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Production dynamics and the economic value of sustainable tuna (*Thunnus sp.*) fisheries management in North Maluku Province, Indonesia

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ABSTRACT

The tuna fishery is one of the capture fisheries subsectors with high economic value and plays a vital role in supporting the economy of coastal communities in North Maluku Province. IFMA 715, which encompasses the Maluku Sea, the Halmahera Sea, Tomini Bay, and the Seram Sea, is one of Indonesia's potential tuna-producing regions. This study aims to analyze the production dynamics and economic value of tuna fisheries in North Maluku Province, IFMA 715, as a basis for supporting sustainable fisheries management. This study employs a quantitative approach using descriptive methods based on secondary data from the Ministry of Marine Affairs and Fisheries, scientific publications, and relevant literature. The results showed that tuna production in North Maluku Province fluctuated during 2020–2024, with the highest production recorded in 2021 (54,637.76 tons) and the lowest in 2022 (18,940.87 tons). 2021 at 54,637.76 tons, and the lowest in 2022 at 18,940.87 tons. The economic value of tuna production reached its highest level in 2021 at Rp 1,213,290 million. The dominant tuna species caught were yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*). Fluctuations in tuna production and economic value are influenced by oceanographic conditions, fishing seasons, fishing effort, fishing gear, the size of the fishing fleet, market demand, and Illegal, Unreported, and Unregulated Fishing (IUU Fishing) activities. The required management strategies include controlling fishing effort, spatially based management of fishing areas, monitoring minimum catch sizes, and strengthening surveillance of illegal fishing to ensure the sustainability of tuna resources in IFMA 715.

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Introduction

The tuna (*Thunnus* sp.) fishery in the Indonesian Fisheries Management Area (IFMA) 715 holds significant economic potential as it serves as a fishing ground for yellowfin tuna, bigeye tuna, and skipjack tuna. Tuna and skipjack fisheries in Indonesia are characterized by both industrial and artisanal operations (Firdaus, 2018). High market demand has driven a continuous increase in tuna fishing activities, providing economic benefits to fishermen, creating jobs, and boosting national foreign exchange earnings. However, increased fishing also raises issues such as overfishing, the use of environmentally harmful fishing gear, and illegal fishing. Therefore, sustainable fisheries management is necessary through monitoring and regulation of catch quotas to ensure tuna resources remain sustainable in the long term (Tambunan, 2021).

The economic potential of the tuna industry in North Maluku Province is immense, as the region boasts abundant pelagic fish resources and is one of Indonesia's leading tuna-producing areas. Tuna is widely exported to countries such as Japan, the United States, and South Korea, thereby contributing to regional revenue and national foreign exchange earnings. Additionally, the tuna fishing sector creates employment opportunities for fishermen, the fish processing industry, and export-related activities. High tuna production has a positive impact on the socioeconomic conditions of coastal communities in North Maluku. Fishermen's incomes are rising, fisheries business opportunities are expanding, and investment in the marine sector is increasing. However, several challenges remain, such as limited cold-chain facilities, inadequate port infrastructure, and suboptimal fisheries management. If managed sustainably, the economic potential of tuna in North Maluku can continue to grow and improve the well-being of coastal communities (Tsalitsa *et al.*, 2025). Bioeconomic modeling of the

tuna fishery requires the implementation of sustainable management using MSY, MEY, and open-access scenarios. The MEY scenario provides the optimal balance between economic benefits and stock sustainability (Kadir *et al.*, 2025).

Fluctuations in tuna production in IFMA 715 are influenced by the fishing season, oceanographic conditions, the size of the fishing fleet, fishing gear, and market demand. The fishing gear used can be grouped into six types: tuna longline, drift longline other than tuna longline, set longline, skipjack pole and line, troll line, and other pole and line (Firdaus, 2018). In some periods, tuna production increases due to high fishing activity and export demand; however, at certain times, production may also decline due to bad weather, seasonal changes, and declining fish stocks. These fluctuations in production directly impact the income of fishermen and fisheries businesses. When catch volumes increase, fishermen's income tends to rise, whereas when production declines, income decreases accordingly. Additionally, unstable tuna prices in the export market also affect the profit margins of coastal communities that depend on the tuna fishing sector. Therefore, sound fisheries management is necessary to ensure that tuna production remains stable and provides sustainable economic benefits for communities in IFMA 715 (Riadi *et al.*, 2024).

Changes in tuna production volumes have a direct impact on fishermen's incomes and the economic value of the tuna fishing sector in North Maluku Province. Therefore, this study focuses on examining the state of tuna production in IFMA 715 and how fluctuations in tuna production affect the income or economic value of the tuna fishing sector from year to year. The objective of this study is to analyze the production conditions and economic value of the tuna fishing sector in North Maluku Province.

Tuna resources in IFMA 715 have strategic importance not only from an ecological perspective but also from an economic standpoint. This fisheries management area is recognized as one of Indonesia's major fishing grounds for large pelagic species, particularly yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*). The availability and distribution of tuna resources are strongly influenced by oceanographic factors such as sea surface temperature, chlorophyll-a concentration, and ocean currents, which affect fish migration patterns and catch productivity. Previous studies have demonstrated that variations in these environmental parameters can significantly influence tuna catch rates and fishing success in Indonesian waters (Wiryawan et al., 2020). Therefore, understanding production dynamics is essential for supporting sustainable fisheries management and maintaining the long-term utilization of tuna resources.

Sustainable management of tuna fisheries has become an increasingly important issue due to the growing exploitation of tuna resources in Indonesian waters. As one of the world's leading tuna-producing countries, Indonesia faces challenges in balancing economic benefits with resource sustainability. Excessive fishing pressure may lead to stock depletion, reduced catch productivity, and declining economic returns for fishing communities. Therefore, fisheries management approaches that integrate biological, ecological, and economic considerations are essential to ensure the long-term sustainability of tuna resources (Budy et al., 2020). Effective management measures, including fishing effort control, monitoring of catch size, and strengthening surveillance against Illegal, Unreported, and Unregulated (IUU) Fishing, are necessary to maintain the sustainability of tuna stocks and fisheries-dependent livelihoods.

In addition, environmental variability can influence tuna distribution

and catch productivity. Oceanographic parameters such as sea surface temperature, chlorophyll-a concentration, and ocean currents are important factors affecting tuna migration patterns and fishing success. reported that fluctuations in sea surface temperature and chlorophyll-a concentration significantly affect yellowfin tuna catch rates in Indonesian waters. Therefore, understanding production dynamics and economic value is essential for providing scientific information that supports sustainable fisheries management and policy development in IFMA 715 (Stacey et al., 2021).

The contribution of tuna fisheries extends beyond fish production and export revenue, as it also plays a vital role in supporting food security and coastal livelihoods. In North Maluku Province, many coastal communities depend directly or indirectly on tuna fisheries through fishing activities, fish processing, transportation, and marketing. Consequently, fluctuations in tuna production may have significant socio-economic implications for local communities. Understanding the relationship between production dynamics and economic value is therefore essential for developing effective fisheries management policies that promote both resource sustainability and community welfare. Furthermore, information on production trends can provide a scientific basis for evaluating the effectiveness of existing fisheries management measures and identifying future management priorities (Munir & Misbah, 2025).

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production conditions and economic value of the tuna fishing sector in North Maluku Province.

Methodology

Time and Location

This study was conducted from April to May 2025 using secondary data obtained from the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia. The study focused on North Maluku Province within the Indonesian Fisheries Management Area (IFMA) 715. The area was selected because it is one of Indonesia's major fishing grounds for tuna and other large pelagic species, contributing significantly to regional fisheries production. Therefore, IFMA 715 was considered an appropriate location for analyzing tuna production and its economic value.

Tools and Materials

The tools used in this study included a laptop equipped with Microsoft Excel and statistical data processing software to facilitate data organization, tabulation, calculation, analysis, and visualization. Microsoft Excel was used to compile and process annual tuna production and economic value data, perform descriptive statistical analyses, and generate tables and figures that support the interpretation of research findings. The materials used in this study consisted of secondary data obtained from the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia. The data included annual statistics on tuna production and fisheries economic value in North Maluku Province within IFMA 715 during the study period. Additional supporting information was collected from national and international scientific journals, research articles, government reports, and other relevant literature related to tuna fisheries, fisheries economics, and sustainable fisheries management. These secondary data sources were used to provide comprehensive

information regarding tuna production dynamics and their economic contribution in North Maluku Province. The combination of statistical data and supporting literature enabled a more comprehensive analysis of trends in tuna production and economic value, as well as the factors influencing their fluctuations over time.

The research method employed is a quantitative descriptive method using a literature review approach and secondary data analysis. This method was used to systematically describe the dynamics of tuna production and changes in the economic value of the tuna fishery in North Maluku Province IFMA 715 based on data collected during the study period. Analysis of tuna production and economic value data was used to describe the status of tuna resource utilization and the development of catch yields in a specific marine area (Primyastanto *et al.*, 2021).

The research data consists of annual tuna production data and the economic value of the tuna fishery in North Maluku Province IFMA 715 for the years 2020–2024. Data collection was conducted through documentation and literature review from various sources, such as capture fishery statistical reports, scientific journals, government publications, and research articles related to tuna resources. The research stages began with the collection of tuna production data and the economic value of the tuna fishery based on the year of the study. The data obtained were then tabulated and analyzed to identify patterns of fluctuations in tuna production, trends in economic value, and the status of tuna resource utilization in the study area. According to (Wiryawan *et al.*, 2020), Changes in tuna catch are influenced by oceanographic conditions such as sea surface temperature and chlorophyll-a concentration, which are directly linked to the distribution of tuna in Indonesian waters.

Data Analysis

The analysis results are presented in tables and graphs to facilitate the interpretation of the research findings and to identify patterns of fluctuation in tuna production in North Maluku Province IFMA 715. Additionally, the percentage change in tuna production and economic value was calculated annually to determine the extent of increases or decreases in production during the study period. The percentage change is calculated by comparing the difference in production value or economic value in a given year to the previous year, then multiplying by 100%. This calculation is used to more clearly understand the dynamics of tuna production development from year to year.

The economic value of tuna is calculated by multiplying the total annual tuna production by the average price of tuna per kilogram in the same year. The results of the analysis are then described in a descriptive manner to identify the relationship between changes in tuna production and increases or decreases in the

economic value of the tuna fishing sector. The quantitative descriptive analysis approach is considered effective in explaining the dynamics of tuna resources and the development of tuna catch yields in Indonesia (Primyastanto *et al.*, 2021).

Results and Discussion

Tuna Production

Based on tuna production data obtained from publications on capture fisheries statistics, tuna production and economic value in North Maluku Province IFMA 715 during the 2020–2024 period showed a fluctuating pattern. These changes in production also affected the economic value or annual revenue from the tuna fishery. The dominant species caught by fishermen during the fishing season were yellowfin tuna (*Thunnus albacares*) and big-eyed tuna (*Thunnus obesus*) (Riadi *et al.*, 2024). Production data and the economic value of tuna in IFMA 715 are shown in Table 1.

Table 1. Tuna Production in North Maluku Province IFMA 715 for the Years 2020–2024

Year	Province	Fish Group	Volume (Ton)
2020	North Maluku	Tuna	34,556.98
2021	North Maluku	Tuna	54,637.76
2022	North Maluku	Tuna	18,940.87
2023	North Maluku	Tuna	44,916.95
2024	North Maluku	Tuna	50,671.84

Source: (MMAF, 2025), processed by the author

In 2020, tuna production volume in North Maluku Province IFMA 715 was recorded at 34,556.98 tons. This production then saw a significant increase in 2021, reaching 54,637.76 tons. This increase in production indicates rising tuna fishing activity as well as high market demand for tuna. Additionally, oceanographic conditions such as sea surface temperature and water productivity are believed to have contributed to the increased tuna catch during that period. The IFMA 715 region is indeed known as one of Indonesia's key

areas for the production of large pelagic fish (Riadi *et al.*, 2024).

However, in 2022, tuna production saw a very significant decline to 18,940.87 tons. This decline is believed to be influenced by changes in the fishing season, weather conditions, and high pressure from the exploitation of tuna resources. Tuna are large pelagic fish with high migratory tendencies, so their presence is greatly influenced by changes in oceanographic conditions. The high level of tuna exploitation in IFMA 715 may also lead to

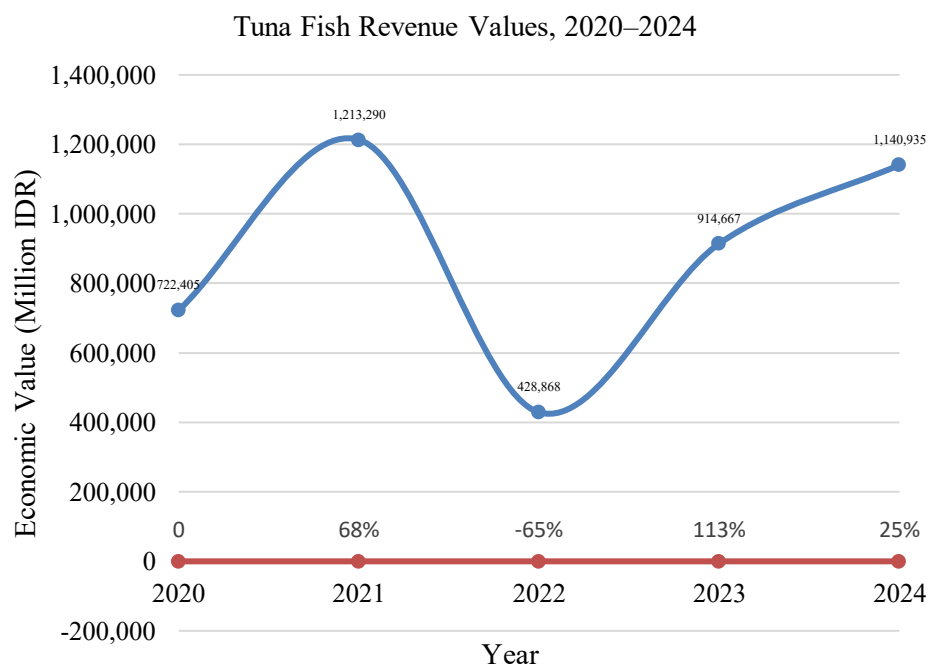
a decline in fish biomass in certain fishing areas (Kadir et al., 2025).

In 2023, tuna production rose again to 44,916.95 tons. This increase indicates a recovery in tuna catches following the decline in the previous year. Furthermore, in 2024, tuna production increased again to 50,671.84 tons. This indicates that the tuna potential in North Maluku Province (IFMA 715) remains substantial, and tuna fishing activity has resumed its upward trend toward the end of the study period. Overall, the trend in tuna production in North Maluku Province (IFMA 715) during 2020–2024 shows unstable or fluctuating conditions. 2021 was the year with the highest production, while 2022 was the year with the lowest production during the study period. These production fluctuations indicate that tuna resources are highly

influenced by environmental factors and the level of fish resource utilization.

Revenue and Percentage Fluctuations in Tuna Production

The economic value or revenue from tuna production in North Maluku Province (IFMA 715) follows a pattern consistent with production volume. The fluctuating pattern of the economic value of tuna in North Maluku Province (IFMA 715) for the years 2020–2024 is shown in Figure 1. As tuna production volume increases, so does the resulting economic value. Tuna is a high-value fishery commodity due to its significant export demand, particularly for the markets of Japan, the United States, and other Asian countries.



Source: (MMAF, 2025), processed by the author

Figure 1. Fluctuating Pattern of Tuna Fish Economic Value in 2020-2024

In 2020, the economic value of tuna production in North Maluku Province IFMA 715 was recorded at Rp 722,405 million. This figure then increased in 2021 to Rp 1,213,290 million in line with the rise in tuna production volume that year. Based on calculations, the percentage increase in tuna production in 2021 reached approximately 68% compared to the previous year. This significant increase indicates that tuna fishing activities in 2021 were quite optimal.

However, in 2022, the economic value of tuna declined to Rp 428,868 million. This decline in economic value aligns with the decrease in tuna production volume during the same year. The percentage change in tuna production in 2022 saw a decrease of approximately -65% compared to 2021. This decline indicates a significant drop in catch yields, which directly impacted the revenue of the tuna fishing sector in North Maluku.

In 2023, the economic value of tuna in North Maluku Province (IFMA 715) increased again to Rp 914,667 million, with a production increase of approximately 113% compared to the previous year. This increase indicates a recovery in production and an improvement in tuna catch yields following the decline in 2022. Furthermore, in 2024, the economic value of tuna increased again to Rp 1,140,935 million, with a production increase of approximately 25% compared to 2023.

The high economic value of tuna indicates that this commodity plays a crucial role in boosting the income of coastal communities and the capture fisheries sector in North Maluku. An economic analysis of large pelagic fish in IFMA 715 reveals that this region offers significant economic benefits and makes a substantial contribution to the national fisheries economy (Riadi *et al.*, 2024). However, increases in tuna production and revenue must also be balanced with

sustainable resource management. High fishing pressure without proper regulation could lead to a decline in tuna stocks in the future. A bioeconomic study of yellowfin tuna in IFMA 715 indicates that tuna exploitation levels are approaching the fully exploited threshold, necessitating more effective management strategies to ensure the sustainability of tuna resources (Kadir *et al.*, 2025a).

Although tuna remains a wild-caught fishery commodity, future management holds great potential for aquaculture. The Ministry of Marine Affairs and Fisheries of the Republic of Indonesia continues to promote the adoption of tuna farming technology. This initiative is a strategic step toward ensuring the sustainability of fish stocks, meeting high global market demand, and boosting the local fishing economy. This can complement the capture fisheries sector, which has long been the mainstay. Hydro-oceanographic parameters that significantly influence marine aquaculture include water current velocity, bathymetry, substrate, the protection of the water area, temperature, and dissolved oxygen (DO) levels in the water (Adibrata *et al.*, 2023)

Fluctuations in tuna production and economic value are influenced not only by oceanographic conditions but also by the fishing season, fishing effort, fishing gear, the size of the fishing fleet, market demand, and Illegal, Unreported, and Unregulated Fishing (IUU Fishing) activities. The necessary management strategies include controlling fishing effort, spatially based management of fishing areas, monitoring minimum catch sizes, and strengthening surveillance of illegal fishing to ensure the sustainability of tuna resources in North Maluku Province, IFMA 715.

Conclusion

Based on the research findings, tuna production in North Maluku Province (IFMA 715) during the 2020–

2024 period experienced significant fluctuations. The highest production occurred in 2021 at 54,637.76 tons, with an economic value of Rp 1,213,290 million. The high production and revenue in that year were influenced by increased fishing activity and high market demand for tuna. Conversely, the lowest production occurred in 2022 at 18,940.87 tons, causing the economic value of the tuna fishery to decline as well. The decline in production from 2021 to 2022 reached approximately 65.3%, thereby impacting the decline in fishermen's income and the tuna fisheries sector in North Maluku. Fluctuations in tuna production are influenced by oceanographic conditions, fishing seasons, and the intensity of tuna fishing in the waters of IFMA 715. Therefore, sustainable tuna fisheries management is necessary to ensure that tuna production and economic value remain stable and can improve the welfare of coastal communities.

References

- Adibrata, S., Pamungkas, A., Priyambada, A., Wahidin, L. O., & Hidayat, S. I. (2023). The Environmental Parameters Suitability For Multispecies-Based Mariculture In Pongok Island Waters, Bangka Belitung. *Indonesian Aquaculture Journal*, 18(2), 133–145.
- Firdaus, M. (2018). The Profile Of Tuna And Cakalang Fishery In Indonesia. *Marine Fisheries Socio-Economic Bulletin (Marina)*, 4(1), 23–34. <https://doi.org/10.15578/Marina.V4i1.7328>
- Kadir, I. A., Rumagia, F., & Wulandari, T. L. (2025). Evaluating The Sustainability Of Yellowfin Tuna Fishery In Wpp-715, North Maluku: A Bioeconomic Modeling Approach. *Amanisal: Journal Of Technology And Management Of Capture Fisheries*, 14(2), 89–100. <https://doi.org/10.30598/Amanisal.V14i2.22930>
- Ministry of Marine Affairs And Fisheries Of The Republic Of Indonesia (MMAF). (2025). *Fish Production Statistics Summary*. <https://portaldata.kkp.go.id/Portals/Data-Statistik/Produk/Ikan/Summary>
- Munir, M., & Misbah, A. (2025). Sustainability Analysis Of Skipjack Tuna Catch Based On Multidimensional Scaling (Mds) In The Coastal Area Of Pasuruan Regency. *Agromix*, 16(1), 155–167.
- Primyastanto, M., Lestariadi, R. A., & Haris, A. K. (2021). Sustainable Operational Analysis Of The Cultivation Of Indonesian *Thunnus Albacares* Using A Bioeconomic Approach. *Croatian Journal Of Fisheries*, 79(2), 61–70. <https://doi.org/10.2478/Cjf-2021-0007>
- Riadi, S., Susanti, A., & Arkham, M. N. (2024). Economic Analysis Of Big Pelagic Fisheries Management In IFMA 715. *Journal Of Tropical Marine Science And Technology*, 16(1), 37–46.
- Stacey, N., Gibson, E., Loneragan, N. R., Warren, C., Wiryawan, B., Adhuri, D. S., Steenbergen, D. J., & Fitriana, R. (2021). Developing Sustainable Small-Scale Fisheries Livelihoods In Indonesia: Trends, Enabling And Constraining Factors, And Future Opportunities. *Marine Policy*, 132, 104654. <https://doi.org/10.1016/J.Marpol.2021.104654>
- Tambunan, N. Y. (2021). The Role Of Fisheries Management Institutions (Lpp) In Tuna Fisheries In Indonesia. *Jisip (Jurnal Ilmu Sosial Dan Pendidikan)*, 5(2). <https://doi.org/10.58258/Jisip.V5i2.1966>
- Tsalitsa, M. S., Kinanti, M. F. A., Annajmi, S. F., & Yulda, Y. (2025).

- The Connection Between Tuna Production In North Maluku And The Socio-Economic Conditions Of Its Community Through Swot Analysis. *Jurnal Pendidikan Perikanan Kelautan*, 5(1), 1–18.
- Wiryawan, B., Loneragan, N. R., Mardhiah, U., Kleinertz, S., Wahyuningrum, P. I., Pingkan, J., Wildan, Timur, P. S., Duggan, D., & Yulianto, I. (2020). Catch Per Unit Effort Dynamics Of Yellowfin Tuna Related To Sea Surface Temperature And Chlorophyll In Southern Indonesia. *Fishes*, 5(3), Article 28. <https://doi.org/10.3390/Fishes5030028>