consumption would represent at least the equivalent of wet fish, both in terms of quantity and nutritional value. The same pattern is noticeable at the individual level, where fresh fish consumption far outpaced meat and meat-related products, followed by chicken and dried fish (Figure 7.2). However, it is important to note that the monthly dried fish consumption per capita declined during 2009-2012 to rise however, to 2009 levels by 2016, not consistent with the level of gradual decline in average household consumption. This might be due to the decrease in average household size (from 4.0 to 3.8) during this period.¹²²

122. MFARD, “Fisheries Statistics 2018”.

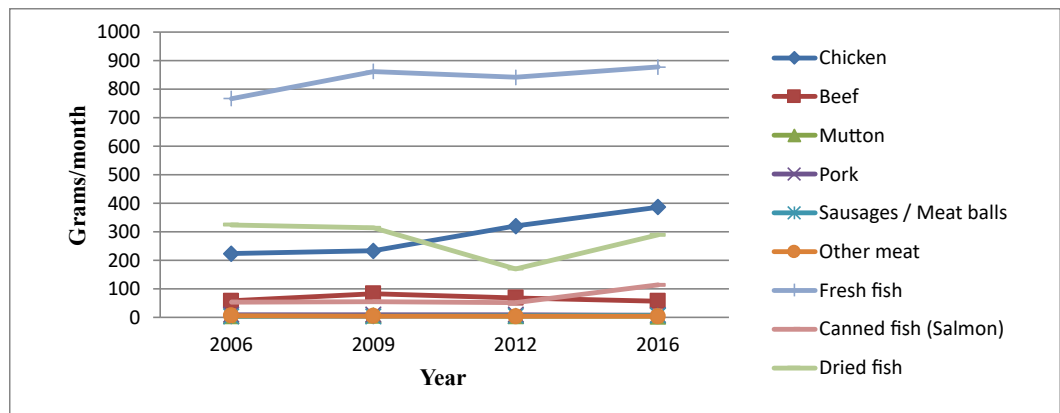


Figure 7.2. Per capita monthly animal protein intake (excluding eggs and milk) (Source: DCS 2016)

Despite the quantity of dried fish consumption in grams per month at the household level showing a decreasing trend and the quantity of chicken consumption showing an increasing trend from 2006 (Figure 7.1), the expenditure on dried fish consumption has gradually increased in the same period at a slightly higher gradient than chicken consumption (Figure 7.3).

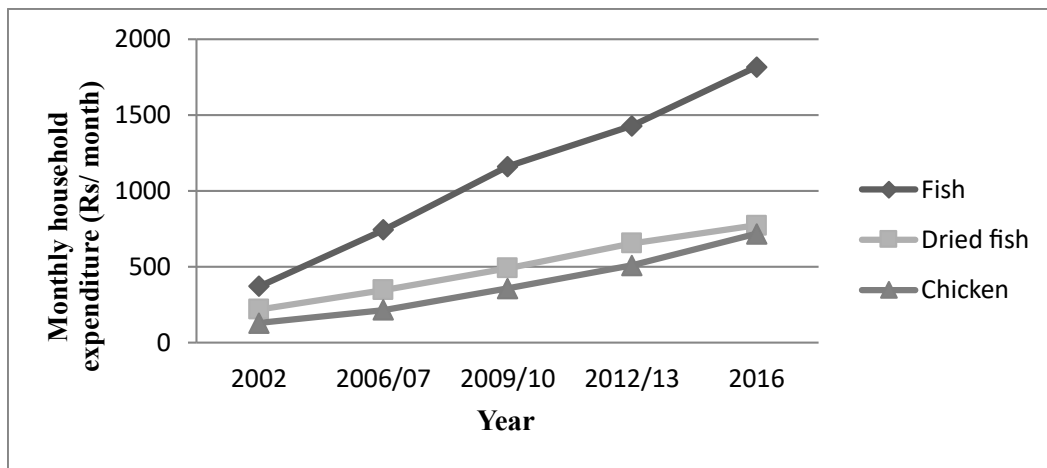


Figure 7.3. Average monthly household expenditure on main animal protein sources (Source: DCS 2016)

On average, households in Sri Lanka spent 2.4 times more on fresh fish than dried fish in 2016 (Figure 7.3). In comparison, with the quantity - three times more fresh fish than dried fish consumed by households in 2016 (calculated from Figure 7.1) – the difference in the expenditure ratio indicates relatively higher marginal expenditure on dried fish (Figure 7.6). This is further validated by the percentage share of monthly expenditure on fresh fish, which is 2.4 times more than dried fish (Figure 7.4).

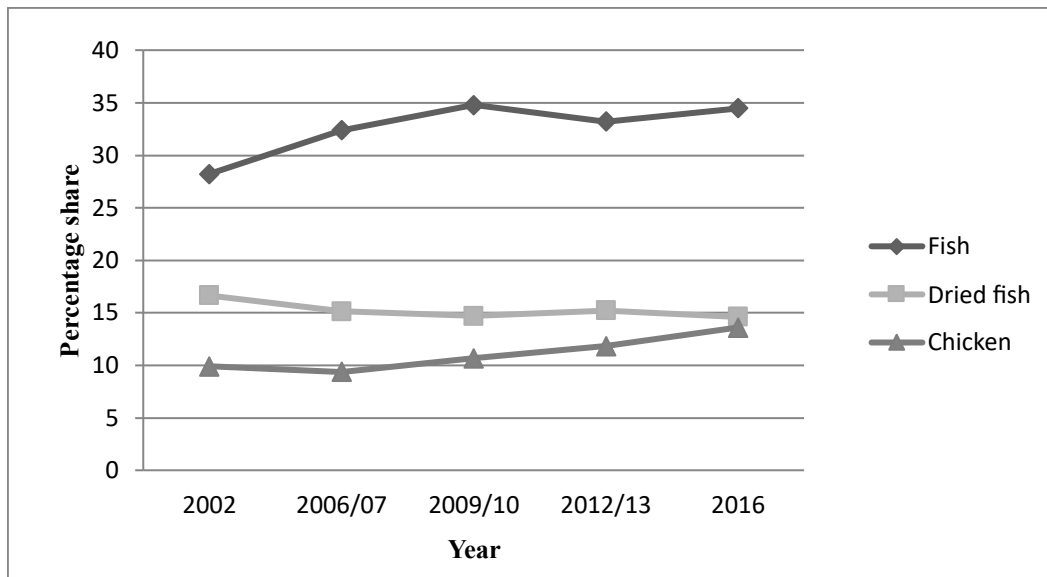


Figure 7.4. Percentage share of average monthly household expenditure from total animal protein (Source: DCS)

The declining percentage share of expenditure on dried fish seems to be captured by the increasing percentage share of expenditure on chicken (Figure 7.4). The percentage share of expenditure on

dried fish declined gradually from 2002 to 2006, reaching a plateau until 2012. On the other hand, the share of expenditure on chicken decreased slightly from 2002 to 2006 but increased thereafter, reaching near parity with the dried fish share in 2016.

The changes in average household expenditure on dried fish and chicken are consistent with the price effects of chicken over dried fish. Price variation of the main three dried fish varieties consumed – skipjack tuna (balaya), sprat (anchovy), and queen fish (katta) – was analyzed in relation to chicken prices (Figure 7.5). Although the price of chicken was relatively constant from 2009 to 2016, the prices of skipjack tuna and queen fish have increased markedly with a higher gradient. However, sprat prices do not show as high an increase as the other two dried fish varieties, reaching 1.5 times the price of chicken in 2016, whereas skipjack tuna and queen fish show 2.12- and 2.75-fold prices respectively, relative to chicken prices in the same year.

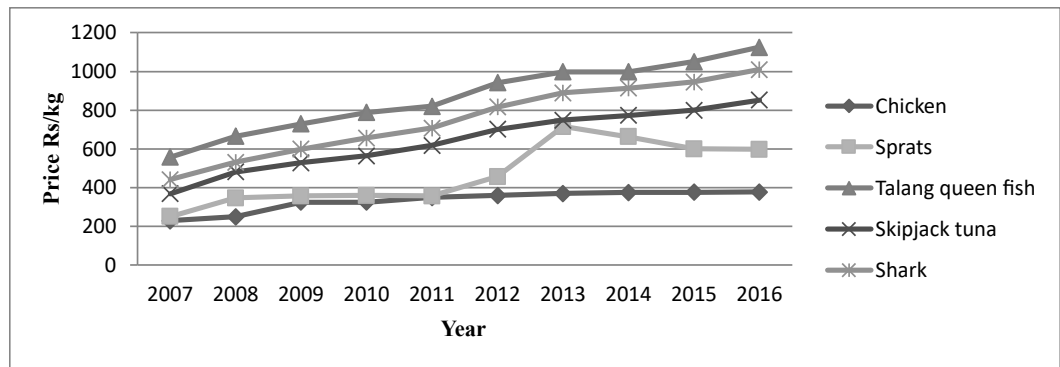


Figure 7.5. Average prices of selected dried fish varieties and chicken (2007-2016) (Source: DCS 2016)

The relationship between the expenditure in purchasing a kilogram of dried fish relative to a kilogram of chicken is shown in Figure 7.6. A kilogram of dried fish was 1.4 times the price of chicken for a household in 2016. It needs to be noted that if the conversion from dry weight to wet weight of dried fish were considered, the nutritional value of a kilogram of dried fish would be considered higher than a kilogram of wet chicken.

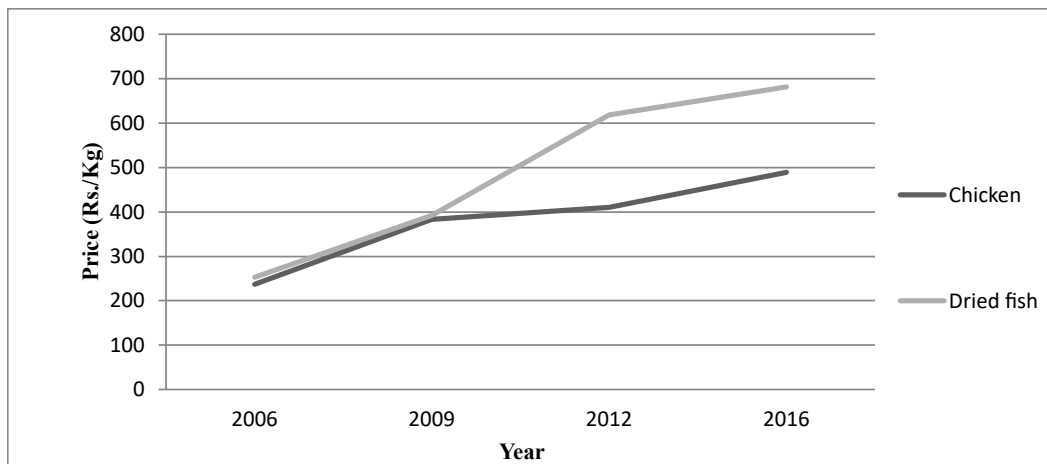


Figure 7.6. Average monthly expenditure to purchase 1 kilogram of dried fish and chicken (2006-2016) (Source: DCS 2016)

However, the proportion of monthly average expenditure of households on dried fish, compared to that of other animal protein to the food basket, has remained relatively constant from 3.5 percent in 1980/81 to 4 percent in 2016. In contrast, the proportion of household expenditure on fresh fish towards the food basket rose from 5 percent to 9.5 percent, while the proportion on chicken rose from 1.8 percent to 3.75 percent in the same period, indicating higher increases in expenditure shares on these other animal products in households.

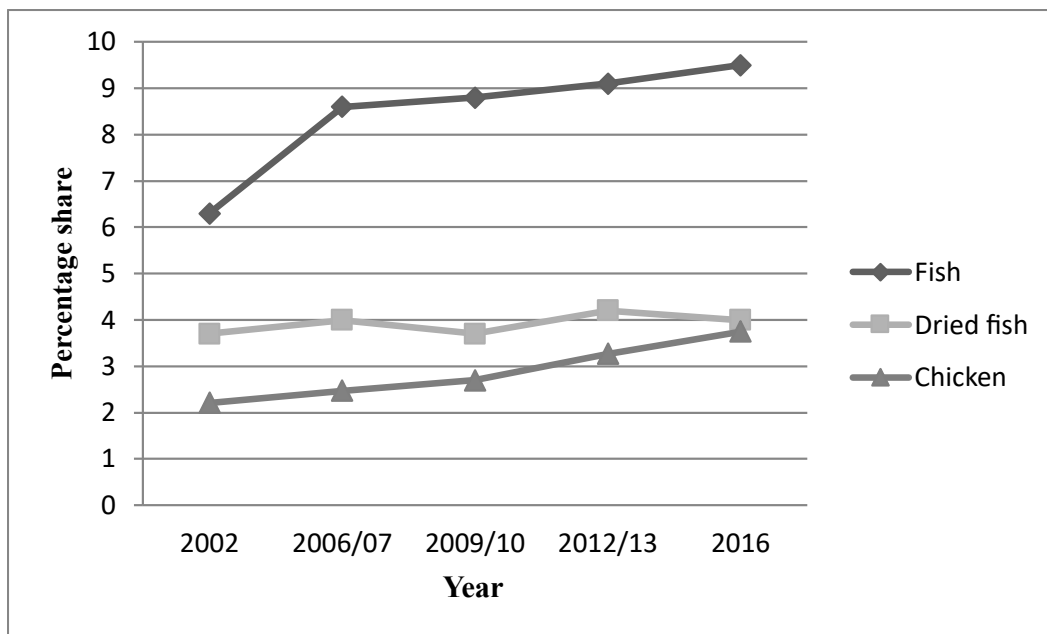
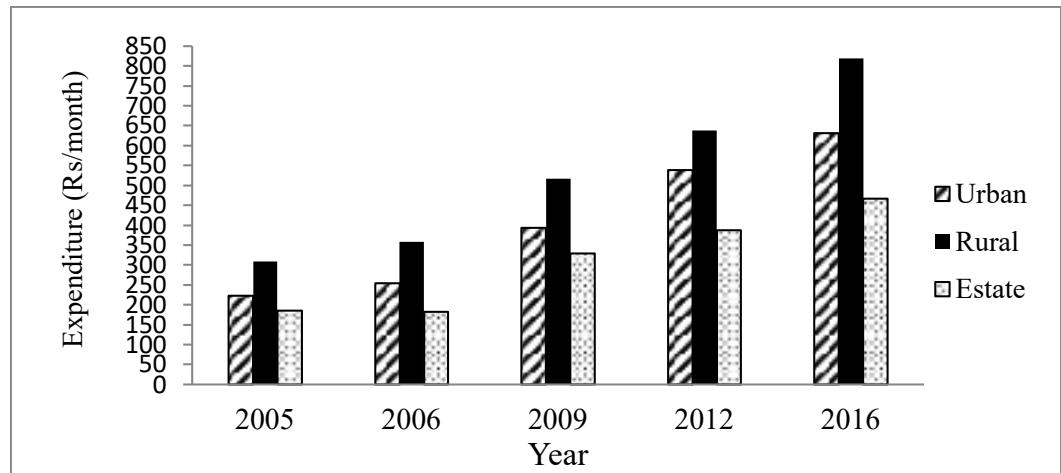


Figure 7.7. Average monthly expenditure to purchase 1 kilogram of dried fish and chicken (2006-2016) (Source: DCS 2016)

When countrywide household monthly expenditure on dried fish is disaggregated by three sectors (urban, rural and estate), based on geographical, demographic and socio-economic characteristics in Sri Lanka, rural households show the highest expenditure, followed by those of the urban and estate sectors respectively (Figure 7.8). Rural households have been spending more than urban and estate households consistently since 2005 and spent around 1.8 times more on dried fish than estate households in 2016.



Average monthly household expenditure on dried fish by geographical sector (Source: DCS 2016)

123. Lokuge Dona et al., “Household Food Consumption And Demand For Nutrients In Sri Lanka”.

Lokuge et al.,¹²³ in their discussion of household food consumption and demand for nutrients, state that urban households are less likely to consume dried fish than rural households (as confirmed in Figure 7.8), and estate households more likely to consume dried fish than rural households (unconfirmed by the current consumption data). They point out that while all animal proteins are price elastic in Sri Lanka, dried fish is less price elastic and can be considered as a substitute for more costly animal source food, such as meat and eggs. The protein intake of households can be affected by price variations in both fish and dried fish. Lower sensitivity to price changes in dried fish, as for cereals, vegetables, and coconut, indicates it as one of the most important food groups in the Sri Lankan diet, for cultural and nutrition reasons. In addition to protein, dried fish is also important as a source of micro-nutrients, unavailable in other meat products.

124. DCS, “Household Income and Expenditure Survey 2016”.

As data on expenditure on total dried fish consumed in relation to expenditure deciles were not available at the national level, HIES data¹²⁴ on the share of average monthly household expenditure on

the two main dried fish varieties (skipjack tuna and sprats) consumed as a proportion of a total of five selected animal food items (chicken, beef, fresh skipjack tuna, fresh sailfish, dried skipjack tuna, dried sprats) for which data were available in relation to expenditure deciles, were analyzed. This showed an inverse relationship between expenditure decile and dried fish expenditure. Lower expenditure deciles have a higher share of expenditure on dried fish and vice versa (Figure 7.9). The proportion of dried fish expenditure to other selected animal food items was especially high at 50% and 37% for the two lowest deciles respectively, revealing the significant role played by dried fish, as an animal protein, in the diet of the poorest households in Sri Lanka.

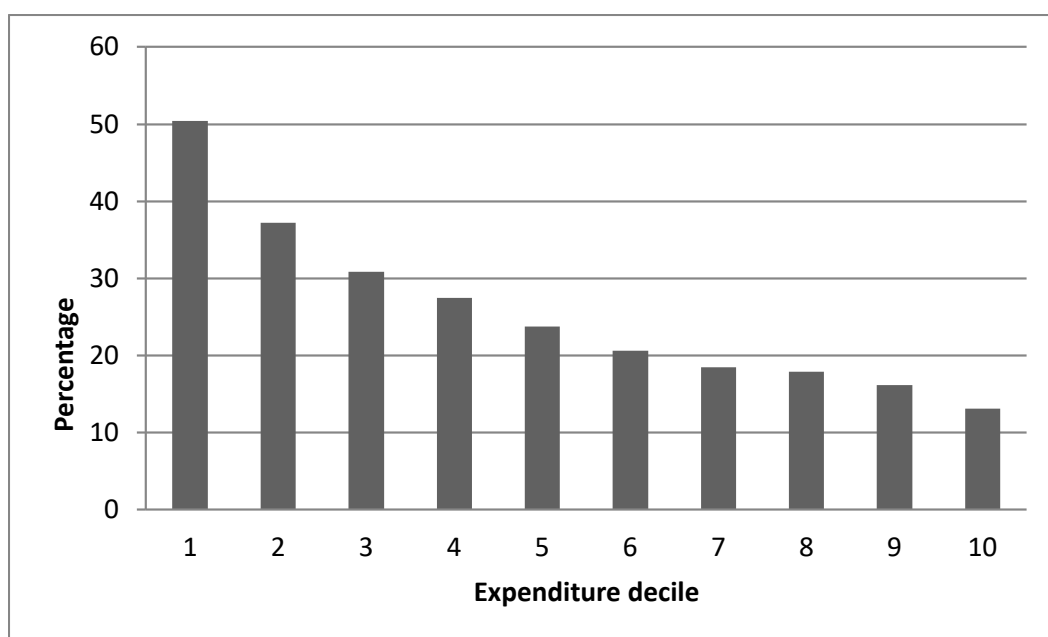


Figure 7.9. Share of dried fish in average monthly household expenditure on selected animal food items, based on expenditure decile (Source: DCS 2016)

However, the absolute expenditure on dried fish by expenditure decile reveal an increasing trend by decile with households in the higher deciles spending considerably more on dried fish on average per month than the lower deciles. The ninth decile (which revealed the highest monthly average household consumption) spent 2.5 times more than the lowest decile on dried fish on average per month.

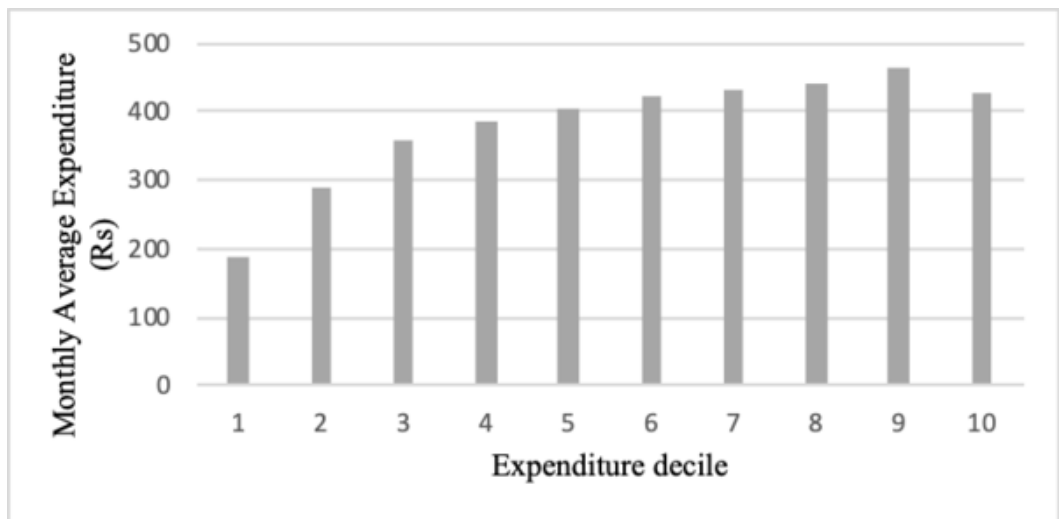


Figure 7.10 Average monthly household expenditure on dried fish based on expenditure decile

An analysis of the geographical variation in average monthly household expenditure on dried fish reveals that households in Kurunegala (interior), Gampaha (coastal), Kegalle (interior) and Galle (coastal) districts, in that order, spent the most on dried fish consumption in 2016 (Figure 7.10). The lowest expenditure was recorded from Jaffna (coastal), Kilinochchi (coastal), Vavuniya (interior), and Mannar (coastal) districts, in that order, in the same period (Figure 7.10). Household expenditure on dried fish has increased between 2006/2007 and 2016 in all districts, consistent with the increase in expenditure on dried fish at the national level during the same period.

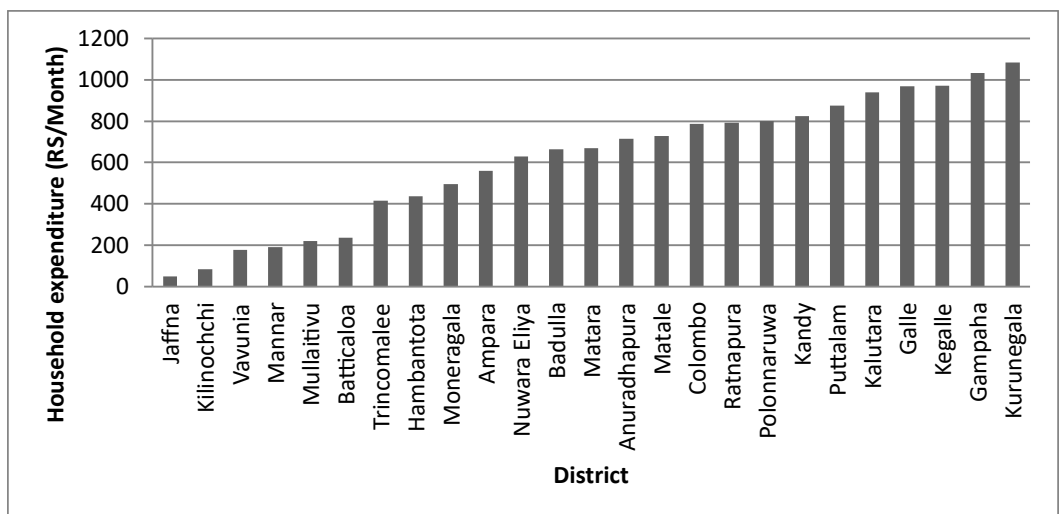
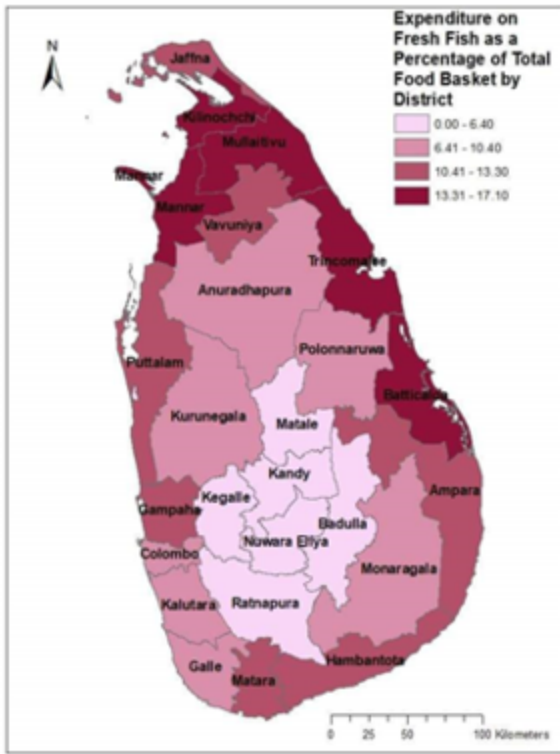
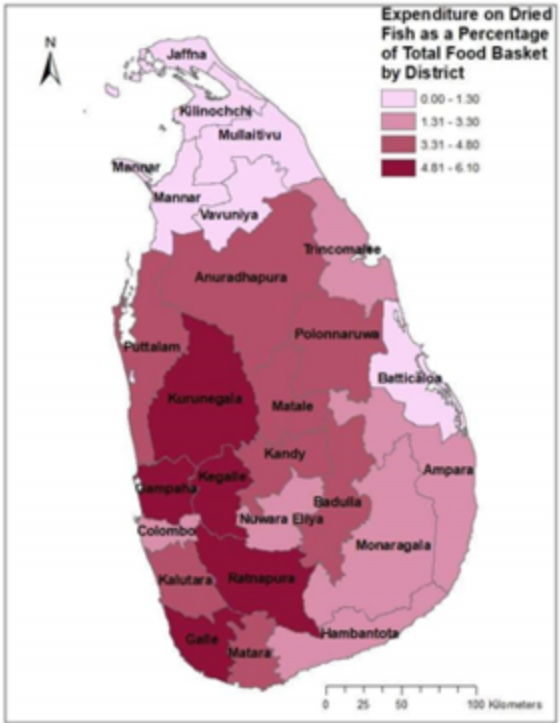


Figure 7.11. Average monthly household expenditure on dried fish by district, 2016



Map 2a. Average monthly household expenditure on dried fish as percentages of the total food basket of main food groups in Sri Lanka by district, 2016 (Source: Authors- based on DCS 2016)



Map 2b. Average monthly household expenditure on fresh fish as percentages of the total food basket of main food groups in Sri Lanka by district, 2016 (Source: Authors- based on DCS 2016)

An analysis of the share of the quantity of fresh fish consumed monthly on average by a household of a food basket comprising the main food groups in Sri Lanka reveals that most coastal districts (with the exception of those on the west coast) consumed more fresh fish than interior districts, with the highest proportion in coastal districts of the north and east. The consumption of dried fish reveals a different pattern. The highest share of dried fish consumption from the same food basket is revealed in the western, north-western, and north-central interior districts of the country, as well as the western and southern coastal districts. The share of dried fish consumed is lowest in the northern and eastern coastal districts, as well as the south-eastern interior districts. Thus, coastal districts with the highest expenditure on fresh fish consumption in the North and East show the lowest expenditure on dried fish consumption. This mapping reveals that there are regional preferences for fresh and dried fish, that might not correlate with national price analysis.

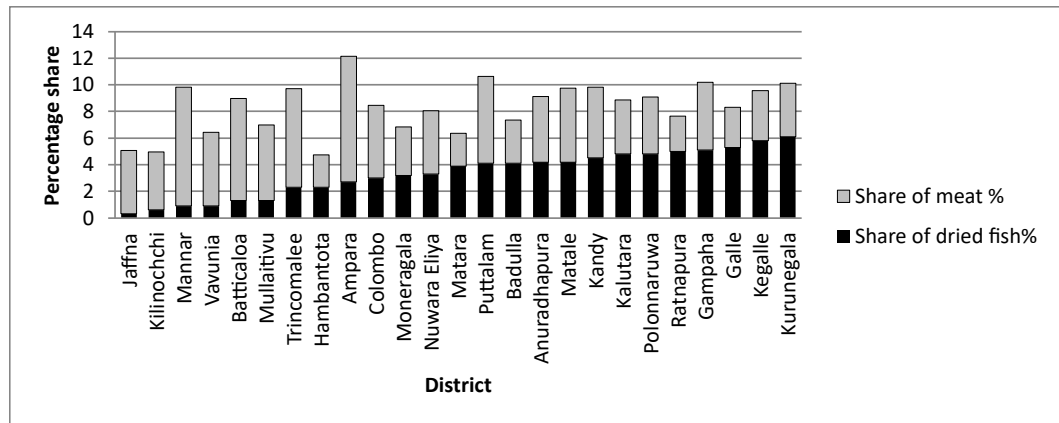


Figure 7.12. Average monthly household expenditure on dried fish and meat as percentages of the total food basket of main food groups in Sri Lanka by district, 2016 (Source: DCS 2016)

Furthermore, despite the higher price of dried fish in relation to meat, which is determined by the chicken price, as the most consumed meat, there are several districts in Sri Lanka with households allocating a higher proportion of their food basket to dried fish over meat, revealing regional and/or socio-cultural preferences for dried fish over meat. As Figure 7.11 shows, these districts are: Kurunegala, Kegalle, Galle, Ratnapura, Polonnaruwa, Kalutara, Badulla, and Matara, three of which are coastal and five of which are interior districts. Four of these districts, Kurunegala,

Kegalle, Galle and Kalutara are also among the five top districts showing the highest overall average monthly consumption expenditure on dried fish of households in the island. The reasons for the preference for dried fish in these districts, and the extent of the significance of socio-cultural factors (e.g., the majority of the population of these seven districts are Buddhist) could be explored by the study.

In assessing demand for different varieties of dried fish, national-level data reveal that sprats (anchovy) are by far the most consumed, followed by Skipjack tuna, shark, and Smooth belly sardines.

Table 3: Average monthly household consumption by types (grams)

Dried fish	2006	2009	2012	2016
Sprats	590.12	556.44	500.22	487
Smoothbelly sardines	82.31	69.46	93.18	76.41
Sardines	45.96	48.52	47.99	43.69
Spotted sardinella	38.2	34.36	41.4	22.85
Seer	8.52	5.74	4.25	4.14
Talang queen fish	71.49	78.43	74.8	74.82
Koduwa	1.73	1.94	2.58	1.51
Anjila	0.59	0.83	1.41	2.46
Skipjack tuna	188.57	140.24	111.42	113.15
Shark	85.14	93.93	79.74	84.19
Dried fish	2006	2009	2012	2016
Trevally	8.15	6.58	6.31	5.75
Anguluwa	57.42	69.48	54.07	41.23
Prawns	8.47	8.99	6.71	9.16
Cuttle fish	0.73	1.29	0.94	1.26
Fresh water dried fishes	22.37	17.97	17.38	14.68
Jaadi	0.32	0.29	0.95	0.42
Other dried fishes	113.17	120.76	99.03	113.55

(Source: DCS 2006; 2009; 2012; 2016)

Average monthly household expenditure on dried fish varieties also follows the same pattern, indicating the highest amount being spent on sprats, followed by Skipjack tuna, shark and Smooth belly sardines. The external trade figures discussed previously confirm this high preference for sprats (anchovy) by Sri Lankan households. However, no data are available on whether these patterns of demand for specific varieties persist within the districts as well.

Data on the consumption segment of the dried fish value chain are quite comprehensive at the national level. However, these macro-level statistics and data analyzed so far do not provide an adequate picture of regional variation, ethnic, gender or local preferences in consumption. Jayantha and Hideki,¹²⁵ who assessed post-tsunami seafood consumption in Sri Lanka, found that that the breakdown of fresh fish consumption was 45% large marine fish, 38% small marine fish, 16% freshwater and 1% aquaculture fish. Fresh fish consumption depended on the income level and the region. The upper and middle classes consumed high value large pelagic species, such as Spanish mackerel (seer), Yellowfin tuna, skipjack tuna, and shrimp, whereas the lower classes consumed low-value small species such as reef fish and shore seine varieties (ibid.). Southern consumers' preferred large pelagic species (so-called "blood fish"), and northern and eastern consumers opted for reef fish and shore seine varieties (ibid.). Consumers in urban cities, such as Colombo, preferred white fish, such as Spanish mackerel and trevally. No research is available to show whether dried fish consumption follows a similar or different pattern. A small study¹²⁶ carried out in three Divisional Secretariat (DS) divisions in Trincomalee district (Kinniya, Trincomalee town and Gravets, and Kuchaveli), which has a multi-ethnic population, reveals that common dried fish varieties consumed are queen fish (Khuronemus) (28%), sprats (Anchovy spp) (25%), Skipjack tuna (Thunnus albacores) (25%), sardinella (Amplicaster spp), and Spanish mackerel (Scomberomorus cavalla). Queen fish (Katta), a bony fish, is most popular because the dried form is considered tastier than the fresh form. Consumer purchasing decisions are dependent on the appearance, colour, and smell of the commodity. Highly fluctuating prices (77%), lack of availability (22%), and poor quality (10%) were stated as constraints encountered by the sample of respondents.¹²⁷ There is a need for more studies of this kind.

125. Jayantha and Hideki, "An Analysis of the Post Tsunami Domestic Fish Marketing and Consumption Trends in Sri Lanka".

126. Krishnal and Dayaani, "Behavior of Household Dry Fish Consumption in Trincomalee District".

127. Krishnal and Dayaani, "Behavior of Household Dry Fish Consumption in Trincomalee District".

Table 4: Average monthly household expenditure on dried fish varieties in Sri Lanka (Rs.)

Dried fish	2006	2009	2012	2016
Sprats	127.14	184.62	246.96	296.04
Smoothbelly sardines	23.78	27.49	51.22	50.37
Sardines	9.07	13.01	17.79	18.04
Spotted sardinella	7.42	10.38	17.89	12.23
Seer	2.86	3.69	3.88	3.97
Talang queen fish	29	49.89	66.46	75.43
Koduwa	0.42	0.78	1.72	1.07
Anjila	0.18	0.26	0.75	1.47
Skipjack tuna	50.58	62.32	70.12	84.31
Dried fish	2006	2009	2012	2016
Shark	26.25	47.77	58.3	75.42
Trevally	3.1	3.02	3.92	4.22
Anguluwa	13.6	24.86	28.36	29.44
Prawns	2.54	4.48	4.8	7.37
Cuttle fish	0.17	0.51	0.5	0.88
Fresh water dried fish	6.16	8.04	9.19	8.43
Jaadi	0.11	0.13	0.45	0.29
Other dried fish	31.75	51.02	57.31	78.18

(Source: DCS 2006; 2009; 2012; 2016)

There are a variety of preparations of dried fish- as curries in coconut sauce, deep-fried, stir-fried, pickled - which are part of the cuisine of different ethnic groups in Sri Lanka. Very little research is available on the culinary diversity of dried fish. There are thousands of Sri Lankan dried fish recipes circulating on the internet, including many videos, which might provide data for an analysis of the regional and ethnic diversity in the preparation of dried fish.

An additional area of inquiry is the symbolic importance of dried fish in Sri Lankan culture. For example, the main funeral meal (malabatha) among the Sinhalese ethnic group in the Colombo region is rice accompanied by a dried fish curry cooked in a coconut sauce (karawala hodi), pumpkin and ash plantains. There does not seem to be any published ethnographic work on funeral rituals, which explores the symbolic relevance of dried fish in ritual food in Sri Lanka.

Thus, the macro-level sources provide a wealth of data on national and regional dried fish consumption patterns in Sri Lanka. However, there is an enormous gap in the literature on preferences for dried fish varieties by ethnic, religious and gender group, local variations in culinary use and taste, and symbolic significance in Sri Lankan culture.

Nutritional value and quality

Most available research has been conducted to analyze the nutritional components of dried fish. Smoked fish, sun-dried fish, salted fish, and jaadive have been analyzed to assess the quality, microbial content, and nutritional content. The water content of several dried fish varieties has been analyzed in Sachithanandan.¹²⁸ Small pelagic dried fish varieties such as sprat, white sardinella (*Sardinella albella*), flying fish, and thilapia are recorded with lower moisture content. The study further identifies dried fish as the cheapest form of concentrated crude fish protein source for low-income groups of people. Crude fat content (ranges from 4-6.5 percent) and ash content are also comparatively higher than in fresh fish. In-depth comparative studies, using proximate analysis,¹²⁹ have been conducted for a number of dried fish and krill varieties, including sun-dried (local), boiled, sun-dried (imported), and frozen and sun-dried (imported). Dried krill was found to be a high-quality protein, a good source of structural and trace minerals for the prevention of bone loss and iron deficiency, as well as providing high amounts of beneficial fatty acids, with no toxic levels of fluoride.¹³⁰

In a study on the quality of fish using traditional processing methods, smoked Catla species have been identified with the highest level of carcinogenic substances compared to Rohu and Nile tilapia.¹³¹ Despite water activity, moisture content and fat content of home-based smoked fish were less than the critical levels of contamination, although containing higher Polycyclic Aromatic Hydrocarbons (PAHs) than the standard levels (12.0 µgKg⁻¹). Therefore, this study proposes improvements in traditional smoking to avoid the adverse effects on consumers. Jayasinghe et al.¹³² analyzed the quality differences in jaadi (fermented fish) in

128. Sachithanandan, "Proximate Composition of Certain Types of Dried Fish Produced in Sri Lanka"

129. Abeywickrama and Attygalle, "Comparative Nutritional Evaluation of Three Dried Krill Products Commercially Available in Sri Lanka"; Surendra et al., "A Comparative Study on Quality of Imported Dried Fish Varieties in Sri Lanka"

130. Abeywickrama and Attygalle, "Comparative Nutritional Evaluation of Three Dried Krill Products Commercially Available in Sri Lanka"

131. Malika, Wickramasinghe, and Premakeerthi, "Investigation of Quality in Fish Produced by Traditional Processing Methods in Sri Lanka".

132. Jayasinghe, Bamunuarachchi, and Fonseka, "Survey on the Quality of Jaadi Available in Sri Lankan Market"

133. Jayasinghe, Bamunuarachchi, and Fonseka, "Survey on the Quality of Jaadi Available in Sri Lankan Market"

134. Goonewardene and Etoh, "Keeping Quality of Imported Dried Fish"

135. Atapattu and Samarajeewa, "Fungi Associated with Dried Fish in Sri Lanka"

136. Atapattu and Samarajeewa, "Fungi Associated with Dried Fish in Sri Lanka"

137. Bindu, Joseph, and Nasser, "Studies on the Insect Infestation of Cured Fish and Their Control"

138. Bindu, Joseph, and Nasser, "Studies on the Insect Infestation of Cured Fish and Their Control"

139. Sugathapala, Suntharabharathy, and Edirisinghe, "Salt Based Dry Fish Processing and Marketing by Fishers of Minneriya Reservoir in Sri Lanka"

140. Basnayake, De Silva, and Weddagala, "Nutrition Value Chain Analysis"

the Sri Lankan market. Quality determinants of jaadi identified were species, processing methods and curing steps, state of the raw fish, the proportion of salt and goraka, handling practices, and storage techniques. Processing centres differed according to processing and handling methods.¹³³ The authors therefore recommended thorough washing, use of proper amounts of salt and fish, and sanitary practices to produce good quality jaadi.

Comparative research on marine and inland dried fish varieties is also available. Goonewardene and Etoh¹³⁴ have investigated the keeping quality, salt content, moisture content and bacteriological characteristics of fresh water and marine dried fish varieties. A higher content of calcium, magnesium, and sulphate has been reported in salted marine dried fish, which has lower keeping quality due to the susceptibility to bacterial and fungal attacks. In contrast, such substances are lower in freshwater dried fish, with less bacterial attacks than on marine dried fish. The authors pointed to an extended shelf life for freshwater dried fish compared to marine dried fish, with the latter being able to retain its quality only for 51 days. Moisture content below 30% and salt content up to 30% have been recommended to control the fungal growth on marine dried fish.¹³⁵ The most common species of fungus on dried fish has been identified as *Aspergillus niger*.¹³⁶ Research also shows the impact of the defensive exoskeleton of dried shrimp as a favourable condition for parasitic development. Studies have identified other pests that attack dried fish.¹³⁷ Beetles invade dried fish during storage and flies (Diptera species) during the curing process. A clean environment, proper waste disposal, use of good quality raw fish, and sealed wastewater outlets are proposed as best practices to reduce pest invasion.¹³⁸ In an analysis on the keeping quality of inland dried fish, Sugathapala et al.¹³⁹ recommend immediate processing to counter rapid deterioration processes and to extend the shelf life of dried fish because fresh fish is subjected to rapid post-harvest deterioration through microbial reactions. Moreover, they point out that as a low acid food, fresh fish is susceptible to the growth of food poisoning bacteria.

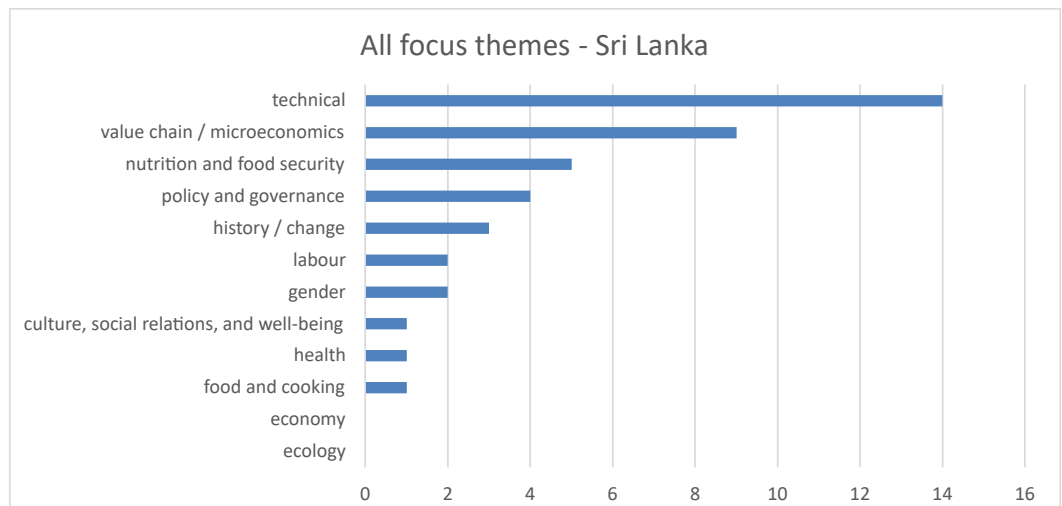
Most dried fish processing centres, particularly on the South coast, neglect quality standards and hygienic practices.¹⁴⁰ Unhygienic raw materials, contamination due to hazards, dust, insect infestation, and low standard practices increase market vulnerability. Thus, the study recommends following prescribed Sri Lanka qual-

ity standards to retain quality and food security of the final product. The quality standards include SLS 643: 1984 and SLS 811: 1988, for dried fish and Maldive fish, respectively and other legal instruments including the Food Act No. 26 of 1980. As dried fish is an affordable food for all households, and a shortage of dried fish would entail a negative impact on the consumption of animal-source foods and proteins, Lokuge et al.¹⁴¹ have emphasized the need for the fisheries sector to focus on strategies favourable to dried fish producers to improve the industry. This would include enhancing the nutritional quality of dried fish. Even though there is a range of studies on the nutritional content and quality of dried fish processed using different methods, and on a number of key varieties, there appear to be noteworthy research gaps. These include the analysis of nutrients among the wide variety of dried fish consumed in Sri Lanka, especially micro-nutrients in dried fish in comparison to other animal protein products in which these micro-nutrients are unavailable, and the benefits or costs of eating dried fish relative to other animal proteins, from a nutrition perspective. There is also a lack of data on the differences in nutrition content of dried fish in respect to how dried fish is prepared in the cuisine of the island.

141. Lokuge Dona et al., "Household Food Consumption And Demand For Nutrients In Sri Lanka"

Conclusion and scoping priorities

Despite its importance, many aspects of the social economy of dried fish in Sri Lanka are almost invisible to researchers and policy-makers. Existing literature emphasizes fishers and fishing, paying far less attention to land-based activities such as processing and trading, which may account for large number of fisheries-related livelihoods, including most of the women involved. Similarly, fresh products are almost always assumed to be the primary, or the only form in which fish is consumed. Post-harvest dried fish value chains are often overlooked, and undocumented in official statistics. Despite data available on consumption of dried fish in rural, urban and estate sector households and among different income quintiles in national household income and expenditure surveys in Sri Lanka for decades, these data have not been systematically analyzed for the most part, and this review here makes the first attempt. There is, therefore, an urgent need to apply a trans-disciplinary perspective to better understand the dried fish economy and raise its profile if much-needed policy interventions to address these concerns are to be developed. The potential to link with policy interventions has increased in Sri Lanka with the new National Fisheries and Aquaculture Policy of 2018, which emphasizes both social and environmental concerns to a greater extent than before. Improving employment opportunities, gender mainstreaming for equality in benefits from the fisheries sector, quality, safety and nutrition of fisheries products, and sustainable management of resources are issues included in the new policy.



Dried fish related research distribution (Source: DFM 2019)

The existing Sri Lankan literature on the dried fish sector reveals several research gaps. Most research has been conducted on the technical aspects of dried fish with lab-based experiments such as nutritional analysis, microbial analysis, quality analysis, and analysis of different processing methods (Figure 9.1). A few studies are available on dried fish supply chains and markets from an economic perspective. However, the value chain approach has not been systematically applied to analyze the social economy of dried fish in Sri Lanka. Very little research has also been carried out from social and political perspectives, including gender relations, social networks, wellbeing, and governance. Identifying these gaps is crucial to encourage future research on dried fish as it provides many direct and indirect benefits at the individual, community, and national levels.

Based on the literature review in the proceeding sections, the following research gaps were identified for scoping (i) the diversity and complexity of post-harvest dried fish value chains, including actors, agents, and their roles; (ii) value creation, prices, price integration, and market integration; (iii) wellbeing processes and outcomes of dried fish processing and trading; (iv) quality parameters, especially on management practices, post-harvest handling, and contaminations; and (v) consumption patterns, demand factors, and variation in consumer preferences. Gender would be an important cross-cutting issue with fieldwork to include collection of data on gender roles, relations, inequality in participation and returns, constraints and opportunities along dried fish value chains. Finally, this literature review reveals a knowledge gap in

assessing the role of formal institutions, governance, and policies in the dried fish industry, which also needs to be addressed at the scoping stage.

Annexes

Annex 1: Production of marine fish and dried fish

Production of marine fish and dried fish

Year	Total marine	Local Dried fish	% of fresh fish
1995	217500	12000	5.52
2000	263680	24360	9.24
2005	130400	7560	5.80
2010	332260	46570	14.02
2011	385270	52230	13.56
2012	417220	61320	14.70
2013	445930	68200	15.29
2014	459300	71810	15.63
2015	452890	57450	12.69
2016	456990	64720	14.16
2017	449440	60190	13.39
2018	439370	61250	13.94

Source: MFARD 2019

Annex 2: Dried fish varieties (marine and inland)

Dried fish varieties (marine and inland)

Scientific name	English name	Sinhala name*	Tamil name*	Habitat
Small Marine Fish				
<i>Stolephorus sp.</i>	Anchovy species (sprats)	Haalmessa	Neththili	Pelagic
<i>Amblygaster cluepeoides</i>	Smoothbelly sardinella	Keerameen	Mundakan kilichchi	Pelagic
<i>Amblygaster sirm</i>	Trenched sardinella (herring)	Hurulla	Keerimeen saalai	Pelagic
<i>Leiognathus sp.</i>	Pony fish species	Karalla	Vari karai	Demersal
<i>Rastrelliger kanagurta</i>	Indian mackerel	Kumbalava	Kanang keluththi	Pelagic
<i>Decapterus macro-soma</i>	Shortfin scad	Linna		Reef-associated
Large Marine Fish				
<i>Katsuwonus pelamis</i>	Skipjack tuna	Balaya		Pelagic
<i>Scomberoides lysan</i>	Double-spotted queen fish	Katta		Reef-associated
<i>Carcharhinus sp.</i>	Shark	Mora/Keelan		
<i>Arlus thalassinus</i>	Giant catfish	Anguluwa		
<i>Scomberomorus commersoni</i>	Narrow-barred Spanish mackerel (Seer)	Thora	Arekula	Pelagic
<i>Dasyatis sp.</i>	Sting ray	Maduwa		
<i>Sardinella gibbose</i>	Gold-striped sardinella	Saalaya		
<i>Istiophorus platypterus</i>	Sailfish	Thalapath	Mayil meen	Pelagic
<i>Harpadon nehereus</i>	Bombay duck	Bombili		Benthopelagic
<i>Chirocentrus dorab</i>	Dorab wolf-herring	Katuwalla		
<i>Lactarius lactarius</i>	False trevally	Pulunna	Suthumbu	
<i>Carangoides ful-</i>				

<i>vogettatusf</i>	Yellow-spotted trevally	Thumba parawa	Manjal parai	Reef-associated
	Perch giant	Koduwa		
		Anjila		
<i>Caranx ignobilis</i>	Giant trevally	Parawa		
	Krill	Kooni		
<i>Penaeus sp.</i>	Shrimp/prawn	Issa		
	Squid/Cuttle fish	Della		
Freshwater Fish Species				
<i>Puntius filamentosus</i>	Filamented barb	Pethiya		Freshwater
<i>Etroplus suratensis</i>	Pearl spot cichlid	Koraliya		
<i>Oreochromis mossambicus</i>	Tilapia	Mozambique Tilapiya		
<i>Oreochromis niloticus</i>	Nile tilapia	Batta		
<i>Glossogobius giuris</i>	Bar eyed goby	Weligouwa		
<i>Channa striatus</i>	Murrel	Loola		
<i>Hyporham</i>	Half beak	Morella		
<i>Arius sp.</i>	Catfish	Magura		

(Source: NARA and NAqDA)

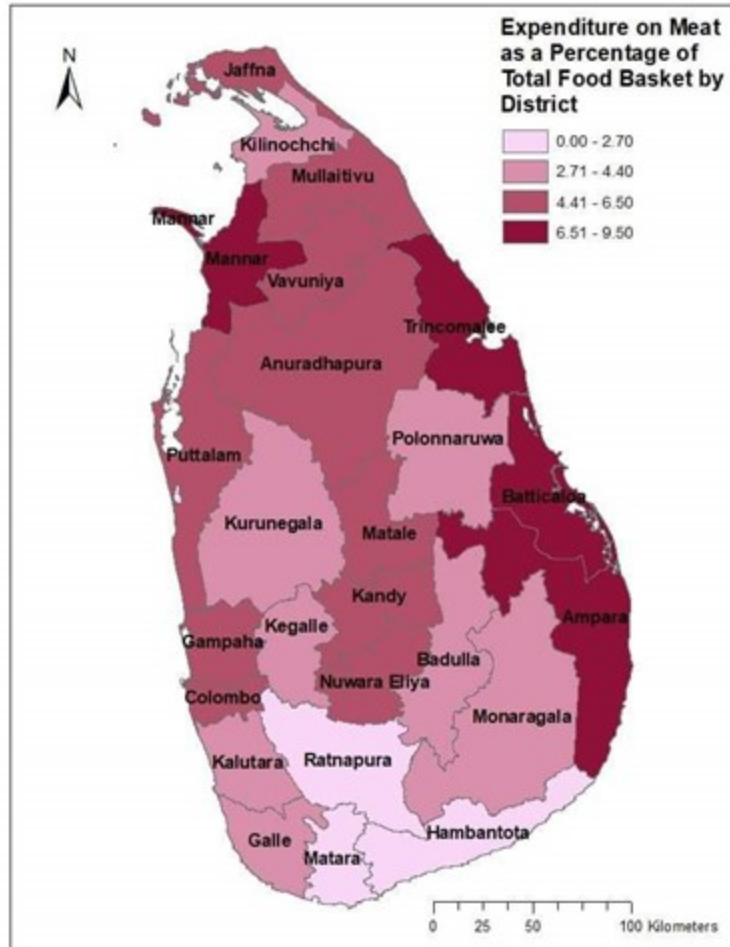
Annex 3: Maldive and dried fish processing methods in southern Sri Lanka

Maldive and dried fish processing methods in southern Sri Lanka

Area	Method
Pelena – Maldive fish	Washing—de-heading—skinned—eviscerated—degutted—washed—cut longitudinal-wise, middle bone kept one side and loin parts separated. Salt add to water, fish pieces boil for 10-15 minutes. Sundry after adding ash for one week (fresh fish: maldive fish—5:1)
Pelena - Maldive fish	Degutted—skinned—washed—cut—water boil with salt and goraka—add fish into the boiled water—parboiled for 10-15 minutes—squeeze to remove water using a piece of cotton cloth—add wood ash—sundry for 10 days
Gandara - Maldive fish	Degutted—skinned—washed—cut—cook in steam—squeeze to remove water—add wood ash—sundry for 7 days
IDB recommended - Maldive fish	Wash—de-headed—eviscerated(degutted)—wash—boil in seawater or salt solution—cool—de-skinned—smoke—sundry
Pelana-dried fish	Degutted—skinned—washed—cut longitudinal-wise—keedi(cut marks to increase salt absorption)—remove gills—salted—keep a day in clay pots—washed in salt water—sundry for one week (fresh:dried - 3:1)
Pelena-dried fish	Degutted—skinned—washed—cut longitudinal-wise—keedi—remove gills—salted (crushing into small granules)—keep in gunny bags (tank, inside a pit covered with cadjans or polythene)—keep for 14 days—wash in salt water—sundry for 7 days
Gandara	Degutted—remove gills—cut the backbone and stomach—keedi—add crushed salt—keep in gunny bags for 3 days—wash by sea water—sundry for one week
Bottu karawata-multiday boats	Degutted—skinned—washed—cut into two—washed in sea water—sundry

(Source: Pieris 2008)

Annex 4: Household expenditures on meat



Average monthly household expenditure on meat as a percentage of the total food basket of main food groups in Sri Lanka by district, 2016 (Source: Authors, based on DCS 2016)

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