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Marine Ecological Analysis: Composition and Catch Diversity of Mini Purse Seine Fisheries in the Coastal Ecosystem of Jepara, Central Java

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Abstract

Ujungbatu Fish Auction Site is a coastal fisheries centre in Jepara Regency. The operation of mini purse seine contributes the most to fishery production than other fishing gears. Mini purse seines in Jepara Regency target small pelagic fish. Mini purse seine fisheries in Jepara are multi-species and operating one day fishing. The study aims to analyze the diversity of mini purse seine catches in Jepara coastal waters. Data collection was based on secondary data in the form of mini purse seine fisheries production data from Fish Auction Site Office. The data calculate to get the catch composition, Shannon-Wiener diversity index and Simpson's dominance index. Additionally, one-way ANOVA analysis used to determine the significant differences in species proportions. The results identified five fish species, namely Mackerel Tuna (*Euthynnus affinis*), Indian Mackerel (*Rastrelliger sp*), Scads (*Decapterus sp*.), Squids (*Loligo sp*.), and Narrow-barred Spanish Mackerel (*Scomberomorus sp*.), with the highest catch was Indian Mackerel (26.40%). The one-way ANOVA show that there is no significant difference between the types of catches in each year. The diversity index was moderate (H=1.56), and the dominance index was low (C=0.22). This reflects a stable ecosystem with an even distribution of species and no significantly dominating species.

1. Introduction

Jepara is a coastal area in northern Central Java (*Pantura*), bordering Kudus and Demak Regencies. This condition affects the demographics of the Jepara community, especially in the profession of society. A significant portion of Jepara's population works as fishermen, operating in its coastal waters (Hertanto, 2013). Jepara Regency has eleven Fish Auction Sites that spread throughout the administrative area of Jepara Regency (Marine and Fisheries Service of Jepara, 2024).

Ujungbatu Fish Auction Site is a major coastal fisheries center in Jepara Regency and one of the most active fish auction sites in the region with a diversity of fishing gears including trawl, mini purse seine, gill net, lift net, line fishing and traps (Imron *et al*., 2021; Wijayanti *et al*., 2024). Ujungbatu Fish Auction Site contributes the most to fisheries production in Jepara Regency, with mini purse seines being the primary fishing gear. Mini purse seines in Jepara primarily target small pelagic fish (Pujianto *et al*., 2013; Marine and Fisheries Service of Jepara Regency, 2024; Statistic Centre of Jepara Regency, 2024). The centre of purse seine fisheries in Jepara is located at Ujungbatu and Jobokuto Villages using vessels < 30 GT and a day fishing operation (Wijayanti *et al*., 2021). Among the different fishing gears operating in Jepara, mini purse seines play a dominant role in the local fisheries economy. However, their impact on fish stock composition and seasonal catch variations remains underexplored.

The mini purse seine fisheries in Jepara are multi-species, this fishing gear can catch many types of fish by being classified into main catch and bycatch. Catch composition in mini purse seine fisheries varies by season, water conditions, and operational factors (Fauzany *et al*., 2024). Understanding these variations is essential for developing sustainable fisheries management strategies (Khoerunnisa *et al*., 2024). Despite the significance of mini

purse seine fisheries in Jepara, there is limited data on their species composition and seasonal variations. Understanding these factors is essential for implementing effective fisheries management strategies and ensuring long-term sustainability. Sustainable fisheries management is crucial in Jepara, where increasing fishing pressure and environmental variability may impact fish stocks. Assessing catch diversity can provide insights into ecosystem health and the resilience of fish populations in these waters. This study aims to analyze the composition and diversity of catches from mini purse seine fisheries for sustainable fisheries management policies solution in Jepara Regency.

2. Material and methods

2.1. Study Site

This study was conducted at the Ujungbatu Fish Auction Site, Jepara Regency (Fig 1). Secondary data on mini purse seine fisheries production were obtained from the Fish Auction Site Office and the Marine and Fisheries Department of Jepara. Data were collected from 2019 to 2023. A descriptive statistical approach was used to analyze the species composition of the catch, while biodiversity was assessed using the Shannon-Wiener diversity index. Data preprocessing was conducted to ensure completeness and accuracy before analysis. Catch composition differences across years were statistical analyzed using one-way ANOVA, was conducted using SPSS.

2.2 Catch Composition

Catch composition was calculated using the equation according to Susaniati *et al*. (2013) as follows:

$$pi = \frac{ni}{N} \text{ x } 100\%$$

Description:

pi : Catch composition (%)

ni : Sum of catches species at-i (kg)

N : Total catch (kg)

2.2 Diversity Index

The diversity index is used to provide information on the number of species populations using the Shannon-Wiener formula (Odum, 1993).

$$H' = -\sum_{i=1}^{s} pi \ln pi$$

Description:

H' : Diversity index

pi : Species proportion (Shannon-Wiener)

s : Sum of species

i = 1,2,3, … n

Criteria for diversity index based on Shannon-Wiener (Odum, 1993: Sambah *et al*. 2020)

- H' < 1 = low diversity
- 1<H'<3 = medium diversity
- H' > 3 = high diversity

2.3 Dominance Index

The Dominance Index was calculated using Simpson's dominance index formula (Odum, 1993).

$$C = \sum_{i=1}^{s} (\frac{ni}{N})^2$$

Description:

C : Dominance Simpson Index

ni : Sum of catches species at-i

N : Total catch

Criteria for diversity index based on Shannon-Wiener (Odum, 1993)

- 0 < C < 0,5 = low dominance (no dominating species)

0,5 < C < 1 = high dominance (dominating species)

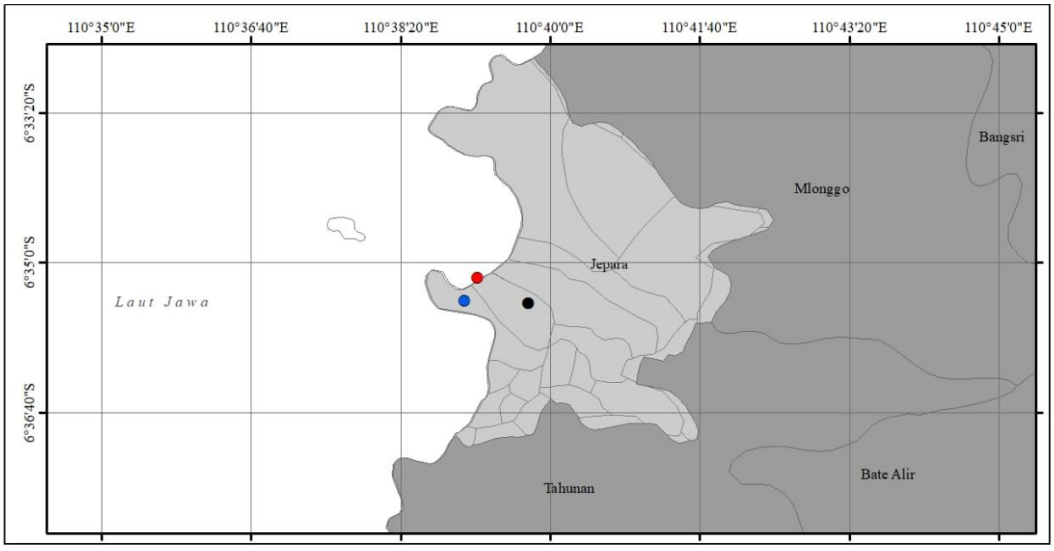

Figure 1. Research Location

3. Results

3.1 Production of Mini Purse Seine Fisheries

The mini purse seine uses 16-21 GT vessels with auxiliaries as lamps (lights). Ujungbatu Fish Auction Site is an active Fish Auction Site in Jepara Regency and a landing place for catches from mini purse seine operations. The fishing grounds are limited to the waters around Jepara with a daily trip system (one day fishing), which departs in the afternoon and returns the next day (Wijayanti *et al*., 2021). The catch of mini purse seine landed at Ujungbatu Fish Auction Site consists of various types of fish and are classified as pelagic fish. Catch composition differences across years were analyzed using one-way ANOVA and obtain p value (0.461) is higher than alpha 5% (p value > 0.05). This means there is no significant difference between the types of catches in each year (Figure 2).

3.2 Composition of Mini Purse Seine Catches

The catches composition of mini purse seine fishing gear operating in the northern coastal waters of Jepara and

landed at Ujungbatu Fish Auction Site, Jepara consists of 5 species. The catch composition is based on data recorded by the authorized institution, locally called UPTD Ujungbatu Fish Auction Site, Jepara. The catch consists of main catch and by catch (Figure 3). Identify the species of fishes based on UPTD Ujungbatu reports Fish Auction Site, Jepara. Mini purse seine fishing gear operated in the northern waters of Central Java is able to catch several types of fish, including Mackerel Tuna (*Euthynnus affinis*), Indian Mackerel (*Rastrelliger sp*.), Scads (*Decapterus sp*.), squid (*Loligo sp*.), Narrow-barred Spanish Mackerel (*Scomberomorus sp*.).

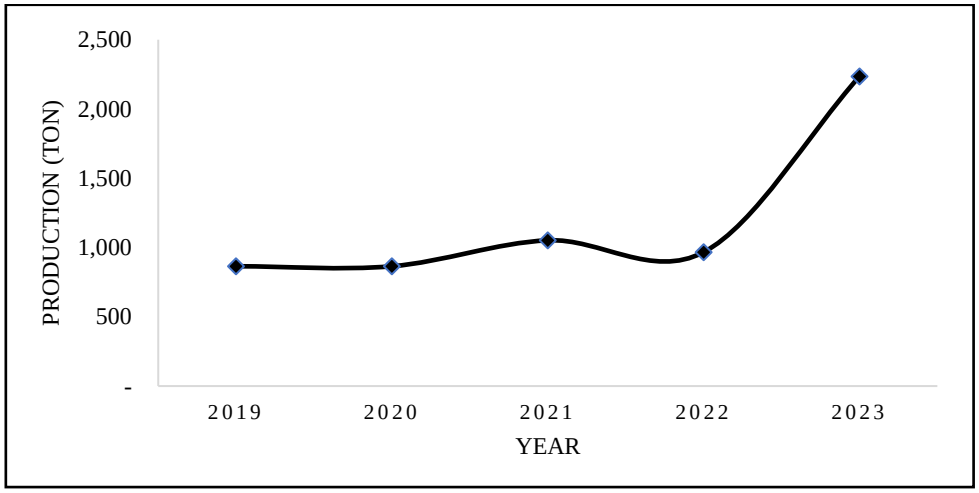

Figure 2. Production Tren of Mini Purse Seine at Ujungbatu Fish Auction Site, Jepara

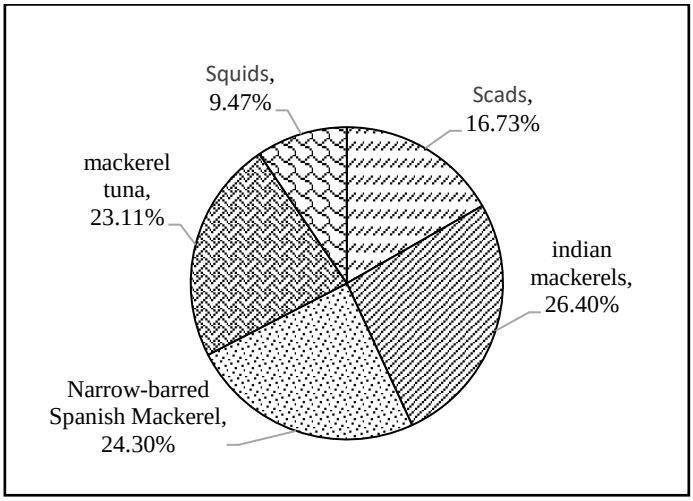

Figure 3. Composition of Mini Purse Seine Catch at Ujungbatu Fish Auction Site, Jepara

3.3 Diversity of Mini Purse Seine Catches

The diversity obtained from the fishing activities in the north coastal waters of Central Java with mini purse seine has various indices and categories. It divided into two indices namely diversity index (H') and dominance index (C) presented in Table 1.

Table 1. Diversity and Dominance Index of Mini Purse Seine Jepara

Description	Hipotesa	Result
Diversity Index		
• H’ < 1	Low Diversity	
• 1 < H’ < 3	Medium Diversity	H’ = 1.56
• H’ > 3	High Diversity	
Dominance Index		
• 0 < C < 0.5	Low Dominance	C = 0.22
• 0.5 < C < 1	High Dominance	

The results of the diversity index analysis (H') in the catch using mini purse seine in Jepara Waters showed a value of 1.56. The value of the diversity index with a range of 1-3 calculated from the Shannon-Wiener equation is classified as a relatively moderate diversity criterion (medium diversity) (Rahayu *et al*., 2023). This indicates a balanced presence of multiple species without a single species dominating. According to Saipul *et al*. (2024) more significant amount of species and individuals variation per species, then higher the diversity index, and vice versa.

4. Discussion

Mini purse seine production in Jepara has fluctuated in the last five years (2019-2023). In 2023, production reached its lowest level compared to previous years. This condition can be influenced by the fishing season, the number of fishing gear operating and the amount of fish weight from the composition of the catch obtained. In addition to small pelagic fish species in the form of Scads and Indian Mackerels, mini purse seine fishing gear is also capable of catching pelagic fish like Mackerel Tuna and Narrow-barred Spanish Mackerel. Sinthia *et al*. (2023) stated that purse seine one day fishing with a mesh size of 1 inch can catch Indian Mackerels, Scads, Mackerels Tuna and Narrow-barred Spanish Mackerel. Factors that affecting productivity fluctuations are highly dynamic natural conditions (Fatoni *et al*., 2017) and increased competition between fishing gears (Wiyono and Hufiadi, 2014).

The main catch is Indian Mackerel and Scads, while the by-catch is Squid, Mackerels Tuna and Narrow-barred Spanish Mackerel (Wijayanti *et al*., 2021; Fauzany *et al*., 2024). Indian Mackerel was the most common fish species caught by mini purse seine gear in Jepara in 2019-2023 with 26.40% of all fish species caught. This condition is in line with the research results of Azlhimsyah *et al*. (2016) and Pramudya *et al*. (2024) which states that Indian Mackerels (*Rastrelliger sp*.) is the main target in pelagic fishing gear using purse seine. Wijayanti *et al*. (2021) added that the production of small pelagic fisheries from mini purse seine fishing gear in Jepara in 2015-2019 was dominated by mackerel and followed by Scads and Squids. In addition, the catches in the form of Narrow-barred Spanish Mackerel (24.30%) and Mackerel Tuna (23.11%) were quite prominent in the last five years (2019-2023).

The catch of mini purse seine is a type of fish that has substantial economic value. Indian mackerel has the highest selling price at IDR 17,147/kg. While Mackerel Tuna and squid are respectively worth IDR 55,411/kg and IDR 36,682/kg. Meanwhile, Narrow-barred Spanish Mackerel (IDR 19,512) and Scads (IDR 12,637) / kg are caught with lower selling values than others. The catch has a high selling value and can provide income to mini purse seine fishermen (Marine and Fisheries Service of Jepara Regency, 2023).

The medium category of the diversity index indicates that no species has low or high diversity. A high diversity index value is influenced by all individuals of different genus or species. Conversely, a low-value diversity index can occur when all individuals of the same genus or species, the number of individuals is quite balanced (Febrian *et al*., 2022).

The dominance index (C) in the catch shows a value of 0.22 which indicates that the dominance of species in these waters is low. This suggests that there is no particular species that dominates significantly in the catch. The relationship between diversity index (H') and dominance index (C) shows an inverse relationship. when the value of H' is high, the value of C tends to be low, and vice versa. This is following the results of the study, where the diversity index is high, still dominance value tends to be low, indicating that the ecosystem conditions are relatively stable and there are no species that dominate to the extreme (Wahyuni *et al*. 2022).

The composition and diversity of mini purse seine catches in Jepara can be important information for sustainable fisheries management. A relatively stable marine ecosystem indicates that an ecosystem condition in which various species live in a reasonably good balance, without one or more species that excessively control the ecosystem. Sustainable fishing practices reduce overfishing and stabilize marine species diversity. Sustainable management of marine ecosystems is essential to ensure stable and diverse catches in the long term.

5. Conclusions

The mini purse seine fishery in Jepara caught five pelagic fish species from 2019 to 2023, with Indian Mackerel (*Rastrelliger sp.*) as the dominant species (26.40%). The diversity index (H' = 1.56) indicated moderate diversity, while the dominance index (C = 0.22) suggested low species dominance. These findings reflect an even species distribution and a relatively balanced ecosystem, which supports the sustainability of mini purse seine fisheries in Jepara.

Ethics approval

No permits were required.

Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Author contributions

SOW is responsible for data curation, conceptualization, project administration, funding acquisition, writing – review & editing. FA and DNR are contributed to investigation, resource acquisition, methodology, formal analysis and writing the original draft.

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Declaration of competing Interest

None

References

Azlhimsyah, R.P. Sunarto. I. Nurrahwati. 2016. Selectivity of Purse Seine Fishing Gear at Muara Angke Jepara Fish Landing Base. *Jurnal Perikanan Kelautan*. 7(2): 97-102.

Fatoni, M.I., Hanani, N., Suhartini. 2017. Technical = Efficiency of Mini Purse Seine Fishing Unit in Sumenep. *HABITAT*. 28(1): 1-6. https://doi.org/10.21776/ub.habitat.2017.028.1.1

Fauzany M., Isnaini, N., Ningsih, E.N. 2024. Diversity of Main Catch And Bycatch in Mini Purse Seine Fishing Operation in Lempasing Waters, Lampung. *Maspari Journal*. 1692: 74-84. https://doi.org/10.56064/maspari.v16i2.45

Febrian, I., Nursaadah, E., Karyadi, B. 2022. Analysis of Diversity Index, Diversity, and Dominance of Fish in Aur Lemau River, Central Bengkulu Regency. *Bioscientist: Jurnal Ilmiah Biologi*. 10(2):600. https://doi:10.33394/bioscientist.v10i2.5056.

Hertanto, S., Kushandayani, P., Astuti, Windiani, R. 2013. The Role of Local Government in Management of Fish Auction Sites in Jepara Regency Jepara. *Jurnal Ilmu Pemerintah*, 2(2): 411-425.

Imron, M., Wijayanti, S.O. & Wiyono, E.S. 2021. Dominant Commodities and Productivity Purse Seine Based at

the Ujungbatu Fish Auction Place, Jepara District. *Marine Fisheries*. 11 (1): 49-60.

Khoerunnisa, N., Wijayanti, L.A.S., Pratama, G.B., Darojat, H.D. 2024. Composition and Diversity of Line Catches in Panggang Island, Thousand Islands, DKI Jakarta. *Jurnal Ilmu Kelautan dan Perikanan Papua*. 7 (2): 23-29. https://doi.org/10.31957//acr.v7i2.4192.

Marine and Fisheries Service of Jepara Regency. (2023). Fisheries Production Report of Ujungbatu Fish Auction Site 2019-2023 period. Jepara

Marine and Fisheries Service of Jepara Regency. (2024). Marine and Fisheries Sector Profile Book of Jepara Regency 2023 period. Jepara.

Odum, E.P., Samingan, T., Srigandono, B. 1993. Dasar-Dasar Ekologi = Fundamentals of Ecology, third ed. Gadjah Mada University Press, Yogyakarta.

Pramudya H., Leto, W., Sitanggang. 2024. Construction and Operational Techniques of Purse Seine on KMN. Sang Enggon-II in Mayangan Port, Probolinggo District, East Java. *Mantis Journal of Fisheries*. 1 (2): 102-109. https://doi.org/10.22437/mjf.v1i02.38660.

Pujianto, Boesono, H., Wijayanto, D. 2013. Business Feasibility Analysis of Financial Aspects Mini Purse Seine Fishing with Different Net Sizes Different Net Sizes at Ujungbatu Fish Auction Place, Jepara Regency. *Journal of Fisheries Resources UtilizationManagement and Technology*, 2(2): 124 133.

Rahayu, M., Rizal, M., Hafinuddin, H., Bahri, S., Khairi, I., Fuadi, A., Zakaria, M., Sarong, M. A. 2023. Catch Diversity Index Analysis of Local Resource-Based Fads in Kuala Daya Waters, Aceh Jaya Regency. *Jurnal Sumberdaya Akuatik Indopasifik*. 7(2):175 190. https://doi.org/10.46252/jsai-fpik-unipa.2023.vol.7.no.2.303.

Saipul, S., Ningsih, A., Ngabito, M., Auliyah, N., Apriliani, I. M. 2024. Abundance and Diversity of Fish Caught in Biau River Estuary, North Gorontalo District. Gorontalo. *Fisheries Journal*. 6(1): 38-49. https://doi.org/10.32662/gfj.v6i1.3320.

Sambah, A. B., Wuryantoro, P., Yulianto, E. S. 2020. Composition and distribution of seine fishing gear in the waters of Pasuruan Regency, East Java. *Marine Fisheries*. 11(2):189–200.

Sinthia, C.F., Farid, A., Zainuri, M., Soecahyo D. 2023. Study of the Level of Environmental Friendliness of Purse Seine Fishing Gear in Pasongsongan Coastal Fishing Port Sumenep Madura. *Prosiding Seminar Hi-Tech*. 2 (1). 607-677. https://ejournal.unuja.ac.id/index.php/hitech

Statistics Center of Jepara Regency.2024. Jepara Regency in Figures 2024. Volume 40. Jepara

Susaniati, W., Nelwan, A., F., & Kurnia, M. Productivity of Different Distance of Lift Net Fishing Areas in Jeneponto Regency Waters. *Jurnal Akuatika*. 4(1): 68-79.

Wahyuni, I., Santoso, D., Artayasa, I. P. 2022. The Structure of Bivalvian Community in the Coastal of Elak Elak, West Sekotong, West Lombok. *Jurnal Biologi Tropis*, 22(3), 840–850. https://doi.org/10.29303/jbt.v22i3.3905

Wijayanti, S.O., Imron, M., Wiyono, E.S. 2021. Evaluation of Mini Purse Seine Operating Season at Ujungbatu Fish Auction Place, Jepara, Central Java. *Jurnal Penelitian Perikanan Indonesia*. 27(1): 13-22. DOI: http://dx.doi.org/10.15578/jppi.27.1.2021.13-22

Wijayanti, S.O., Khoerunnisa, N., Rema, D.N. 2024. Technical Efficiency Analysis of Mini Purse Seine Fisheries in Jepara, Central Java. *International Journal of Research Publication and Reviews*. 5 (11): 100-107.

Wiyono, E.S., Hufiadi. 2014. Measuring the Technical Efficiency of Purse Seines in Tropical Small-Scale Fisheries in Indonesia. *Asian Fisheries Science*. 27: 297-208. https://doi.org/10.33997/j.afs.2014.27.4.006