

Supply chain analysis of coral trout (*Plectropomus leopardus*) in simeulue regency: case study of production value and contribution of PiSiSi MPA

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Abstract. Coral Trout (*Plectropomus leopardus*) is a species of grouper that is highly valued and the main commodity in Simeulue Regency. This research aims to identify the supply chain, calculate the value of fisheries production and the percentage of production of Coral Trout (*Plectropomus leopardus*) in the PiSiSi Simeulue MPA. It is hoped that the benefit of this research will be market literacy so that it can be used as consideration for management policies and optimization of fisheries marketing in Simeulue Regency. The research was carried out in March-April 2023 through interviews, field surveys and collecting data on purchases/sales of Coral Trout from collectors. The results of the research show that there is a production value of Coral Trout that is different for each buyer in Simeulue Regency. The production value generated by buyers (collectors) was IDR 1,293,195,632 with a total weight of 10.23 tons. The fisheries sector in the PiSiSi MPA contributes to Coral Trout fish production of 41.47% or IDR. 536.3 million in 2022. Based on this research, Coral Trout fish is sold to local communities, processing coMPAnies and exporters in Belawan, North Sumatra and Jakarta.

1 Introduction

Coral Trout (*Plectropomus leopardus*) is a species of grouper commonly found in tropical marine waters in the Indo-Pacific region. Coral Trout are often found in coral waters, or in muddy coral areas, living at depths of 40 meters to 60 meters. In their life cycle, juvenile of Coral Trout live in coral waters with a depth of 0.5-3 meters, then they reach adulthood and go deeper, and usually this movement takes place during the day and at dusk [1]. Coral Trout has a red body, therefore it is also called red grouper. There are dark blue spots on the edges of its body. According to Heemstra [2], the scientific classification of Coral Trout (*Plectropomus leopardus*) consists of Kingdom: Animalia, Phylum: Chordata, Class: Actinopterygi, Family: Serranidae, Genus: *Plectropomus*, Species: *Plectropomus leopardus*. Coral Trout is a hermaphrodite protagonist fish which has the female to male sex of a certain size [3]. Coral Trout is a type of demersal fish which is a fish that lives on the seabed, both looking for food and spawning.

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A commodity is any real economic product that directly or indirectly contributes to fulfilling human satisfaction and needs. So it can be said that a product, commodity is an item or object that is real and has a certain physical substance so that it can be traded or bought and sold. Fish is one of the main commodities traded in the Indonesian domestic market and international markets [4]. One of the fish that has become a commodity is the Coral Trout, with a high selling value and market demand, so this fish has become one of the targets for fishermen's catches. Some areas refer to Coral Trout as Janang grouper and red grouper [5]. Economic analysis of the Coral Trout commodity includes factors such as selling price, market demand, production, distribution and government regulations [6]. The selling price of Coral Trout tends to be high due to large demand from Asian and European markets, as well as limited supply from cultivation and natural catch. The supply chain process for fish consists of all production activities up to the delivery point in safe conditions so as to provide consumers with good service and quality [7]. The supply chain is also a marketing journey that a product must go through from the time it is produced to the final consumer. Supply chains require management as the design, operation, and enhancement of the systems used to create and trade the products and services of a company. Supply chain management relates to the entire system that produces a product [8].

Simeulue Regency has a marine conservation area called Pulau Pinang Pulau Siumat Pulau Simanaha Marine Protected Area (PiSiSi MPA) which was formed in 2020 through the Governor of Aceh Decree Number: 523/1297/2018 with an area of 44,404.10 hectares. The PiSiSi MPA was established by the Decree of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia NUMBER 78/KEPMEN-KP/2020 concerning the Aceh Besar Marine Conservation Area, the Pinang Island, Siumat Island and Simanaha Island Marine Conservation Area, the Southwest Aceh Water Conservation Area, and the Aquatic Conservation Area South Aceh in Aceh Province. The ecosystems found in the PiSiSi MPA area are mangroves, seagrass and coral reefs [9].

By conducting research on the supply chain of Coral Trout on Simeulue Island, it is hoped that we can increase understanding of Coral Trout fish resources and assist in the development of sustainable fisheries management strategies and can improve the welfare of local communities who depend on fishery resources. This study aims to analyze how the supply chain process and production value and the contribution of PiSiSi MPA in the supply of Coral Trout in Simeulue district. This research is limited to the scope of fishermen and fish collectors. Apart from that, the scope of the discussion was carried out by comparing the performance efficiency of the Coral Trout supply chain between fishermen and collectors in the PiSiSi MPA area.

2 Research Methods

2.1 Location and Time

This research was conducted in March-April 2023 in six fish storage locations in Sinabang and Kuala Makmur, East Simeulue District, Simeulue Regency. All the research site are within PiSiSi MPA and can be seen through Figure 1 below.

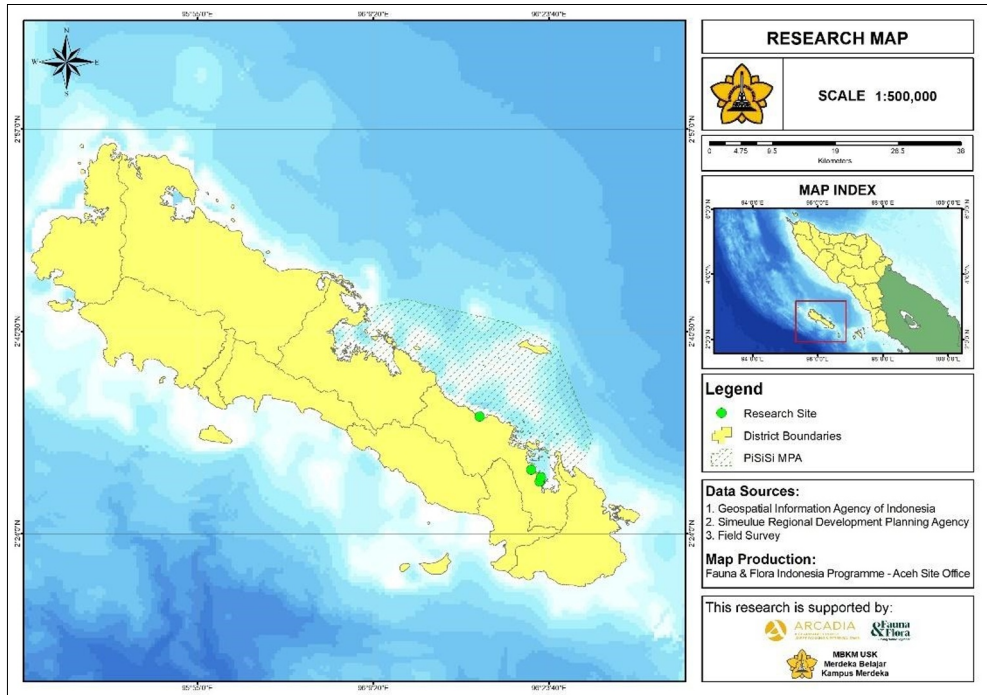


Fig.1. Map of Simeulue Regency

2.2 Tools and Materials

The tools and materials used in the research are writing instruments for recording observations made, cameras for documentation, laptops for data processing, analysis and reporting, and questionnaires for guiding questions in gathering information.

2.3 Data Retrieval

Data collection began by conducting interviews with collectors who were determined using purposive sampling techniques. Interviews were conducted using direct interview techniques with questions that had been prepared in a questionnaire. The questions in the questionnaire are arranged based on the parameters to be measured so that they can produce the required information. The respondents in this study were 6 people who were owners of fish shelters. After the interview was conducted, it was continued with a field survey where the data taken was the size of the Coral Trout, as well as the freezing treatment of the fish.

2.4 Data Analysis

The identification of the supply chain was carried out by direct interviews with the collectors who became respondents. The identification of the supply chain was carried out by direct interviews with the respondent collectors. The identification of the supply chain in this study focuses on how Coral Trout fish travels from producers (fishermen) to consumers (collectors and buyers) [10]. Analysis of supply chain performance to measure production value using measurements that take into account the calculation of fish production issued to market the product and the percentage of each actor (Permen kp No. 1 of 2023).

- Production Value (PV)

To calculate the production value formula, the following formula is used:

$$\text{Fish PV} = \text{Weight of caught fish (kg)} \times \text{Reference price of fish (IDR)} \quad (1)$$

- Percentage of production value

To calculate the percentage of Production Value, the following formula is used:

$$\% \text{ Production Value} = \frac{\text{Production Value MPAs PiSiSi}}{\text{Production Value Simeulue}} \times 100 \quad (2)$$

3 Results And Discussion

3.1 Coral Trout Production Data

During 2022, production of Coral Trout (*Plectropomus leopardus*) will fluctuate every month, with the lowest production values occurring in January and February, each at 0.16 tons. Meanwhile, the highest production value was in December with a total of 1.56 tons. Overall, peak production during the year increased twice, namely in April and December (fig 2).

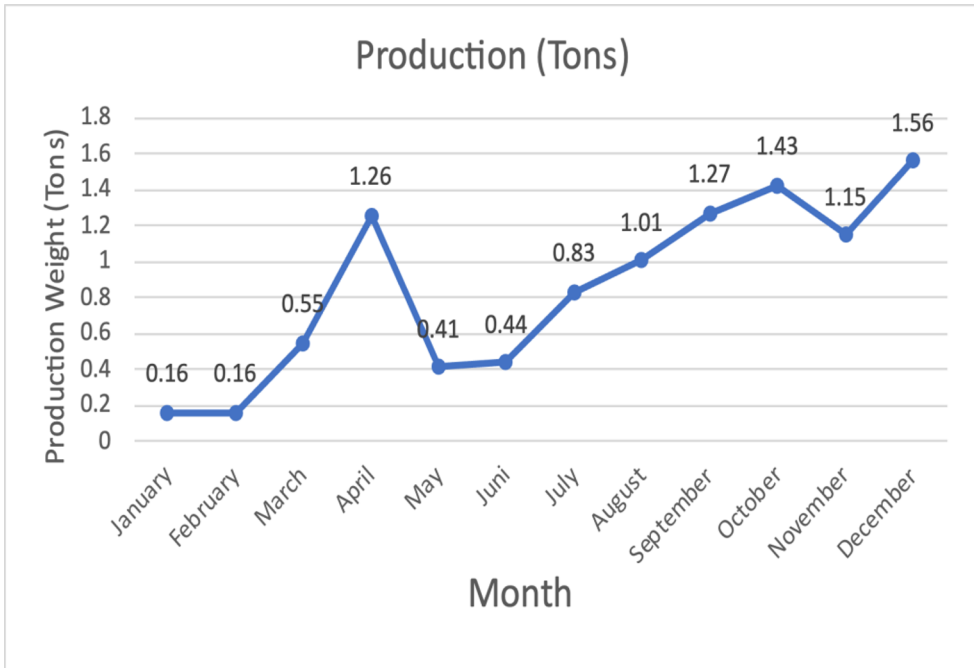


Fig 2. Graph of the amount of Coral Trout production in Simeulue Regency in 2022 in tons

The increase in production value in December occurs because that month enters the fishing season, where the population of Coral Trout increases, which is a reciprocal relationship between water conditions and fish. This increase can also be caused by increased fish activity in searching for food by utilizing low sea currents, so that it is easier for fish to move and some fish can also feed in strong current conditions [11]. One of the reasons for the increase in Coral Trout production in December is supportive water conditions, such as relatively calm waves and tolerable storm conditions, making it easier for fishermen to carry

out fishing operations [12]. Meanwhile, the lowest production occurred in January and February, namely 0.16 tonnes. This decrease in production levels was caused by the Coral Trout fish spawning so that their activity decreased. This is in line with Sadovy [13] that when spawning, Coral Trout fish are in groups so that the fish are difficult to catch if the speed of the sea current makes it difficult for the fish to move.

3.2 Percentage of Production Value of Coral Trout (*Plectropomus leopardus*)

Based on the results of observations, it shows that the percentage value of production of Coral Trout (*Plectropomus leopardus*) in Simeulue Regency in 2022. This includes the production value in Simeulue Regency and in the PiSiSi Conservation Area. Production Value Percentage Value Data in table 1 below.

Table 1. Percentage (%) of Production Value in 2022

Month	Production Value Simeulue (IDR)	Production Value PiSiSi MPA (IDR)	% Production Value PiSiSi MPA
January	20,064,200	5,955,200	29.68
February	20,155,950	2,869,450	14.24
March	66,521,000	17,309,600	26.02
April	151,763,057	76,828,030	50.62
May	48,578,750	35,807,150	73.71
June	52,549,250	41,632,600	79.23
July	99,652,055	73,934,555	74.19
August	123,179,400	57,097,150	46.35
September	157,899,350	69,210,800	43.83
October	189,582,650	42,067,250	22.19
November	156,504,000	56,079,550	35.83
December	206,745,970	57,523,270	27.82
Total	1,293,195,632	536,314,605	41.47

Source: Production data (collectors) 2022.

Based on the results of research that has been carried out, it is known that the percentage value of Coral Trout production in 2022 at the PiSiSi Simeulue MPA is 41.47%. Based on Ministerial Decree No. 1 of 2023, the production value is obtained from multiplying the weight of Coral Trout times the price per kg of fish. Meanwhile, the percentage (%) of the PiSiSi MPA Production Value is obtained from the division between the PiSiSi MPA Production Value and the Simeulue Production Value and then multiplied by 100. The difference in fish size greatly influences the price of the fish itself, the higher the type of fish size, the higher the price [14]. Apart from that, variations in fish prices also often occur due to fish condition, collector purchasing prices and production costs which of course will influence the price of fish each month [15]. The production value of Coral Trout (*Plectropomus leopardus*) in Simeulue Regency in 2022 will reach IDR. 1,293,195,632 and the Production Value of the PiSiSi MPA is IDR. 536,314,605.

The highest production value of the PiSiSi MPA was obtained in April with a production value of IDR. 76,828,030. The high production value occurred because in April the PiSiSi

MPA area entered the west season so that fishermen's catches increased. This is in line with Kusnadi [16] During the western season (October to April) fishing activities by fishermen will increase. Meanwhile, the lowest production value of the PiSiSi MPA occurred in February, namely IDR 2,869,450. According to some collectors, this happens because there is a transition between the west and east seasons. The seasonal winds (eastern and western seasons) greatly determine the seeds of Coral Trout in nature, these two seasons influence current conditions, salinity, temperature, and nutrients contained. The spawning season for Coral Trout usually occurs in April and June and between January and September [1].

3.3 Size Grouping Based on Market Sorting

Observation results show that buyers in Simeulue group the Coral Trout (*Plectropomus leopardus*) in Simeulue Regency based on the weight size in 2022, with different weight sizes per fish. Based on the weight sorting of Coral Trout by buyers, it is grouped into four categories, namely Up, A, B and C in grams. The Up size category has a weight range of over 1000 grams/head, the A size category has a weight range of 500 - 1000 grams/individu, the B size category weighs 300 - 500 grams/head, the C size category weighs under 300 grams/head. The weight of Coral Trout in Simeulue Regency in 2022 can be seen in fig 3.

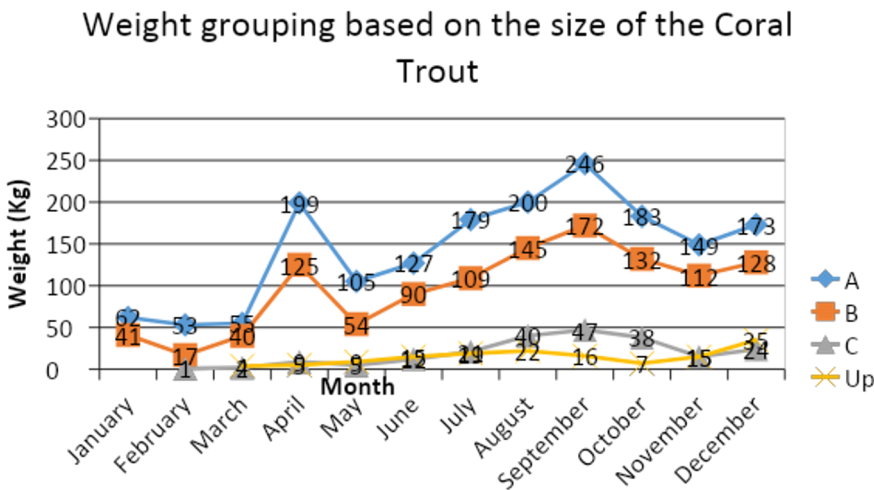


Fig 3. Size Grouping of Coral Trout (*Plectropomus leopardus*) in 2022.

The highest size grouping for Coral Trout in Simeulue Regency is in size group A with a total size weight reaching 1,731 kg/year. The highest catch of A-sized Coral Trout was in September, namely 246 kg. This is in line with Suwirya and Giri [17] in Jakarta. A weight of 500 grams for Coral Trout is a size that meets the requirements for local consumption or export. Apart from that, in Riau the distribution process for Coral Trout fish is carried out every day, especially for Coral Trout fish with a consumption size of 500-800 grams/fish, as well as for fish exported to Singapore or Hong Kong [18].

Meanwhile, the lowest fish catch was in size C (<300 grams/head), namely in February, it was 1 kg. The low catch of C size Coral Trout is caused by the C size fish being very small fish, ranging between 25-29 cm. This is also because many Simeulue district fishermen still use fishing gear, so that if they catch a C size fish they will be released again. This will also

minimize the number of small Coral Trout fish caught, thus avoiding indications of growth overfishing [19].

3.4 Fish Market Chain

It can be seen from the market chain for Coral Trout in Simeulue Regency that fishermen are starting to sell their catch of Coral Trout to buyers in the village and also to fish collectors in Sinabang, then grouper that are small in size and do not meet export quality requirements will be sold. sold to the people of Simeulue and Coral Trout fish that meet export standards will be distributed outside areas such as North Sumatra (Belawan), Jakarta and also exported to other countries. However, there are obstacles in this fish market chain, namely difficulties in processing interbank transactions, a lack of ice production during fish exports which causes the fish to no longer be fresh when it arrives at its destination, and also erratic ship schedules so that the delivery process cannot be carried out according to with the specified time.

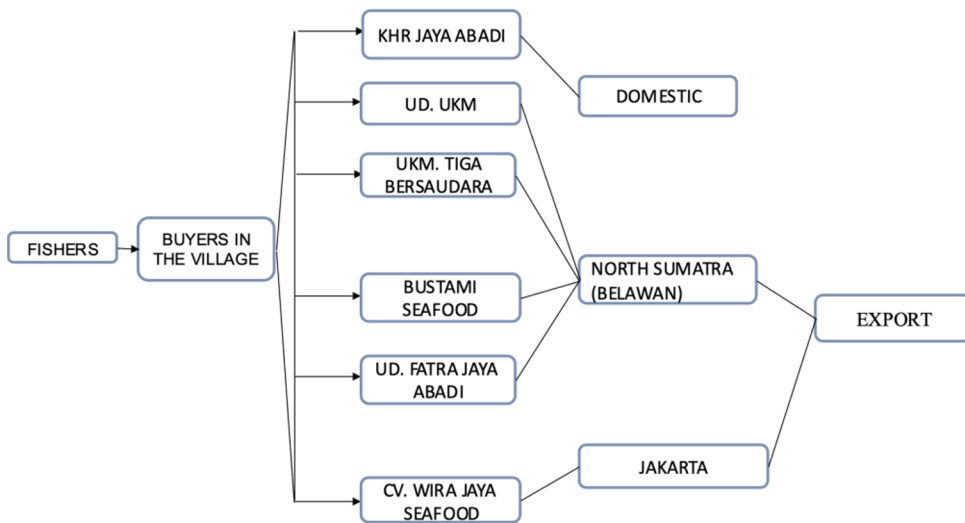


Fig 4. Market Chains for Coral Trout (*Plectropomus leopardus*) in Simeulue

The distribution and marketing process requires special treatment so that the quality and freshness of the fish can be maintained. This special treatment is one of the marketing functions which aims to increase the economic value of fish products, which can be done through increasing the efficiency of the marketing system in the context of coordination mechanisms for fish production, distribution, and consumption activities [20]. Based on the results of the questionnaire, in the marketing process there are several factors that must be taken into account, such as the grouping time according to the type and weight of fish, the storage time of the fish, marketing costs, and the ratio of ice to the number of Coral Trout in one storage fiber tub. For the length of fish storage, collectors usually store Coral Trout before shipping for ± 1 week with the ice ratio for each storage fiber tub ranging from 10-14 sticks of ice for 100-120 kg of Coral Trout. The costs incurred in the marketing process range from IDR. 600,000 - 60 million depending on the number of fish transported. The large marketing costs received are a result of the large costs incurred in marketing the production results, such as transportation and loading and unloading costs, cooling costs and other costs [21].

3.5 Quarantine Production Value in 2022

Based on observations on traffic data on the Coral Trout fishery at the Fisheries Quarantine Work area, it shows that in 2022 Simeulue Regency will have two types of commodities, namely Frozen Coral Trout and Live Coral Trout. The number of Coral Trout fish ranges from 3 - 2,808 kg with a commodity value of around IDR. 180,000 - IDR. 207,000,000. Data on Quarantine Production Values in Simeulue Regency in 2022 can be seen in table 2 below.

Table 2. Quarantine Production Value in 2022

No	Month	Commodity Name	Amount (kg)	Mark Commodities (IDR)	Average Price (IDR)
1	January	Frozen Coral Trout Fish	35	2,100,000	60,000
2	April	Frozen Coral Trout Fish	2,500	150,000,000	60,000
3	May	Frozen Coral Trout Fish	2,808	207,000,000	73,718
4	May	Live Coral Trout Fish	350	33,250,000	95,000
5	June	Frozen Coral Trout Fish	300	18,000,000	60,000
6	July	Frozen Coral Trout Fish	5	300,000	60,000
7	September	Frozen Coral Trout Fish	3	180,000	60,000
8	November	Live Coral Trout Fish	300	28,500,000	95,000

Source: Simeulue Fisheries Quarantine Work area Traffic Commodity Data 2022

Simeulue Fishery Quarantine Work Area Traffic acts as a sign that fishery products supplied outside the area are the result of Simeulue fishery production. This is also an effort to prevent the spread of fish diseases and control the quality and safety of fishery products in traffic [22].

The table presented above illustrates that the highest production output within the quarantine work area data occurred in May 2022, with a total of 2,808 kg, whereas the lowest production output was recorded in September 2022, only 3 kg.

4 Conclusion

It can be concluded that the Coral Trout supply chain in Simeulue Regency can be described as follows: fishermen start selling their catch of Coral Trout to buyers in the village and also fish collectors in Sinabang, then the Coral Trout will be sold to processing companies and exporters in Belawan, North Sumatra, Jakarta, and then exported abroad. The results showed that there were differences in the value of Coral Trout production for each buyer in Simeulue Regency. The total production value generated by buyers (collectors) was IDR 1,293,195,632 with a total weight of 10.23 tons. The contribution of PiSiSi MPA to the production value of Coral Trout in Simeulue Regency was 41.47%. This indicates that the existence of conservation areas is very important to maintain the sustainability of sun grouper stocks that will provide fisheries and economic benefits in Simeulue Regency.

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