Coastal and Inland Dried Fish Value Chains in Sri Lanka: A Photo Essay Exploring the Processing Node and its Linkages

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Summary

The goal of this chapter is to explore the processing node and its linkages within two distinct dried fish value chains in Sri Lanka to gain insights into their organization and functioning. The two value chains we present include a coastal marine value chain and an inland freshwater value chain, with a series of photos to enable visual engagement. In doing so, we outline the activities within the processing node, their structural organization, and linkages to

adjacent fishing and trading nodes. The accounts we present also encompass resource usage, livelihood aspects, and place-based connections of these value chains, including gendered tasks and responsibilities. We conclude the chapter with a broad comparison between the two study value chains and brief reflections on areas for further investigation.

Introduction

Dried fish value chains are an important sub-sector of small-scale fisheries that support fishing livelihoods and local economies, predominantly in the Global South. Despite their importance, dried fish value chains remain hidden and undervalued (Belton et al., 2022). In particular, the organization and functioning of activities and nodes that comprise dried fish value chains have been rarely documented and poorly understood. Better understanding of the workings of these value chains is crucial to identify the opportunities to improve them to better support the livelihoods of those who participate in them.

The goal of this chapter is to explore the processing node and its linkages within two distinct place-based dried fish value chains in Sri Lanka to gain insights into their organization and functioning. The processing node of the value chain warrants special attention as it encompasses the land-based activities where raw fish is transformed to dried fish, a product that can be stored at ambient temperature. The processing node therefore primarily sets apart a dried fish value chain from other similar value chains such as fresh fish chains and cold chains. Due to processors' engagement in multiple activities, it is also anticipated that the exploration of the processing node will provide insights into its linkages to the adjacent nodes of the value chain.

The two value chains presented here represent urban coastal dried fish production and inland freshwater artisanal dried fish production. They have been carefully selected based on several criteria and in consultation with the local researchers. The selection criteria included type of fishery (marine vs. freshwater), location (urban coastal vs. inland rural), and evidence of both men's and women's involvement. The value chains were studied from

January to October 2021 using in-depth interviews with dried fish processors (n=70) and key informant interviews (n=19). Key informants included the stakeholders who have influence over the institutional and governance context of dried fish such as the fisheries managers, harbour officials, development officials, and community leaders.

Sri Lanka is a tropical island in the Indian Ocean located approximately 100 km from the southeastern coast of India. The island has 1,770 kms of coastline and an Exclusive Economic Zone (EEZ) that spans over 517,000 km^2. The fisheries sector of the country is considered small in scale, comprising both marine and inland fisheries. Marine fishing activities take place in coastal waters, within the EEZ, and beyond in international waters. Sri Lanka has also 2,600 km^2 of freshwater bodies (natural and human-made) that host inland fisheries.

Salting and sun-drying, smoking, and pickling are the traditional fish processing methods in Sri Lanka. Dried fish is a major source of animal protein in local rice-based diets and an important culinary ingredient. Local annual dried fish production has steadily increased over the past couple of decades from 24,000 Mt in 2000 to 64,000 Mt in 2017, although about 30% of the local demand is being met through imports (Fisheries Statistics, 2019). Marine fish is processed along the entire coastal belt around the island. Substantial inland dried fish production also occurs, mainly surrounding the perennial reservoirs of the country.

The following section explores in detail the activities associated with the processing nodes of the two study value chains.

Kalutara coastal dried fish value chain

Kalutara is an urban coastal district in the Southwestern province of Sri Lanka. There are nine fisheries divisions along the coastal strip of Kalutara district. Most recent fisheries statistics report about 80 households engaging in dried fish processing. In 2020, 1,047,300 kg of dried fish production was recorded in the entire district. This volume suggests that about 40% of the total fish harvest was processed as dried fish during that year (total fish harvest volume

was 2,740,200 kg) (Fisheries Statistics, 2020).

The data collection took place in the communities of Payagala, Maggona, and Beruwala (Figure 1). Salting and sun drying is the main fish processing method in this area[1]. Fish drying activities are organized as private-owned independently managed businesses. They range from small to medium scale businesses and use family labour and/or hired casual wage labour, depending on the volumes processed. Most processing sites operate year-around while some are home-based small seasonal operations. Commonly dried fish varieties include both large/medium-sized fish such as skipjack tuna, queen fish, yellowfin tuna, dolphin fish, sharks, rays, and Indian scad as well as small pelagic fish species such as anchovies and smoothbelly sardinella.

Gendered tasks and responsibilities

About one third of the fish drying workforce is comprised of women. They are expected to perform salting, washing, and drying activities whereas cutting and carrying are designated as men's activities. This division of tasks is shaped by the local attitudes and perceptions around the need to assign 'heavy work' to men. However, in practice, both women and men collaborate in performing the tasks depending on labour availability and the fish volume to be processed in a given day. In fact, in a few drying sites it was observed that the entire operation is handled only by women.

Gendered differences also exist in ownership and handling of drying operations. Men own and manage all the small and medium scale operations while employing workers belonging to both gender groups. In contrast, home-based small fish drying operations are often handled by women with assistance from family members, especially during peak seasons. Some of these women also engage in selling dried fish in roadside stalls within the community. All sales operations outside the village are handled by men.

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[1] Pickling of small pelagic fish (locally known as 'jaadi') is also a traditional method of fish preservation in Sri Lanka, although this method is rarely practiced today. A small quantity of fish is also processed as Maldive fish, which involves the additional steps of boiling and smoking prior to sun-drying.

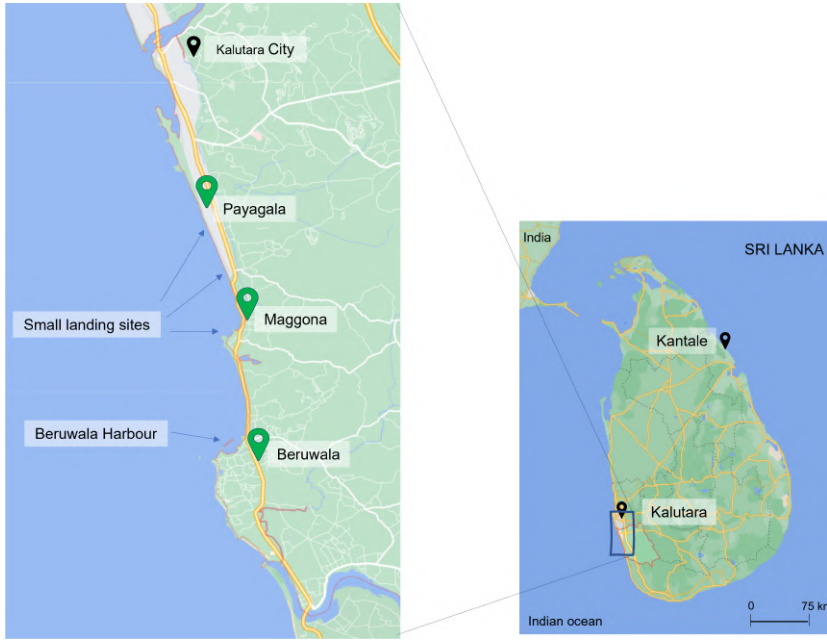

Figure 1: Study communities in Kalutara

Processing related activities and organization

Sourcing of raw fish for drying

Raw fish used for dried fish production is supplied through three main sources: auction at the fishing harbour, small landing sites and seasonal beach seine landing sites, and excess fish stocks bought from other places in the country.

(a) Outdoor auction at Beruwala fishing harbour

The main source of fish used for drying is from Beruwala harbour, one of the main fishing harbours in the country. All the activities at the harbour auction are performed by men, therefore, women are rarely seen at the harbour.

Fish landed at the harbour are caught by multi-day fishing vessels (30'' - 45'' in length with capacity for ice storage) in offshore fishing trips that

last about 30-40 days. The types of gear used are gill nets, long lines, and coarse nets (local name for small purse seines targeting schooling fish such as Indian scad). About 15 multi-day vessels land in the harbour each day. Each boat lands a catch volume of about 12,000-15,000 kg during each trip, however, these catches are typically considered of lower quality due to the longer duration of preservation in ice. Smaller vessels (28'' in length) also land at the harbour. These vessels are used for 5-6 days fishing trips within the country's territorial waters and these catches are considered fresh.

Figure 2: Multi-day fishing vessels (Left) and the entrance to the auction at the fishing harbour (Right). Credit: W. C. Hiroshini, 2021.

The fish auction at the harbour starts around 5 am each day. Fish stocks to be auctioned (boatloads) are graded into three grades based on quality. First to be auctioned is the fresh fish —grades 1 and 2 — destined for different local markets. Grade 3 (kapana maalu) is typically used for drying, although grades 1 and 2 are also used during peak seasons. The auctioning of Grade 3 fish begins around 7am. An estimated 5,000 - 6,000kg of fish is sold each day for drying in nearby sites at a rate around CAD 2.25/kg (=LKR 350/kg)[2]. These transactions happen largely based on credit relations underpinned by local networks of contact and trust relations, although some processors prefer to buy with cash.

[2] Price levels as of April 2021 at an exchange rate of: 1 CAD = 156 LKR (Sri Lankan Rupees)

Figure 3: Skipjack tuna stocks sold for dried fish making. Credit: I. Weththasinghe, 2021.

Partially processed fish at sea

In addition to raw (iced) fish, each multi-day boat also lands about 5,000 - 6,000kg of partially processed fish, mostly Skipjack tuna. Partial processing at sea entails beheading, gutting, cleaning, and storage in salt brine in plastic barrels (Figure 4). Partially processed fish is locally referred to as 'lunu maalu' (salted fish). The quantity of salted fish landed is higher during rainy or stormy weather. The barrels of salted fish are purchased by the dried fish producers at a lower price than raw fish (CAD 1.92/kg = LKR 300/kg).

Figure 4: Barrels of partially processed fish.
Credit: L. Fernando, 2021.

Fully processed fish at sea

A much smaller quantity of fish 200-500 kg/boat is also fully processed at sea (cleaned, salted, and dried) and is landed by the offshore fishing vessels. Boat dried fish, referred to as 'bottu karawala', is popular among locals for its unique taste, texture, and perceived high quality. Upon arrival, it is customary that the boat owners share several of these bags among crew members as a gift in appreciation of labour at sea during the long fishing trips.

Figure 5: Boat dried fish. Credit: L. Fernando, 2021.

(b) Traditional small landing sites and seasonal beach seine

Several small traditional landing sites, called 'thotupola', are also located along the coast in Thudawa, South Payagala, North Payagala, and Maggona. Each of these landing sites has about 3-10 small boats, traditional-style 18 ½" fiberglass canoes with a single outrigger (Figure 6) or an outboard engine. These boats are mostly used for day trips (from dawn to 11 am) in coastal waters. Only a small portion of these harvests are used for dried fish production as the quality of fish is higher due to the shorter duration of the trips. These fish catches are referred to as 'dawal maalu' (daytime fish).

Kalutara area is also known for its intergenerational seasonal beach seine fishery that operates from around October to March (Figure 6). Fish availability during the season largely depends on the rhythms of the sea. Calmer and shallower coastal waters (locally referred to as 'walaala muhuda') are considered ideal for this fishery. However, the number of beach seines in operation has drastically reduced over the past few years: from 135 in 2016 to 40 in 2019 (Fisheries Statistics, 2019). Beach seines target smaller pelagic fish such as anchovies and sardinella, which are very popular among locals in dried form. According to fishers, sharing of common beach space between

fish drying people and beach seine fishers is governed by the local traditional practices, which give priority to the beach seine when in operation.

Figure 6: Traditional boat landing (Top) and a beach seine stored away during off-season (Bottom). Credit: L. Fernando, 2021.

(c) Fish bought and transported from other fishing harbours

Large excess fish harvests from other areas, such as the Southern areas of Galle, Kudawella, Tangalle, and Mirissa, and sometimes also from Western areas such as Negombo, are purchased by the processors using established contacts. The fishers then arrange the transportation of these fish stocks by lorries directly to the drying sites in Kalutara area. The size of these stocks can go up to 5,000 kg per lorry.

Figure 7: Large dried fish sold as pieces Left) and small dried fish sold as the whole fish. Credit: S. Weththasinghe, 2021.

Cleaning and salting of raw fish

The drying node involves a series of activities that takes place once the fish arrives at the drying site. First, the fish is cleaned by de-heading and gutting. For bigger fish, a few small cuts are made on each side of the fish to allow better salt absorption, and washed with running water. Amount of salt to be rubbed is determined by experience (some workers described it as when the red colour of 'meat' becomes invisible). Smaller fish varieties (e.g., Indian scad) are cleaned by removing only the guts.

The fish are salted the same day by carefully rubbing with salt, and then stored in barrels or cement tanks (tanks are used in most medium-scale operations) for a period of two days to a week depending on the weather and the availability of drying space. Barrels are often tightened with the lid or using a polyethene cover to protect from fly infestations. Lid-less barrels are also often seen with a heavy rock placed on top of fish to ensure that the fish is submerged in salt water as salt also acts as a fly repellent (Figure 8).

Figure 8: Salting barrels. Credit: Lakshitha Fernando, 2021.

Washing and preparation of salted fish for drying

Washing mostly happens in batches and only in a quantity that can be handled based on space availability and also the weather patterns (drying takes longer during cloudy days or when there's intermittent rains and it is not done during heavy rains). Most places use a cement-made shallow tank for washing. Salted fish is brushed to remove excess salt and washed well with running water just before sun drying. For the fish salted at sea (partially processed), the fish is washed directly and sun dried within 2-3 days.

Figure 9: Washing off excess salt (Top) and draining the fish before sun drying (Bottom). Credit: W.C. Hiroshini, 2021.

Sun drying

Sun drying is done at drying sites on private lands closer to the beach, some of which are the backyards of the processors' homes. The sun drying process takes about 2-3 days and the fish are laid out in a single layer to dry in the morning, flipped once in the afternoon, and stored away each evening until fully dried. Drying is done mostly on large coir mats spread on the ground, outdoor cement floors or on permanent drying racks (Figure 10). In some cases of home-based micro-scale operations, drying is done on the roofs or on rocks at the beach. Once fully dried, the weight conversion ratio of raw fish

to dried fish is about 3:1.

Figure 10: Sun drying using coir mats (Left) and drying racks (Right). Credit: L. Fernando, 2021.

Trading and distribution

Dried fish is traded using several main channels – wholesale shops, small traders who buy and sell, roadside retail stalls, and selling directly to consumers who visit the processing sites. Larger dried fish stocks (1,000-2,000 kg) are sold to mostly dried fish wholesalers in Colombo. In addition, some processors also send their stocks to traders in regional produce markets (e.g., Dambulla, Kandy), who then supply to retail shops across the country. Many small traders, who buy and sell in relatively smaller quantities, also arrive at the drying sites to purchase and distribute in smaller quantities (10-50kg). They sell to retailers in inland areas, sell in farmers' markets or sell directly to consumers.

Roadside dried fish stalls along the coast, especially in Maggona and Beruwala, are popular for both smaller and medium quantity purchases by consumers and small traders. There are about 15 such stalls, each carrying a range of dried fish products. These products sometimes include dried fish produced in northwestern of northeastern areas of the country, and sometimes also even imported products (e.g., anchovies or queen fish).

Figure 11: Roadside dried fish stalls in Beruwala.
Credit: W.C. Hiroshini and Lakshitha Fernando, 2021.

Kantale inland dried fish value chain

Kantale is a small inland town located in the Trincomalee district of North-eastern Sri Lanka. As shown in Figure 12, the study communities included Agbopura, Wewsirigama, Mollipathana, Galmitiyawa, Jayanthigama, Suriya-pura, and Seeni Kamhala.

Kantale is locally well-known for its freshwater fishery and artisanal dried fish production. Traditionally, salting and sun drying, and smoking are the main methods of fish processing. Fish drying operations are dispersed across the villages surrounding the freshwater bodies. The main freshwater bodies include Kantale reservoir and many other perennial and seasonal lakes (e.g., Wan Ela wewa, Janasavi wewa, Paravipaggan wewa, Janaranjana wewa).

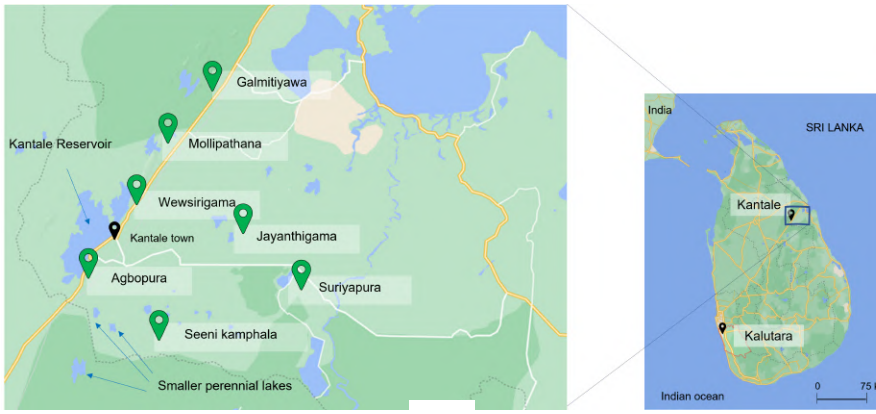

Figure 12: Study communities in Kantale

Gendered tasks and responsibilities

Unlike the coastal value chain, fishing is done by both men and women. Women's participation in the fishing, however, is shaped by the local gendered norms and expectations which restrict women's scope for participation. For example, married women we interviewed mentioned that they go fishing only with their husbands while unmarried women mentioned that they fish alone or with another woman (a relative or a neighbour).

Fish drying is generally perceived as a women-led activity. Most drying operations are organized as wife-husband teams with help from older children, parents and/or in-laws. A few processors who handle larger quantities hire part-time wage workers, who are also neighbours or relatives. Dried fish trading is also done by both women and men. However, women sell within the village and men target outside markets and handle larger quantities of dried fish.

Processing related activities and organization

The dried fish value chain in Kantale is organized as backyard community-based drying operations and dispersed across the villages surrounding the reservoir and other small lakes.

Sourcing of raw fish

Fish for drying is sourced in three main ways — fishers processing their own harvests, processors who buy raw fish at the landing, and the processors who purchase the entire fish stock in a seasonal shallow lake(s). The total amount of fish processed by each processor during each day therefore may come from Kantale reservoir and/or the small lakes in surrounding areas. The daily catch amounts processed by each processor may range from 2 to 50 kg.

(a) Fishers catching and processing all or some of their own harvests

Some of the fish used for drying is caught then dried by the fishers themselves, i.e. some processors are also fishers. Fishers who do not process fish on their own sell their catches to others.

The main source of fish is Kantale reservoir[3], an ancient lake built for irrigating rice lands (Figure 13). The reservoir fishery is culture-based (e.g., tilapia and carp) and harbours some wild fish varieties as well (e.g., stinging catfish, pearl spot cichlid). Fish fingerlings are stocked by the National Aquaculture Resources Development Authority (NAQDA) in collaboration with the Village Fisheries Societies. In addition, several smaller perennial and seasonal lakes in the area also provide many families with access to fishing. A few small lakes are also cultured while most smaller lakes harbour only wild fish varieties.

Fishing is done using traditional canoes called ‘Oruwa’, a non-motorized

[3] Kantale reservoir is an ancient lake built in 604-614 AD by King Aggabodhi II using the Mahaweli River as its main water source, the largest and longest river in Sri Lanka. The primary purpose of the reservoir is to irrigate rice lands with fishing as a supplementary activity (rice is the staple food of Sri Lanka).

boat with an outrigger (Figure 13). Gill nets (4") are used in the reservoir and in the perennial culture-based lakes. Some fishers use a separate net with smaller mesh size (1 1/3") called 'Karawala dela or Binthul dela' to target wild varieties for drying. Each canoe typically lands about 10-15 kg of fish each day although the catch amounts generally fluctuate seasonally and due to overfishing. Once landed, larger fish are sold to fresh fish sellers. Generally, juveniles of relatively large fish varieties (e.g., carps, stinging catfish) or smaller fish varieties (pearl spot cichlid) are used to produce dried fish. Cold storage in post-harvest handling is minimal and is limited to Styrofoam boxes that sometimes contain homemade ice. The prices vary by the size of fish (small fish vs. big fish) and not the variety.

Figure 13: Kantale reservoir and traditional fishing canoes.
Credit: R. Ishan Indunil, 2021.

Some processors prefer (and can afford) to buy the fish from one or more lakes rather than fishing on their own. This is because fishing involves fluctuating catch amounts as well as the hardship and risks (e.g., nets have to be set at night and fishers must spend the night on the lake to prevent theft of their nets).

Figure 14: A traditional fish landing site at the lake and cultured fish. Credit: R. Ishan Indunil, 2021.

(c) Purchasing the entire fish stock in seasonal shallow lakes

Several Village Rice Farmers' Societies, who manage smaller rain-fed lakes, sell the entire fish stock to a selected individual processor for producing dried fish. These buyers are often local people, sometimes fishers themselves. Cast nets are used to catch the fish (wild varieties) as these are shallow lakes. Daily fish catch is about 50-60 kg and the fishing takes place for about 2-4 weeks until all the fish of a large enough size for processing are caught.

Figure 15: A shallow lake (Top) and a displayed notice that reads "Fingerlings have been stocked. Fishing is prohibited. – Section 9 Fisheries Association". Credit: R. Ishan Indunil, 2021.

Salting and processing

Fish are cleaned by removing the guts and skin, then washed, salted, and stored in plastic barrels. As smaller fish are used for drying (bigger fish are usually sold as fresh fish), it takes about a day for the salting process, following which the fish are ready to be washed and sun dried the next day, although drying may be delayed on rainy days. Sun drying is often done on homemade temporary wooden structures, wire meshes, or on metal sheets that are popularly used as roofing materials in rural areas (Figures 16). Some processors smoke larger fish using firewood, although salting and sun drying is the most popular processing method (Figure 17).

Figure 16: Sun drying on simple structures and roofing metal sheets. Credit: R. Ishan Indunil, 2021.

Figure 17: Artisanal smoking. Credit: R. Ishan Indunil, 2021.

Trading and distribution

Processors generally attempt to sell their dried fish stocks within a period of two weeks, as dried fish absorbs moisture from the air, especially during rainy weather. The prices are determined based on the size of the dried fish, with smaller fish fetching about CAD 2.24/kg (= LKR 350) and larger fish CAD 3.20/kg (= LKR 500).

Figure 18: A roadside stall with a sign that reads "Smoked fish freshwater dried fish available". Credit: R. Ishan Indunil, 2021.

Dried fish is mainly sold to collectors who visit the processors door-to-door. Some of these collectors visit from distant areas, while others are local small traders or processors who also act as collectors. Local collectors usually prepare boxes of dried fish to be loaded on the lorries that pass through Kantale and transport marine fish and marine dried fish from the northeastern coastal areas to regional wholesale produce markets (e.g., Kandy, Dambulla). A small quality of dried fish is also sold at roadside stalls. Some processors prefer to bring their products to long distance retail or wholesale stores with which they have long-standing trade relations.

Figure 19: Salted-sun-dried fish and smoked fish.
Credit: R. Ishan Indunil, 2021.

Conclusion

This chapter explored the processing node and its linkages within both coastal and inland dried fish value chains in Sri Lanka. In doing so, we gained insights into the workings of the value chains and how embedded they are in local contexts, for example, by revealing processing methods, key activities, resource dependencies (e.g., fish, drying space, labour), and how the value chains underpin local livelihoods.

It is apparent that most processors engage in the processing node as well as fishing and trading nodes within both value chains at some level. As a result, this chapter also facilitates the development of a broad insights about the entire value chain in both study locations, allowing for a high-level comparison between the two. Structurally, the two value chains demonstrate similarities as well as differences. The key similarities include the complexity of organization within each chain, decentralized operations, and heavily overlapping nodes. Each value chain comprises a series of different channels through which dried fish move. Some channels, for example, involve wholesale dried fish

shops whereas others involve processing and direct sales to consumers at the roadside stalls. Both value chains also have decentralized operations, where there is no single actor such as a wholesale market or an intermediary through which dried fish is centrally distributed. As alluded to above, both value chains have heavily overlapping nodes. For example, some fishers process and sell their own catch (i.e., overlaps among fishing, processing, and trading nodes) while some processors sell directly to consumers (i.e., overlaps between processing and trading nodes).

On the other hand, the key differences between the two value chains include volumes handled and the associated complexity of activity organization within each chain, level of commercialization, and gendered tasks. In the coastal value chain, the scale of year-around production ranges from home-based operations to small and medium scale drying sites using wage labour that can handle large production volumes. However, fish drying operations comprising the inland value chain are family-run small businesses although the production volumes are much lower than the coastal one. The coastal chain is also more commercialized and profit oriented than the inland chain, which is artisanal and supports rural livelihoods. Gendered tasks and responsibilities also vary between the two. For example, men lead activities across the coastal chain while women participate in the fish drying workforce or selling within the village. In comparison, women play vital roles across the inland value chain while leading the drying node.

Overall, the details explored through this chapter provide foundational accounts of the two study value chains encompassing the organization of activities, livelihood aspects, and place-based connections while also shedding light on the areas for further research. For example, gendered value chain participation and relational underpinnings of the value chains undoubtedly emerge as stimulating areas for further investigation, among others.

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