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THE EXISTING CONDITION OF THE DRIED SALTED FISH SUPPLY CHAIN IN SIBOLGA CITY, NORTH SUMATRA

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ABSTRACT

Sibolga City is one of the coastal areas in North Sumatra Province that plays a vital role in Indonesia's marine and fisheries sector. This study aims to analyze the supply chain system of dried salted fish in Sibolga City, which includes three main components: the product flow, information flow, and financial flow. The research was conducted in September 2025 using a descriptive method with a mixed quantitative and qualitative approach. Primary data were obtained through interviews and field observations involving fishermen, dried salted fish processors, collectors, retailers, and the Department of Marine Affairs and Fisheries (DKP) of Sibolga City. In contrast, secondary data were derived from DKP reports. The results showed that there are three main supply chain patterns: (1) fisherman–processor–collector–retailer–consumer, (2) fisherman–processor–collector–consumer, and (3) fisherman–processor–direct consumer. On average, dried salted fish processors in Sibolga can produce between 100 and 200 kg per day, depending on the availability of raw materials. Shorter distribution channels generate higher efficiency by reducing marketing costs, accelerating the flow of information and finance, and maintaining product quality. This study concludes that the dried salted fish supply chain in Sibolga City has been functioning but remains sub-optimal. Strengthening coordination among actors, improving access to formal financing, and utilizing information technology in distribution and marketing are necessary to enhance efficiency and increase the added value of dried salted fish products at the local level.

Keywords: Efficiency, Fish Production, Salted Fish, Product Flow, Supply Chain

1. INTRODUCTION

Sibolga City is one of the coastal areas in North Sumatra Province that plays a vital role in Indonesia's marine and fisheries sector. Its strategic location on the western coast of Sumatra Island, directly facing the Indian Ocean, makes Sibolga a center for capture fisheries activities and seafood processing along the west coast. Based on data from the North Sumatra Provincial Marine and Fisheries Service[1], capture fisheries production in Sibolga City exceeds 20,000 tons per year, with the primary commodities including skipjack tuna (*Katsuwonus pelamis*), mackerel tuna (*Euthynnus affinis*), and Indian mackerel (*Rastrelliger kanagurta*). A portion of these catches is processed into dried salted fish to extend shelf life and increase the added value of fishery products.

Dried salted fish processing in Sibolga is generally managed by small-scale and household enterprises located in coastal areas such as Aek Manis, Huta Tonga-Tonga, and Aek Parombunan villages. Sibolga's dried salted fish products are well known for their distinctive flavor and have been marketed to various regions, including

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Medan, Padang, and Pekanbaru. This processing activity has significant economic value as it absorbs local labor, reduces post-harvest losses, and stabilizes fish prices during periods of abundant catches[2]. However, the processing is still carried out traditionally through sun-drying methods that rely heavily on weather conditions and fishing seasons[3].

Despite its substantial potential, the supply chain system for dried salted fish in Sibolga City faces several challenges. The main issues include fluctuating raw material availability, seasonal dependency, and weak coordination among actors in terms of distribution and market information. These challenges align with the findings of Saraswati[4], who reported that fishery product supply chains in Indonesian traditional markets continue to encounter obstacles related to product, information, and financial flows. Most salted fish business actors in Sibolga rely on direct communication between fishermen, collectors, and traders, without an integrated market information system, which causes frequent delays in price and demand updates. Conducting a supply chain analysis is essential, as it provides the basis for formulating recommendations to enhance supply chain performance[5].

In addition, limited access to formal financing sources also constrains the strengthening of financial flows within the supply chain. Most dried fish processors still rely on personal capital or informal loans from intermediaries (locally known as punggawa), utilizing deferred payment systems, which reduces their profit margins[3]. Other studies have shown that the efficiency of Indonesia's fishery supply chains can be improved through market diversification, digitalization of price information, and access to microfinance for small-scale enterprises[6].

Therefore, to enhance the competitiveness and sustainability of dried salted fish enterprises in Sibolga City, a comprehensive analysis of the supply chain is necessary, encompassing three main aspects: product flow, information flow, and financial flow. This study is crucial for identifying weaknesses in the distribution chain, determining coordination strategies among business actors, and formulating policies that support improved efficiency and added value within the local fish processing sector.

2. RESEARCH METHOD

Time and Place

This research was conducted in September 2025 in the coastal area of Sibolga City, North Sumatra Province. The study focused on coastal districts with active fishing and fish-processing activities, namely Aek Manis, Huta Tonga-Tonga, and Aek Parombunan Villages.

Method

This study employed a mixed-method approach, combining quantitative and qualitative descriptive analysis. The purpose was to provide a comprehensive overview of the dried salted fish supply chain in Sibolga City, including the characteristics of business actors, the relationships among them, production volume, and the role of each sector within the supply chain.

The data used in this research consisted of primary and secondary data. Primary data were obtained through direct interviews and field observations with key stakeholders involved in the dried salted fish supply chain, including fishermen, salted fish processors, collectors, retailers, and the Department of Marine Affairs and Fisheries (DKP) of Sibolga City. Fishermen supplied fresh fish raw materials, processors handled the processing and drying of fish catches, collectors and retailers acted as product distributors, and DKP Sibolga served as the institution responsible for facilitating, guiding, and supervising fisheries activities in the area.

Procedures

The data used in this research consisted of primary and secondary data. Primary data were obtained through direct

interviews and field observations with key stakeholders involved in the dried salted fish supply chain, including fishermen, salted fish processors, collectors, retailers, and the Department of Marine Affairs and Fisheries (DKP) of Sibolga City. Fishermen served as suppliers of fresh fish raw materials, processors handled the production and drying of fish catches, collectors and retailers acted as product distributors, and DKP Sibolga functioned as the institution responsible for facilitating, guiding, and supervising fisheries activities in the area.

Secondary data were collected from official sources, including the annual reports of the Sibolga City DKP, the North Sumatra Capture Fisheries Statistics (2020–2024), and relevant scientific literature and studies related to supply chain management and salted fish processing in Indonesia. These secondary data were used to complement and verify the findings obtained from field observations.

Respondents were selected using purposive sampling, targeting individuals considered to have the most relevant information regarding the salted fish supply chain system. The sample included approximately ten active fishermen, ten salted fish processors, five collectors and retailers, and two to three representatives from the Sibolga City DKP. Data collection was conducted through structured interviews using pre-prepared questionnaires based on research variables, as well as direct observations at processing sites and fish landing locations.

The variables analyzed in this study included the volume of fresh fish production from 2020 to 2024, the volume of dried salted fish production during the same period, and the types of fishing gear used by fishermen in Sibolga City. Furthermore, the study examined the structure and mechanisms of the salted fish supply chain, focusing on three main flows: product flow, information flow, and financial flow. The analysis aimed to assess the role of each actor, from fishermen and processors to traders and government institutions. The research also described the stages of salted fish processing within the fishery product value chain in the study area.

Data analysis was conducted using both quantitative and qualitative descriptive methods. Quantitative data, such as the production volume of fresh and salted fish between 2020 and 2024, were analyzed using averages, percentages, and annual trend calculations to observe changes and fluctuations over time. Qualitative data obtained from interviews and field observations were analyzed narratively to describe the relationships among actors, distribution systems, and communication patterns within the dried salted fish supply chain. The results were presented in a descriptive form and illustrated through a schematic diagram that showed the interactions among product, information, and financial flows.

To ensure the validity of the findings, data triangulation was applied by comparing information from different respondents and secondary data from DKP Sibolga. The final results are presented as a comprehensive descriptive account of the roles of each actor in the supply chain, their interactions, and the overall dried salted fish processing process in Sibolga City.

3. RESULT AND DISCUSSION

Volume of Fresh Fish and Dried Salted Fish Production in Sibolga City

The volume of fresh fish catches in Sibolga City has fluctuated with an overall increasing trend from 2021 to 2024, based on production data over the past five years, as shown in Figure 1. In 2020, fresh fish production was recorded at 38,891 tons, decreasing to 31,689 tons in 2021, and then rising again to reach 35,207 tons in 2024. Meanwhile, the production of dried salted fish remained relatively stable, ranging from 4,200 to 5,300 tons per year during the 2020–2024 period. This trend indicates that the increase in fresh fish catches has not been followed by a significant growth in the salted fish processing subsector, suggesting

a gap between the capture fishery production capacity and the local processing capacity.

A study analyzing fish landings at the Sibolga Nusantara Fishing Port from 2017 to 2021 revealed that the total landing volume fluctuated and declined between 2019 and 2021 due to extreme weather conditions and a reduction in active fishing fleets[7]. This condition indicates that although Sibolga's marine resources remain abundant, fishing efficiency and sustainability still need improvement. From a processing perspective, the relatively stagnant production of dried salted fish is likely caused by the fluctuating availability of raw materials, following seasonal patterns, and the processors' dependence on traditional sun-drying methods. Research conducted in Bengkulu revealed that small-scale dried fish businesses are exposed to high risks due to weather variability and the lack of modern drying technology, resulting in unstable product quality and production volumes[8]. A similar situation is presumed to occur in Sibolga, where drying activities still rely on natural sunlight exposure.

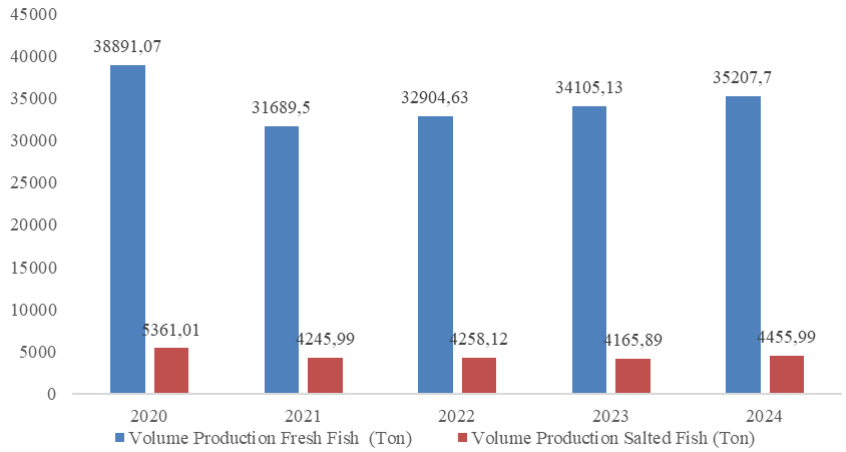

Figure 1. Production volume of fresh fish and salted fish in Sibolga City (Year 2020-2024)

Fishing operations have a significant impact on the performance of small-scale fishery enterprises, fish processing output, and marketing strategies[9]. The fishing gear most commonly used by Sibolga fishermen includes spear guns, handlines, traps, lift nets, small-pelagic purse seines, large-pelagic purse seines, gill nets, and transport vessels. Consequently, the fish species most frequently caught in Sibolga waters are skipjack tuna, longtail tuna, frigate tuna, and scads. This finding is consistent with a previous study conducted at the Sibolga Nusantara Fishing Port (PPN Sibolga), which explained that purse seine fishing gear has a high level of productivity in catching fish[10]. The catches obtained using efficient and environmentally friendly fishing gear will ensure the sustainability of raw material supplies for the salted fish processing industry in Sibolga and support the overall efficiency of the supply chain[11].

The main species used for the processing of dried salted fish in Sibolga are talang queenfish, anchovy, snakehead (*Channa striata*), stingray (*Dasyatis* sp.), Indian mackerel (*Rastrelliger kanagurta*), giant trevally or jack (*Caranx ignobilis*), and yellow-stripe scad (*Selaroides leptolepis*). Large pelagic species, such as queenfish and giant trevally, are often used in the production of seasoned salted fish products due to their soft flesh and desirable texture[9].

Marketing strategies at the Pasar Belakang salted-fish market in Sibolga remain primarily conventional, involving direct sales and distribution to several out-of-town areas, such as Medan and Pekanbaru, as well as to other islands, including Kalimantan and Java. However, some producers have begun adopting digital marketing approaches through social media and e-commerce platforms, although implementation is still limited. Studies

conducted in Bengkulu showed that dried-fish traders utilized Facebook and WhatsApp as marketing media, focusing on improving product quality and service during the COVID-19 pandemic[12,13]. These findings suggest that online marketing can enhance product visibility and market reach while maintaining direct customer relationships.

Furthermore, strengthening the supply-chain linkages among fishermen, processors, and traders remains a significant challenge. The lack of coordination among actors and the absence of an integrated market information system for prices and demand often lead to an imbalance between raw-material supply and processing capacity. This condition limits the economic growth of the dried-fish subsector compared with the capture-fisheries sector as a whole. Therefore, improving productivity and supply-chain efficiency for dried salted fish in Sibolga City should focus on modernizing processing facilities, enhancing drying infrastructure, and strengthening marketing networks among stakeholders to maximize the added value of fishery products.

Supply Chain Analysis of Dried Salted Fish in Sibolga City

These three channels demonstrate an integrated relationship among the key actors within the fishery production and distribution system in Sibolga. This pattern is similar to the findings of a study conducted in Bengkulu City, which also identified three to four supply chain flow patterns for dried fish, differing in distribution length and efficiency levels[14].

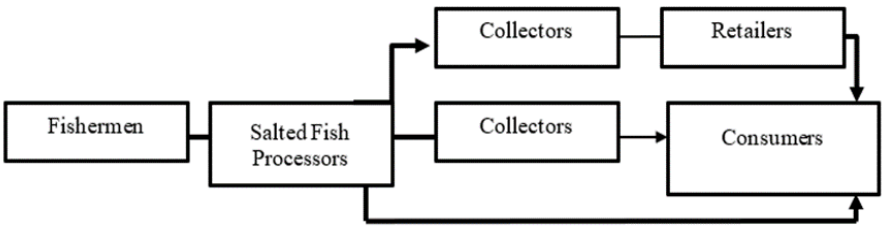

Figure 2. Supply chain flow of dried salted fish

The dried salted fish supply chain in Sibolga City involves three main distribution channels, namely: (1) Fishermen → salted fish processors → collectors → retailers → consumers; (2) Fishermen → salted fish processors → collectors → consumers; and (3) Fishermen → salted fish processors → direct consumers

The product flow illustrates the physical movement of commodities from the source of raw materials to the final consumers. The process begins with fishermen who supply fresh marine fish catches and sell them to salted fish processors. The processors then carry out salting and drying using traditional methods. On average, processors in Sibolga can produce between 100 and 200 kg of salted fish per day, depending on the season and the availability of raw materials.

In the first distribution channel, the finished products are delivered to collectors, who then distribute them to retailers before being sold to consumers. This is the longest chain and has the highest marketing margin because it involves more intermediary institutions. In the second channel, collectors sell directly to end consumers without going through retailers, while in the third channel, processors sell directly to consumers around the production area.

A study by Dewi & Widiyanto[3] found that the longer the distribution channel for dried fish, the greater the risk of quality degradation during storage and transportation. Therefore, shorter distribution channels, such as the third pattern, are considered more efficient and capable of maintaining product quality until it reaches consumers.

The information flow within the dried salted fish supply chain in Sibolga occurs bidirectionally among actors, primarily concerning raw material prices, supply availability, and market demand. The initial information originates from fishermen regarding catch volume and fish species available. Subsequently, salted fish processors provide information to collectors about the quantity of finished products ready for sale, while collectors relay information back to processors concerning market prices and consumer preferences.

In the first distribution channel, the flow of information tends to be slower because it involves more intermediaries. Conversely, in the second and third channels, communication occurs more rapidly since the relationship between processors and collectors or consumers is more direct. Saraswati et al.[4] explained that the shorter the distribution network, the faster the flow of information, making the supply chain more responsive to market changes.

Most business actors in Sibolga still rely on conventional communication methods such as face-to-face interactions, telephone calls, and WhatsApp messaging to exchange information about fish prices and average sales volumes. Some traders have begun marketing their products through online marketplaces and social media platforms. The adoption of digital systems can improve efficiency and accuracy of information flow, as recommended in previous studies on fishery supply chains in Indonesia[6].

The financial flow represents the movement of funds from consumers to fishermen through distribution intermediaries. In the first channel, money flows from consumers to retailers, then to collectors, salted fish processors, and finally to fishermen as raw material suppliers. This pattern causes relatively slow capital turnover due to payment delays at each level of the marketing chain.

In the second channel, financial flows occur more quickly because collectors conduct cash transactions with processors and fishermen. Meanwhile, in the third channel, salted fish processors receive direct payments from consumers without intermediaries, resulting in faster capital circulation and greater profit margins.

Daniel[14] stated that the shorter the financial flow and the fewer intermediaries involved, the higher the marketing efficiency due to reduced distribution costs and higher selling prices at the producer level. These findings are also consistent with those of Sinta et al.[13], who found that supply chains involving multiple intermediaries reduce the farmer's share because profits are divided among more actors within the chain.

Overall, the dried salted fish supply chain system in Sibolga City has functioned fairly well; however, efficiency can still be improved through stronger coordination among actors, the implementation of direct cash payment systems, and the use of information technology to accelerate the flow of pricing and market demand data.

4. CONCLUSION

This study reveals that the dried salted fish processing sector in Sibolga City is an integral part of the capture fisheries value chain, involving fishermen, salted fish processors, collectors, retailers, and final consumers. The three identified distribution patterns demonstrate variations in efficiency levels and margin distribution among actors. The product flow remains dominated by traditional mechanisms, while the information flow is still mostly conventional, relying on personal interactions between actors without digital system support. Financial flows are conducted through both cash and limited digital transactions, although some processors still depend on delayed payment systems with fishermen due to capital constraints.

Shorter distribution channels—particularly the third pattern (direct sales from processors to consumers)—are proven to be the most efficient, as they reduce marketing costs, accelerate financial

turnover, and help maintain product quality. In contrast, longer supply chains increase distribution costs and reduce product quality due to repeated handling and storage processes.

Therefore, improving the efficiency of the dried salted fish supply chain in Sibolga City can be achieved through stronger coordination among actors, the utilization of information technology to accelerate data flow on prices and market demand, and the provision of financing support for processors to ensure smoother financial circulation. Moreover, the modernization of drying facilities is essential to increase production capacity and enhance the competitiveness of Sibolga's dried salted fish products in regional markets.

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