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Freshwater Fish and Challenge of Supply Chain for Production Enhancement: West Southern Region of Aceh Province, Indonesia

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ABSTRAK

ABSTRACT

This research aims to analyze the supply chain and marketing chain of freshwater fish in the West-Southern Region of Aceh Province, Indonesia. The research activities took place from May to July 2022, with data collection continuing in 2023. The determination of data collection locations used purposive methods, and data collection was conducted through survey methods. Data were obtained from fish traders in four markets: Ujong Baroh Meulaboh Fish Market, Blang Pidie Market, Nagan Raya Market, and Krueng Sabe Fish Market. Data analysis was conducted descriptively. The research results indicate that the supply chain includes fish farmers, partner traders, collector traders, retailers, and consumers, and there are two supply chains based on regions: inter-insular and intra-region. The dominant types of freshwater fish supply are catfish and tilapia. Tilapia has a higher price compared to catfish. Tilapia is dominant in the Ujong Baroh market, while catfish is dominant in the Blang Pidie market. It has become a substitute when sea fish are scarce or expensive in the market. Based on the value chain analysis, a margin ranging from 10% to 30% was obtained. Partner traders play a significant role in production activities and the supply chain due to cooperation in input-output factors. Challenges in the freshwater fish supply consist of seeds and feed, with seeds mostly supplied from outside West-South, accounting for more than 80%.. Addressing freshwater fish supply challenges in Southwest Aceh requires an integrated supply chain approach enhancing hatchery systems and fry distribution upstream, improving aquaculture infrastructure and feed subsidies at the production level, and establishing collection centers, cold storage, and modern markets in key districts to strengthen distribution, stabilize prices, and improve food security.

Keywords: freshwater fish; margin; price; production; supply chain

INTRODUCTION

The economic value of marine fish has experienced an increase in prices, and there is fluctuating limited supply. In the fisheries trade system, marine fish have much better facilities and distribution transportation compared to freshwater fish. As a result, marine fish are more easily marketed outside their production areas, with 80% of the supply chain criteria already in place (Gumilang and Susilawati, 2019). The solution to meet consumer demand for marine fish is expected to involve the supply of freshwater fish as a substitute for marine fish.

Fish, as a food source, has several advantages, including being a source of essential nutrients, white meat, universally available, relatively inexpensive, with a relatively short production process, and local supply. The level of fish consumption in Indonesia is relatively low compared to the potential fisheries resources available. Fish consumption in Indonesia increased from 30.48 kg/capita/year in 2010 to 38.1 kg/capita/year in 2014 (annual growth rate: 5.78%), while fish supply rose from 38.39 to 51.8 kg/capita/year (annual growth rate: 7.85%). However, consumption remains below supply due to limited awareness of fish nutritional benefits, suboptimal distribution networks, inadequate infrastructure, and persistent sociocultural myths. Several factors suspected to contribute to the relatively low level of fish consumption in Indonesia include the low supply of fish due to inefficient distribution, the underdevelopment of fish processing and preservation technologies to diversify and meet the tastes of all consumers, as well as limited marketing and distribution facilities in terms of both quality and quantity (Djunaidah, 2017). According to Rahmawati et al. (2023), the low consumption of fish in the community is caused by a lack of public knowledge about the nutritional content and benefits of consuming fish.

The freshwater fish has already experienced a high market demand because people favor freshwater fish, especially carp, tilapia, and Sangkuriang catfish. Information from one freshwater fish trader in the Blang Pidie Fish Market, Southwest Aceh, states

that the demand for freshwater fish has sharply increased in the last two years, reaching 200 kg per day, compared to the previous 50 kg per day (Abdya fish trader, 2022). This is due to the fact that the districts/cities in the West Southern Region of Aceh (Barsela) have the potential for water and land resources, with a geographical structure that spreads from coastal areas to inland and mountainous regions, ranging from Aceh Jaya District to Aceh Singkil District.

The issues that have arisen in the community regarding freshwater fish in the Barsela Region include the limited supply of Sangkuriang catfish seeds. The supply of Sangkuriang catfish seeds is generally sourced from outside West Southern Region of Aceh (Barsela), hindering the development of freshwater fish cultivation. According to Circular Letter No. 4 from the Governor of Aceh in 2019, one of the directives included in the circular is to promote fish consumption to address stunting in various districts/cities in the province of Aceh. However, this does not align with the Governor of Aceh's expectation stated in the circular, which indicates relatively high fish prices in the field. This situation can lead to reduced purchasing power among the population and may result in a deficiency in fish consumption. This is in line with the statement by Rahman and Islam (2020), who argue that prices are a factor influencing fish consumption patterns in a region.

The supply chain is a network of companies or individuals working together to create and deliver products to end-users. If the supply chain is one of the physical networks of companies, institutions, or groups involved in supplying raw materials, producing, and delivering to end-users, then the methods, equipment, or management of this supply can be considered as supply chain management (Pujawan, 2010). Data on the supply chain and optimal routes for the supply of freshwater fish always consider factors related to the distribution of goods, such as travel time, distance, supply, and demand for goods. In principle, route optimization will improve the effectiveness and efficiency of distribution, leading to positive impacts such as time and cost savings for those involved (Perdana & Soemardj, 2015). Proper management of the procurement of inputs, the manufacturing and processing of goods, and the transportation of those goods to the client or consumer make up a cohesive supply chain (Chopra & Meindl, 2016).The Southwestern Aceh Region, with its various conditions in meeting the fish needs of the community, is currently facing limitations. As a result, the demand for fish consistently experiences shortages that do not meet consumer expectations. The current condition of marine fish reaching consumers is no longer in fresh form due to the distant supply from its source. Additionally, the cultivation of freshwater fish is restricted, especially Sangkuriang catfish, due to the limited availability of fish seeds. Production of Sangkuriang catfish are decreasing with value of 1.80% between 2020 and 2023 (Badan Pusat Statistik Aceh, 2023). With such conditions, there is a need for a more specific study on the fish supply chain in in the West-South Region, which can be conducted through research activities. As far as the authors are aware, there is a lack of data describing the West-Southern Region farmed fish value chain. None of the studies that are currently available have examined the practices and perceptions of all value chain actors, including consumers. The majority of these studies concentrate on the financial performance of the farmed fish marketing, and a smaller number examine the farmed fish sector as a whole (Norman-López & Bjørndal, 2009, Macfadyen et al., 2012, Macfadyen et al., 2011, Kleih et al., 2013, El-Naggar et al., 2006). To ensure the availability and safety of freshwater fish in the South West of Aceh region, study is necessary to understand the existing situation of freshwater production, marketing, and consumption trends.

The research objective is to analyze the supply chain and marketing chain of freshwater fish in the Southwestern Region of Aceh Province, Indonesia. The expectation from this study is to provide information and solutions for ensuring the availability of fish supply for the community. This aims to maintain food security, preventing nutrient deficiencies that can lead to stunting. The research is crucial because understanding the formulation of the freshwater fish cultivation supply chain and addressing challenges related to the insufficient supply of freshwater fish for consumption are essential for strengthening protein fish food security in the community.

RESEARCH METHODS

Location and Time of Research.

The primary data collection was conducted from May to July 2022 in the West Aceh District, Aceh Jaya District, and Southwest Aceh District, and Southwestern Region of Aceh Province.

Type and Method of Data Collection

The data was collected in the form of primary and secondary data. Primary data were obtained from fish farmers and freshwater fish traders at three

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Figure 1. Research Location

fish markets: Ujong Baroh Meulaboh Fish Market in West Aceh District, Blang Pidie Fish Market in Southwest Aceh District, and Krueng Sabe Fish Market in Aceh Jaya District. Seed supply data were obtained from seed suppliers between regions and local seed producers. Secondary data were sourced from the Marine and Fisheries Agency of Aceh Jaya, West Aceh, and from the Marine and Fisheries Agency of Southwest Aceh.

Method of Analysis

The collected data were analyzed using a quantitative approach through simple descriptive statistics, including measures of central tendency, dispersion, and frequency distribution, to summarize key variables across the value chain. The results were systematically presented in tabular and graphical formats to facilitate clarity and interpretation. Subsequently, a qualitative-descriptive analysis was conducted to interpret the patterns, trends, and contextual factors influencing freshwater fish production and distribution. To gain a deeper understanding of the structure, performance, and governance of the aquaculture sector, Value Chain Analysis (VCA) was employed as a comprehensive analytical framework. This approach enabled the identification of key actors, their roles, linkages, value addition at each stage, as well as constraints and opportunities within the production-to-consumption chain, thereby supporting evidence-based recommendations for improving efficiency, equity, and sustainability in the freshwater fish value chain.

RESULTS AND DISCUSSION

The results of the freshwater fish supply data indicate that the supply in the Southwestern Region of Aceh Province is dominated by Sangkuriang catfish (*Clarias gariepinus*) and tilapia (*Oreochromis niloticus*), both in terms of seed supply and consumable fish. The supply of Sangkuriang catfish seeds is mostly still sourced from outside the West-South of Aceh region region, while the consumable fish market is already dominated by the production of freshwater fish farmers within the West-South of Aceh region. One of the challenges in supply and the supply chain is the suboptimal supply of input factors for the fish farming business. Subasinghe et al., (2009) has explained that the increasing demand for aquatic food worldwide cannot be satisfied by maintaining fish stocks from catch fisheries, and in most parts of the world, aquaculture

is seen as a potential solution to close the supply and demand gap. But there will be a lot of obstacles for the industry to overcome if we want to realise this promise. The industry is continuing to use new species, diversify, intensify, and adapt its systems and procedures, according to key development trends. Demands for the manufacture of high-quality, safe products are evident in markets, trade, and consumer preferences, all of which have a significant impact on the sector's growth.

The supply of fish seeds

The cultivation of tilapia and catfish by the community requires an adequate and quality supply of seeds at affordable prices. Based on data from the Provincial Marine and Fisheries Office (2021), the largest overall seed supply in the Barsela region is in Nagan Raya District. The production of various fish species is obtained through the facilities of the Fish Seed Center (Balai Benih Ikan - BBI) and from People's Seed Hatcheries (Unit Pembenihan Rakyat - UPR). Further information indicates that the production capacity of freshwater fish seeds reaches more than 12 million individuals.

Based on the development of ponds, including earthen ponds, tarpaulin ponds, and others currently available, the required quantity of catfish seeds in the three districts of the West-South of Aceh region can be seen in Table 1 below.

From the supplied quantity of catfish seeds to fish farmers, an average survival rate (SR) of 70% is obtained. Therefore, out of 300,000 seeds, the fish production amounts to 21 tons per month with an average size of 10 fish per kilogram. This production is supplied to the three main markets in the West-South of Aceh region: Ujong Baroh Market, Blang Pidie Market, and Krueng Sabe Market in Aceh Jaya.

The supply of consumable fish

Freshwater fish farming has seen significant growth in urban areas, as seen in Aceh Barat District, for example, in the Meureubo and Johan Pahlawan sub-districts. There are over 200 units engaged in freshwater fish farming, utilizing facilities such as tarpaulin ponds, earthen ponds, and concrete ponds. In recent years, this sector has experienced quite encouraging development. According to data from the Department of Marine and Fisheries (DKP) of Aceh Barat, there are three types of freshwater fish dominated by catfish and tilapia, with an increase of over 100%, as shown in Table 2 below.

The research results also indicate that in the three districts of the West Southern Region of Aceh (Barsela), the dominant freshwater fish supply consists of tilapia and Sangkuriang catfish. The supply of consumable fish for one month includes 5,788 kg of Sangkuriang catfish and 7,015 kg of tilapia. Information from retail traders mentions that during various social and cultural events, the demand increases, and fish are supplied from the cities of Banda Aceh and Medan, contributing to 50 to 60% of the total supply, as shown in Figure 1 below.

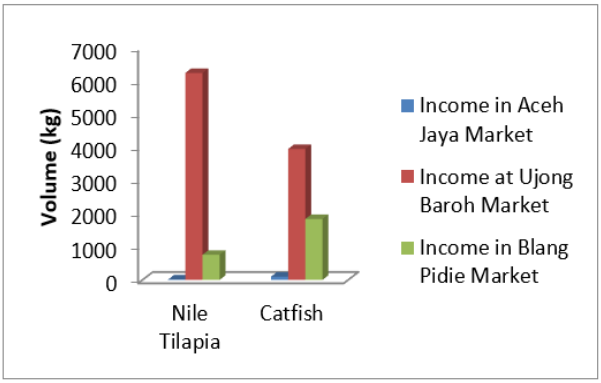

Figure 1. The Freshwater Fish Consumption Production in the Three West-South of Aceh Regions in 2022.

Table 1. The Need For Supply 0f Catfish and Tilapia Seeds for Enlargement Business per Month.

Regency	Number of Pools	Catfish (Tails)	Perpetrator	Tilapia (Tail)
West Aceh	250	200,000	30	30,000
Abdya	120	120,000	20	15,000
Aceh Jaya	30	20,000	2	5,000

Table2. Volume and Value of Freshwater Fish Production In West Aceh District.

Fish Type	Production Volume (kg)		Production Value (IDR)	
	2019	2020	2019	2020
Catfish	247,150	57,280	1,432,000,000	3,707,250,000
Mas	5,390	11,880	415.800.000	169,785,000
Tilapia	25,460	52,590	1,577,700,000	636,500,000

Source: (DKP West Aceh, 2020).

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The main issue with freshwater fishery products is the uneven availability of freshwater fish supply due to the limited aquaculture efforts. Simultaneously, the Aceh Government, through Governor's Circular Letter No. 14 of 2019, includes a campaign promoting fish consumption to address stunting. Similar challenges exist in other areas, as stated by Basahudin (2012). Despite favorable market opportunities for catfish in Bogor, with a supplier sending 8 tons of catfish daily to Jakarta, the demand is still perceived as insufficient due to inadequate aquaculture production.

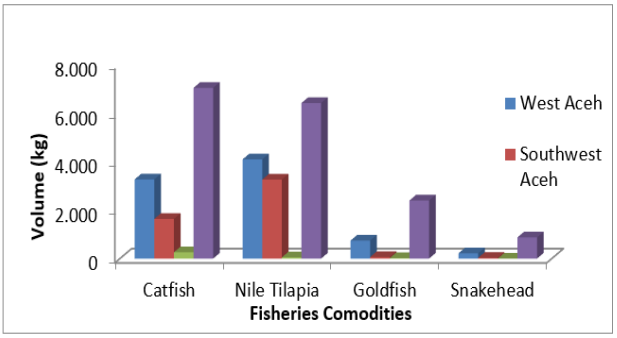

Figure. 2. The Freshwater Fish Production in the West-South of Aceh Regions in the Year 2023.

The overall aquaculture fisheries production in the Barsela region has seen an increase, attributed to developments in brackish water aquaculture, including both fish and shrimp. This can be observed in Figure 3 below.

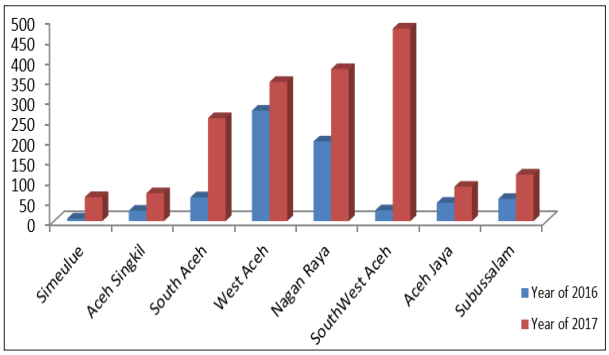

Figure 3. The Aquaculture Production in the West-South of Aceh Regions.

In Nagan Raya Regency, marine fish production occurs at PPI Langkak and Tripa. Guritno et al., (2018) has reported that catchment of the supply chain for sea fish to yield high-quality fish with a high market value, proper management is necessary. In order to maintain control over and strike a balance between the price and quantity of fish along the supply chain, logistics expenses must be handled as they rise at each level. Therefore, Reactive supply chain strategies for fishermen and effective supply chain strategies for traders and collectors are appropriate approaches to use. The push supply chain strategy is the overall supply chain approach. The supplied demersal fish result from purse seine fishing, with the following types of fish.

Laraswati et al., (2016) reported that finding the activities that can be regulated and determining the percentage of the logistic cost are the goals of the analysis of the logistic cost structure in the cold supply chain of capture fish. A supply chain strategy is required to reduce the overall cost of managing a cold supply chain.

Meanwhile, the freshwater fish market is centralized in two markets: Simpang Empat Market and the Fish Market of Jueram Sub-District. The types of freshwater fish available in these markets include Sangkuriang catfish, tilapia, and carp. However, other types of freshwater fish are scarce or not found in the fish market. According to a disclosure from a trader named Nanda, local catfish is becoming somewhat rare. This is evident as it is not available every day in the market, and if present, the quantity is very limited, approximately around 1 kg. This scarcity is attributed to the declining population of these fish in the water, and local fishermen catch only a small quantity, around 2 kg. They often sell it directly to local eateries in the Nagan Raya region. Similar situations are reported by other traders in Aceh Barat and Aceh Barat Daya regencies, where non-cultivated freshwater fish, such as snakehead fish (ikan gabus or locally known as ikan Bace in Acehnese), are also very limited.

Table 3. Average of Marine Fish in Simpang four Market.

No	Fish species	Buy price (IDR/kg)	Sell price (IDR/kg)	Season Price (IDR/kg)	Famine Price (IDR/kg)
1	Dencis	25.000	40.000	15.000	50.000
2	Selar	22.000	40.000	30.000	40.000
3	Kembung	50.000	60.000	25.000	60.000
5	Rambe	60.000	80.000	40.000	100.000
6	Tuna	35.000	50.000	35.000	50.000
7	Gabu	65.000	70.000	45.000	75.000
8	Tongkol	22.000	35.000	13.000	40.000
9	Kerapu	70.000	80.000	60.000	90.000

Level of Price

The research results show freshwater fish production in the fish markets of the Barsela region in Aceh, including the fish markets in Aceh Barat, Aceh Barat Daya, and Aceh Jaya regencies. The dominant species is Sangkurang catfish, followed by tilapia. The prices of Sangkurang catfish range from IDR.23,000 to IDR.25,000 at the farmer's level, and at the market, it ranges from IDR.30,000 to IDR.35,000. Meanwhile, the prices of tilapia are IDR.27,000 at the farmer's level and range from IDR.35,000 to IDR.45,000 at the market, as shown in Table 4 below.

The catfish farming business has experienced growth in urban areas due to the ease of production and marketing factors. With the increasing consumer demand, especially during celebratory events and the Maulid season, typically occurring after the Hajj month or Zulhijjah until the month of Rajab, it indicates that there are still opportunities for investmentin freshwater fish farming. This is illustrated in the flow of the supply chain of seeds and consumable fish, as depicted in Figure 4.

Tabel 4. Price and Margin of Freshwater fish in West-South of Aceh Region.

Regions	Nile Tilapia			Catfish		
	Purchase Price (IDR/kg)	Selling Price (IDR/kg)	Margin	Purchase Price (IDR/kg)	Selling Price (IDR/kg)	Margin
West Aceh	27,000	36,000	9,000	23,000	30,000	7,000
Aceh Jaya	27,000	35,000	8,000	23,000	30,000	7,000
Nagan raya	25,000	38,000	13,000	23,000	30,000	7,000
West-South Aceh	27,000	40,000	13,000	25,000	35,000	10,000

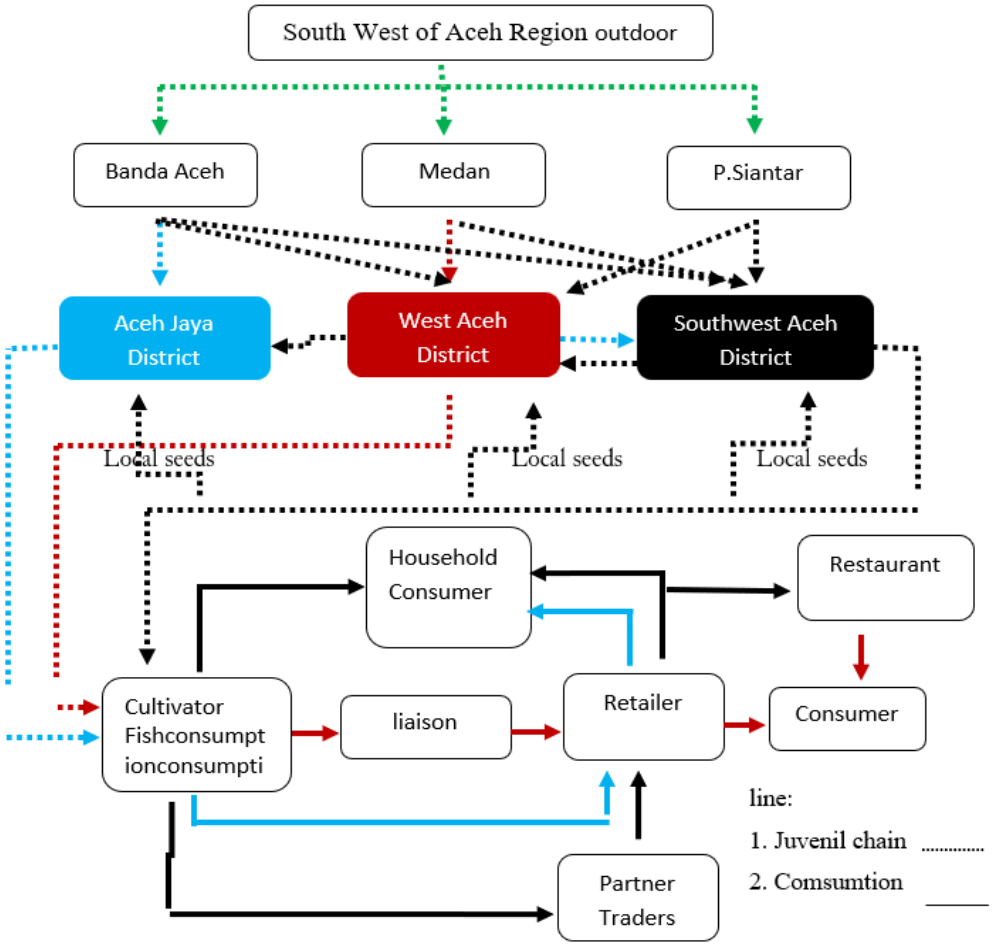

Figure 4. The Supply Chain of Seeds and Consumption Fish in the South West of Aceh Region.

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Based on the information obtained, for Sangkuriang catfish, 88% of the seed supply comes from outside the Barsela region. Looking at the number of fish farming groups (Pokdakan), in Aceh Barat Regency alone, there are 63 pokdakan with a total of 823 members, cultivating catfish and tilapia. Each farmer requires 1,000 to 10,000 individuals per month, resulting in a total seed requirement of over 823,000 individuals per month. The same applies to other farming communities in the Barsela region, which comprises eight regencies: Aceh Jaya, Aceh Barat, Nagan Raya, Abdya, Aceh Selatan, Kota Subussalam, Aceh Singkil, and Simeulue.

The retail price for seeds with a size of 6-7 cm is Rp. 250 per individual, increasing by Rp. 50 according to the size increment. Meanwhile, the supplier price from Pematang Siantar, as informed by the inter-island seed trader named Asmadi, is Rp. 150, resulting in a Value Chain Analysis (VCA) value of Rp. 100 per individual. Retailers state that the margin value, reaching 40%, is for feed, medicine, and the risk of death during the seed cultivation period, which takes one to two weeks.

The development of freshwater fish farming businesses in the last two years has been quite encouraging. The catfish seed needed by farmers in three regencies amounts to 340,000 individuals per month, while the local supply is only 40,000 individuals. The remaining 300,000 individuals are supplied from outside Aceh, meaning that 89% of the seeds come from outside Barsela, specifically from Pematang Siantar and Medan. Superior tilapia seeds are supplied from Banda Aceh, Pematang Siantar, and Nagan Raya. For tilapia, there is a supply from Nagan Raya Regency produced by UD. Reukan Buemaju, with a production rate of 1,238,000 in 2018 and 2019 (DKP Aceh, 2018) intended for tilapia farmers in that area. The seed supply chain consists of inter-island traders, partner traders, retail traders, and freshwater fish farmers. Meanwhile, the supply chain for consumable fish involves producers, partner traders, connecting traders, retail traders, and consumers.

Saraswati and Suadi (2020) has reported that There were three steps in the supply chain model for fresh fish (supplier, seller, final customer/ household), and four stages in the supply chain model for processed fish (supplier, wholesaler, trader/seller, ultimate consumer).The limited supply of seeds from local production is due to the suboptimal role of hatchery institutions such as BBI and UPR. Therefore, catfish seed production in the Barsela region is still small. According to Mustika, (2020) that the implementation of the CPiB concept is required to achieve optimal quantities and good quality fish seeds. Local seed production, based on survey results, shows that it is not yet optimal in the Barsela region. This research discusses the challenges in the freshwater fish supply chain in the Barsela region, proposes solutions, and explores its relevance to the food security program where the government advocates encouraging the public to enjoy eating fish (Gemarikan). This is because fish is highly suitable for consumption due to its adequate nutritional content (Kinasih, 2012). The strengthening of Indonesia's government support for fish consumption patterns is manifested through the issuance of Presidential Instruction Number 1 of 2017 concerning the Healthy Living Movement. In this instruction, the Minister of Maritime Affairs and Fisheries is mandated to: 1) enhance and expand the implementation of the People's Movement to Eat Fish (GEMARIKAN) in society, and 2) supervise the quality and safety of fishery products (Minister of Maritime Affairs and Fisheries, 2017).

The production factors of freshwater fish

The local seed production, especially for Sangkuriang catfish, by fish breeders in the Barsela region is still low. As a result, seed supplies are imported from outside Aceh. It is a common knowledge that catfish and tilapia seeds are often sourced from regions outside Aceh. The high risks and pricing factors in seed supply pose challenges to the development of consumer fish production businesses. The number of catfish seed breeders is limited to around 5 individuals, and the production of seeds from existing breeding institutions is not yet optimal. However, seeds and feed are dominant input factors in the effort to produce fish to meet the needs of the community. The supply chain is a network of companies or individuals working together to create and deliver products to end-users. If the supply chain is a physical network involving companies, institutions, or groups involved in supplying raw materials, manufacturing, and delivering to end-users, then the method, tools, or supply management is referred to as supply chain management (Rahman et al., 2021).

Supply challenges

Tackling the challenges in meeting the supply of consumer fish and ensuring the smooth flow of the supply chain includes the recent increase in the price of quality feed. In 2021, a sack of quality feed with 31% protein content was priced at Rp. 310,000, but it has now increased to Rp. 385,000. The challenges faced include:

1. Improving the Quality and Quantity of Freshwater Fish Seed Production Locally:
2. Addressing the need to enhance both the quality and quantity of locally produced freshwater fish seeds.
3. Providing Alternative Feeds: Exploring and supplying alternative feed options to mitigate the impact of rising feed prices.
4. Enhancing Technical and Managerial Skills in Seed Multiplication: Improving the technical and managerial capabilities of technicians and freshwater fish farmers in seed multiplication.

According to (Marisa, 2023) that the fisheries supply chain is long and winding, with various components from upstream to downstream, making it challenging to manage. In comparison to other regions, tilapia production in Kabupaten Tobasa is supplied to the processing industry, as reported by (Hendrati et al., 2019). Tilapia from this region is sourced from farmers, supplied to collectors, then to large-scale traders before being delivered to processing industries. The lack of local seed supply results in seed imports from outside the region, specifically from Medan and Pematang Siantar, facilitated by seed suppliers partnering with local retailers.

In the marketing of fishery products, which involves a broad network, effective management aspects are crucial. Hendrati et al., (2019) highlights that the high demand for fish in Surabaya requires the implementation of risk management, beneficial not only for fish farmers but also for end-users.

Supply and Food Security

The fish supply data also indicates inter-district trade, where abundant production in one location needs to be supplied to another district. In such cases, producers or farmers are no longer aiming for optimal fish prices, but rather focus on harvesting the fish promptly. Failure to do so can result in catfish growing larger, making them less desirable to consumers in the market. This is in contrast to tilapia, which becomes more desirable and commands higher prices as it grows larger, assuming there is sufficient demand. If demand is low, the surplus fish will be supplied to areas outside the district. Technological innovations in fish distribution have also entered the fish supply chain, incorporating cold chain logistics (Douet, 2016).

In the freshwater fish supply chain, there is a pattern of abundance. Producers from Abdya seek buyers in Meulaboh, and when there is an oversupply in Meulaboh, fish is supplied to Southwest Aceh and Nagan Raya, reaching 1200 kg per month based on data. There are also imports from outside to Abdya (400 kg per month) and to Nagan (800 kg per month). If stocks are limited in the Barsela region, freshwater fish, especially Sangkuriang catfish, will be supplied from Banda Aceh and Medan (Wardah et al., 2019).

According to Dahuri (2011), the supply chain structure can be analyzed using methods that involve factors such as transportation time, the quantity of fish sold, and the selling price. The primary purpose of the supply chain is to build a centralized supplier chain that focuses on maximizing value for customers. In the case of fish, various supply chain models exist, including direct purchases by consumers from fishermen. However, this approach is limited by time, location, and ownership. Kumar et al., (2020) has reported that A few issues that farmers in the fish producing industry confront are a lack of training facilities, a shortage of high-quality fingerlings, and a lack of water. The main issues that fish customers experienced were market distances, price fluctuations, and the unavailability of fresh fish. The process of selling freshwater and saltwater fish in the research market location is depicted in Figure 5.

Figure 5. Consumers Buy Fish at the Blang Pidie Abdya and Ujong Baroh Fish Markets.

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Fishery production in Aceh has experienced a significant increase, as reported by the Department of Marine and Fisheries (2021). According to the report, the production of Sangkuriang catfish is significantly influenced by the supply of feed and seeds, accounting for 70% of the production value. Therefore, in efforts to strengthen food security for the community, it is crucial to develop freshwater fish farming through existing fish farming business development programs in relevant institutions.

According to Effendi (2009), the potential for fish farming in the Barsela and Abdya regions is substantial, especially if developed properly, particularly in the household yards of rural communities. This is because the supply of fish to rural areas is limited due to a significant portion of marine fish production from Barsela being sent outside the region. Hence, developing freshwater fish farming in household yards can be a solution to increase fish supply in the area. Consumption fish is intended to meet food demand, especially as a primary source of protein for humans. Therefore, steps need to be taken to strengthen the fish supply chain to rural communities, including increasing the utilization of existing land and water resources and enhancing the role of extension services. Kotni (2016) has reported that Value chain management should be used by all parties involved in the fish supply chain in order to maximise vendor value in terms of pricing and customer pleasure in terms of product convenience. The supply chain of fisheries products, as explained by the author, is a system for distributing the production of captured and cultivated fish until it reaches the final consumer. Therefore, developing freshwater fish farming and improving the efficiency of the supply chain are key factors in ensuring an adequate supply of consumption fish for the community. Research findings indicate that achieving complete advantages from a supply chain integration approach necessitates a close comprehension and reliable cooperation between supply chain participants, including manufacturers and suppliers (Eng, 2006; Li et al., 2007; Roy et al., 2004). This is a result of the parties' increased ability to comprehend one another's businesses and work together to find creative ways to improve the supply chain procedure. The search for factors that indicate how well business connections operate across a range of industries and supply chains has made trust a key notion (Carr and Pearson, 1999; Ireland and Webb, 2007). Furthermore, the pursuit of enhancing quality and performance necessitates the notion of innovativeness (Mone et al., 1998). Innovation plays a key role in the supply chain's pursuit of a competitive edge by enabling the creation of new operational processes and information-related technologies that increase service efficacy and efficiency (Bello et al., 2004). Innovation capability is seen to be the result of numerous resources interacting with one another. Accordingly, the resources of businesses—people, machinery, expertise, and capital—are essential to successful innovation (Bessant and Tidd, 2007; Leskovar-Spacapan and Bastic, 2007).

Iqbal and Shalij (2017) has reported that an increasing level of competition makes a company's supply chain a crucial factor in its ability to succeed in the market. Measuring the performance of the supply chain is crucial because it helps managers make wise decisions by providing information to decision makers about the likelihood of success and efficiency.

CONCLUSIONS AND POLICY RECOMMENDATION

Conclusions

there are still challenges related to the supply of fish seeds in the West-South of Aceh region, and the role of partner traders is crucial in overcoming these limitations in the freshwater fish marketing chain. These challenges that face including freshwater fish farming continues to face challenges, primarily due to inconsistent supply of locally sourced fingerlings, leading to fluctuating production levels. Despite growing demand, farmers struggle with low market prices for their produce, which is further compounded by rising production costs, especially for high-quality feed. Moreover, freshwater fish are still widely regarded as an alternative to marine fish, limiting their perceived value and market potential in the eyes of consumers. Efforts are needed for the development of local hatcheries and the strategic involvement of business actors in the supply chain to ensure the resilience and sustainability of freshwater fish production in the region.

Policy Recommendation

To strengthen the freshwater aquaculture sector, several key policy interventions are recommended. First, there should be a focused effort to upgrade and expand aquaculture infrastructure such as ponds, hatcheries, and water management systems while also ensuring a healthier and more sustainable farming environment. Second, to alleviate the financial burden on farmers, targeted subsidies should be provided, particularly for critical inputs like feed, which constitutes a major portion of production costs. Lastly, to improve farmers' income and market access, the development of

specialized freshwater fish markets is essential. Establishing well-organized distribution channels and dedicated marketplaces can help stabilize prices, reduce middlemen margins, and elevate the status of freshwater fish in the domestic seafood market.

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AUTHORS CONTRIBUTION STATEMENT

We hereby declare that the contributions of each author to the writing of this paper are: (Zuriat) as main contributor, Amarullah, Gazali, M. Ali S, M. Irham, Rina Syafitri as member. The authors declare that the Author Contribution Letter has been attached.

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