

LENGTH-CLASS AND LEGAL CATCH SIZE ANALYSIS OF MAJOR TRAWL FISH SPECIES FOR FISHERY RESOURCE MANAGEMENT IN EAST MUARA SABAK WATERS

Analisis Selang Kelas Panjang dan Ukuran Layak Tangkap Ikan Hasil Tangkapan Utama *Trawl* sebagai Dasar Pengelolaan Sumber Daya Ikan di Perairan Muara Sabak Timur

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ABSTRACT

The coastal waters of Muara Sabak Timur, located in Tanjung Jabung Timur Regency, Jambi Province, possess significant potential for marine fishery resources but are currently experiencing fishing pressure due to the extensive use of trawl nets. This study aimed to analyze the length-frequency distribution of the main trawl catches and to determine the proportion of fish that have reached the Minimum Legal Size (MLS) in the area. The research was conducted from March to May 2025 in Lambur Luar Village using a field survey method with a purposive sampling approach. Primary data were obtained through total length measurements of three dominant species: narrow-barred Spanish mackerel (*Scomberomorus guttatus*), silver pomfret (*Pampus argenteus*), and black pomfret (*Parastromateus niger*), with 120 specimens collected for each species. Length-frequency distribution was analyzed using Sturges' formula, and the size at first maturity (L_m) was determined based on FishBase. The results indicated that most of the fish caught were below their L_m , with only 10% of *S. guttatus*, 32% of *P. argenteus*, and 21% of *P. niger* categorized as legally harvestable. This suggests that *trawl* operations in Muara Sabak Timur predominantly capture juvenile and sub-adult fish. The low selectivity of the *trawl* nets, caused by small mesh sizes (<2 inches), allows immature fish to be caught before reproducing, indicating the onset of overfishing that threatens natural recruitment. These findings highlight the urgent need for size-based management strategies, including the implementation of minimum mesh sizes, enforcement of species-specific MLS regulations, and the establishment of spawning protection zones. Promoting selective fishing technologies and enhancing fisher participation are essential steps toward achieving sustainable fishery management and maintaining the ecological balance of coastal resources in Muara Sabak Timur.

Keywords: Black Pomfret, Minimum Legal Size, Narrow-Barred Spanish Mackerel, Silver Pomfret, Trawl

ABSTRAK

Perairan Muara Sabak Timur di Kabupaten Tanjung Jabung Timur, Provinsi Jambi, merupakan kawasan pesisir dengan potensi sumber daya ikan yang tinggi namun menghadapi tekanan penangkapan akibat penggunaan alat tangkap *trawl*. Penelitian ini bertujuan untuk menganalisis distribusi ukuran panjang ikan hasil tangkapan utama *trawl* serta menentukan proporsi ikan yang telah mencapai ukuran layak tangkap di wilayah tersebut. Penelitian dilaksanakan pada Maret-Mei 2025 di Desa Lambur Luar dengan metode survei lapangan menggunakan pendekatan *purposive sampling*. Data primer diperoleh melalui pengukuran panjang total ikan tenggiri (*Scomberomorus guttatus*), bawal putih (*Pampus argenteus*), dan bawal hitam (*Parastromateus niger*), masing-masing sebanyak 120 ekor. Analisis selang kelas panjang dilakukan menggunakan rumus Sturges, sedangkan ukuran layak tangkap (Lm) ditentukan berdasarkan literatur biologis dari *FishBase*. Hasil penelitian menunjukkan bahwa sebagian besar ikan yang tertangkap berukuran di bawah Lm. Proporsi ikan layak tangkap untuk tenggiri hanya 10%, bawal putih 32%, dan bawal hitam 21%. Hal ini menunjukkan bahwa operasi *trawl* di Muara Sabak Timur masih didominasi oleh penangkapan juvenil dan sub-dewasa. Rendahnya selektivitas alat tangkap disebabkan oleh ukuran mata jaring yang terlalu kecil (<2 inci) sehingga banyak ikan muda tertangkap sebelum bereproduksi. Kondisi ini mengindikasikan adanya potensi *overfishing* tahap awal yang dapat mengganggu rekrutmen alami populasi ikan. Temuan ini memperkuat pentingnya penerapan pengelolaan berbasis ukuran (*size-based management*) melalui penetapan ukuran minimum tangkap, pengaturan ukuran mata jaring, serta zonasi perlindungan pemijahan. Dengan penerapan teknologi penangkapan selektif dan partisipasi aktif nelayan, keberlanjutan sumber daya ikan di Muara Sabak Timur dapat terjaga.

Kata Kunci: Bawal Putih, Bawal Hitam, *Trawl*, Tenggiri, Ukuran Layak Tangkap

INTRODUCTION

The waters of East Muara Sabak, located in East Tanjung Jabung Regency, Jambi Province, constitute a coastal area with considerable capture fisheries resource potential. This area encompasses approximately $\pm 77,752$ hectares of water with an estimated marine fish production potential of 23,491.54 tons per year (Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu [DPMPTSP], 2020). Most coastal communities, particularly in Lambur Luar Village, rely on the capture fisheries sector for their livelihoods. The dominant fishing gear used is fish trawls, considered effective in capturing various economically important fish species. However, this effectiveness is accompanied by ecological concerns related to the low selectivity of the gear for the size of fish caught (Jarwanto *et al.*, 2014).

The main issue with trawl use in coastal waters is the high proportion of small or juvenile fish caught, including species that have not yet reached gonadal maturity. This gear operates by sweeping extensive areas of the seabed, capturing fish of various sizes and species simultaneously (Sudirman & Mallawa, 2004). This condition poses a risk of declining fish stocks, as juvenile fish do not have the opportunity to reproduce before being captured. This phenomenon indicates the presence of overfishing pressure, which may threaten the sustainability of the local marine ecosystem (Pal *et al.*, 2025).

To support sustainable fisheries management, a quantitative analysis of fish length structure and determination of Minimum Legal Size (MLS) is required. This approach can illustrate population conditions, recruitment rates, and exploitation levels in a given water body (Saber *et al.*, 2022). One commonly used method is the identification of Length at First Maturity (Lm), which provides an indication of when individual fish are first reproductively capable. Catching fish below Lm is considered unsustainable, as it can disrupt natural population recruitment (Sunarto & Nurruhwati, 2016; Widiyastuti *et al.*, 2021).

Several studies indicate that information on length structure is crucial for establishing Ecosystem-Based Fisheries Management (EBFM) strategies. In addition to serving as an indicator of stock status, length data forms the basis for fisheries policies such as minimum mesh size, closed seasons, and protection area zoning (Brinkhof *et al.*, 2022; Herrón *et al.*, 2019). Without accurate biological information, fisheries management in coastal areas will be difficult to direct toward sustainable principles.

Based on these conditions, this study aims to analyze length distribution (length class intervals) and determine whether the main trawl-caught fish meet minimum legal size requirements in the waters of East Muara Sabak. The results are expected to provide biological insights into the stock condition of Indian mackerel (*Scomberomorus guttatus*), silver pomfret (*Pampus argenteus*), and black pomfret (*Parastromateus niger*). Furthermore, the findings can be used as scientific evidence to inform policies for sustainable fisheries management in the coastal areas of Jambi.

METHODS

Time and Place of Research

This research was conducted from 19 March to 25 May 2025 in Lambur Luar Village, East Muara Sabak District, East Tanjung Jabung Regency, Jambi Province. This location was purposively selected as one of the centers of activity for fishers using trawl gear along the eastern coast of Jambi.

Equipment and Materials

The equipment used in this study included stationery, GPS, scales, calculators, cameras, metal rulers, baskets, and cutting mats. The materials used were the main catch from trawl fishing operations, namely Indian mackerel (*Scomberomorus guttatus*), silver pomfret (*Pampus argenteus*), and black pomfret (*Parastromateus niger*).

Research Method

This study employed a field survey method with a purposive sampling approach, targeting active fishers operating trawl gear. Data were collected through direct observation and interviews in the field and subsequently analyzed descriptively. Data collection involved two fishers with 30 repeated trawl operations in East Muara Sabak waters.

The data collected consisted of primary and secondary data. Primary data included total length measurements of fish, species identification, and direct field observations such as operation location, fishing duration, and type of gear used. Secondary data were obtained from relevant institutions such as the Fisheries Department of East Tanjung Jabung Regency, as well as literature and scientific databases such as FishBase (Froese & Pauly, 2025) for biological information (Lm and population characteristics). The main catch *S. guttatus*, *P. argenteus*, and *P. niger* comprised 120 individuals per species. Total fish length was measured using a metal ruler with 0.1 cm precision, and the results were recorded for further analysis. Morphological identification of fish followed the identification key from FishBase.

Data Analysis

Length Class Intervals

Data analysis was conducted using a descriptive-quantitative approach by determining the number of length classes (K) and the class interval (i) using the Sturges formula (Usman & Purnomo, 2006):

$$K = 1 + 3,3 \log N$$

$$i = \frac{R}{K}$$

Information:

K = Number of classes

N = Total number

i = Number of intervals

R = Largest value-Smallest value

Catchable Size

Catchable size (Lm) was determined based on biological literature from FishBase (Froese and Pauly, 2025):

Table 1. Catchable fish size categories

Fish Species	Length at First Gonadal Maturity
Silver Pomfret (<i>Pampus argenteus</i>)	18 cm
Black Pomfret (<i>Parastromateus niger</i>)	22–24 cm
Mackerel (<i>Scomberomorus guttatus</i>)	33–46.5 cm

Determining the size of fish considered suitable for fishing is based on biological parameters, namely the size at which the fish first reach gonadal maturity. The comparison of catch results to the Lm value is used to determine the proportion of fish that are suitable for fishing and those that are not, as a basis for evaluating the level of exploitation of fish resources in the waters of East Muara Sabak.

RESULTS

General Conditions of the Research Area

This research was conducted in Lambur Luar Village, which is administratively part of the Muara Sabak Timur District, Tanjung Jabung Timur Regency, Jambi Province. This area is one of the coastal villages directly facing the Berhala Strait on the east coast of Sumatra. Its strategic geographic location makes Lambur Luar an area with relatively high capture fisheries activity, primarily due to the abundant fish resources in the surrounding waters. Most local residents rely on the fisheries sector for their livelihoods, either as full-time fishermen or seasonal fishermen who utilize marine resources to meet their family's economic needs.

The research focused on fishing areas that serve as the primary operating locations for trawl fishing gear. This gear is widely used by local fishermen because it is considered effective in catching various types of demersal fish that live on the bottom. A map of trawl fishing locations in the waters of Muara Sabak Timur can be seen in Figure 1.

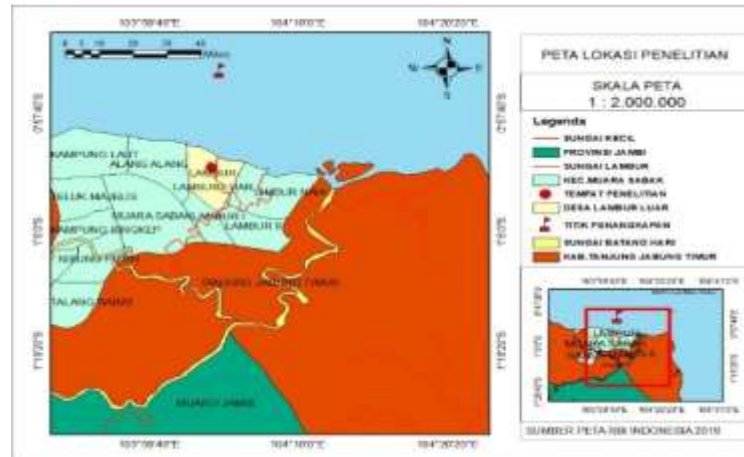


Figure 1. Research Location

Analysis of Class Intervals and Catchable Sizes Spanish Spanish Mackerel (*Scomberomorus guttatus*)

The length distribution of mackerel in the waters of the East Sabak Estuary shows a bimodal pattern with two dominant frequency peaks in the 9–14 cm and 25–29 cm classes (Figure 2). This indicates the presence of two population cohorts actively captured by trawlers: juveniles and subadults. Of the 120 individuals analyzed, only 12 (10%) were classified as suitable for capture (>46.5 cm) (Figure 3).

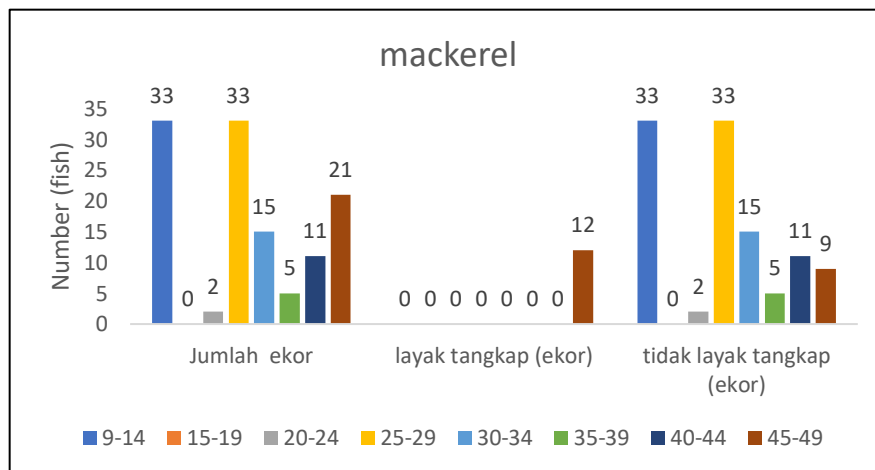


Figure 2. Class and Size Range Suitable for Catching Spanish Mackerel

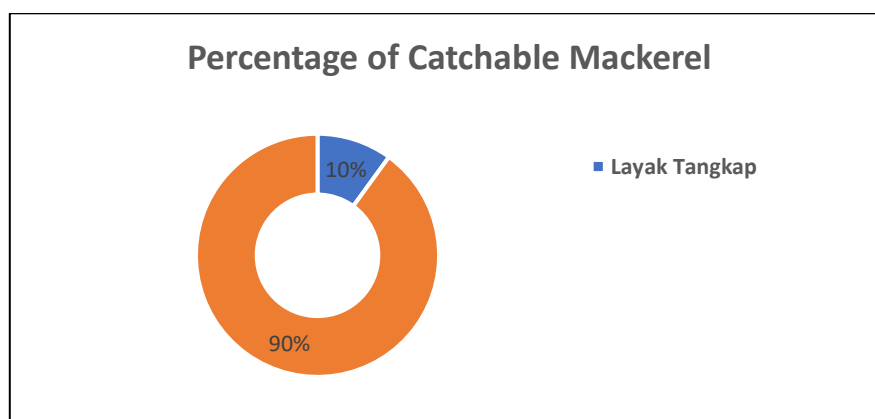


Figure 3. Percentage of Catchable Mackerel

Silver Pomfret (*Pampus argenteus*)

The length distribution of silver pomfret (*Pampus argenteus*) caught by trawl in Muara Sabak Timur exhibited a unimodal pattern, with dominance in the 17–19 cm size class and the highest number of individuals reaching 50 fish (Figure 4). The proportion of fish exceeding the length at first gonadal maturity ($L_m = 18$ cm) was only 32% of the total 120 sampled individuals (Figure 5).

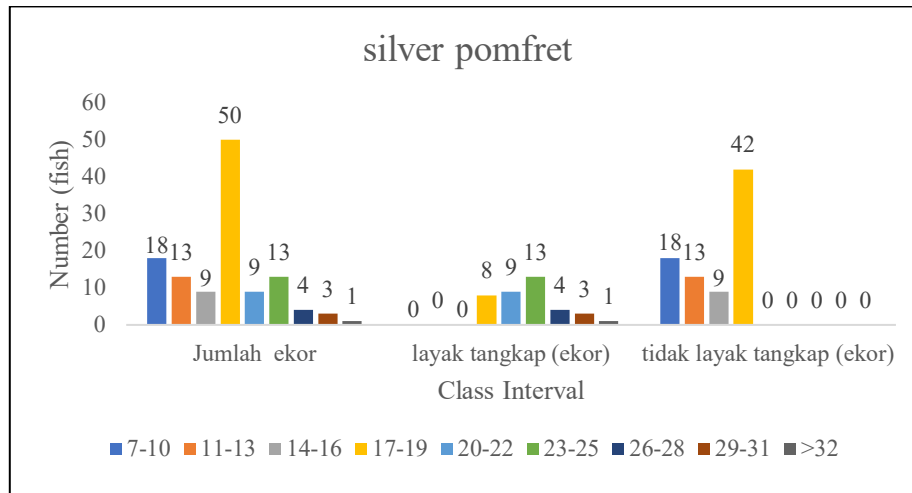


Figure 4. Class intervals and appropriate sizes for catching white pomfret

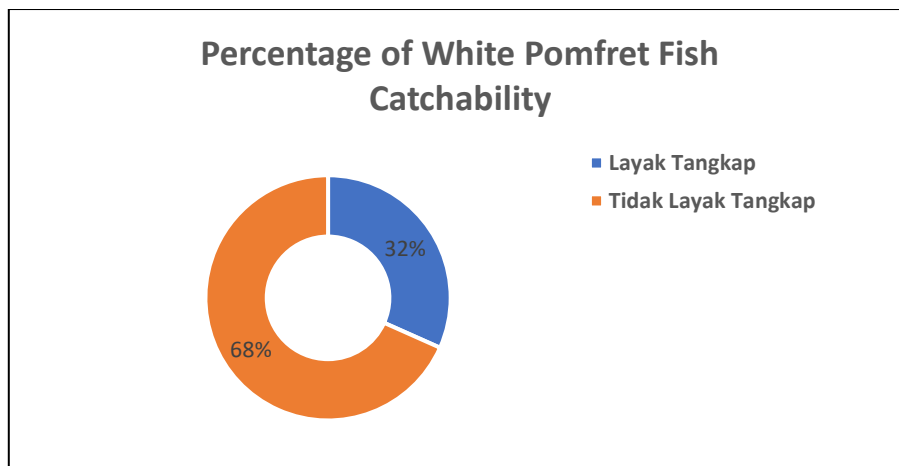


Figure 5. Percentage of Catchable Mackerel

Black Pomfret (*Parastromateus niger*)

The length measurements of black pomfret fish showed a dominant size distribution in the 14-17 cm range, with 35 individuals (Figure 6). Only 21% of the 120 samples were considered suitable for capture (length >24 cm) (Figure 7). This proportion indicates that most of the fish caught were still below the mature gonad size ($L_m = 22-24$ cm).

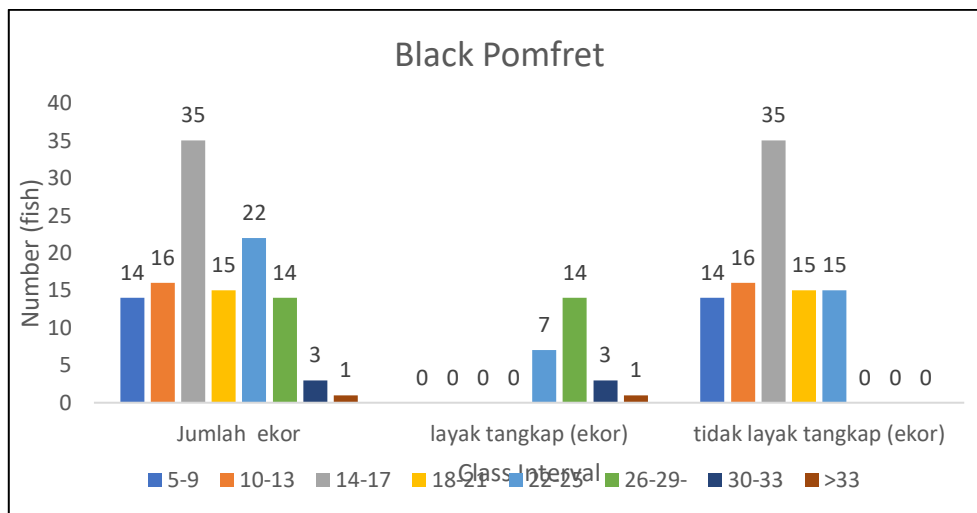


Figure 6. Class intervals and appropriate sizes for catching black pomfret

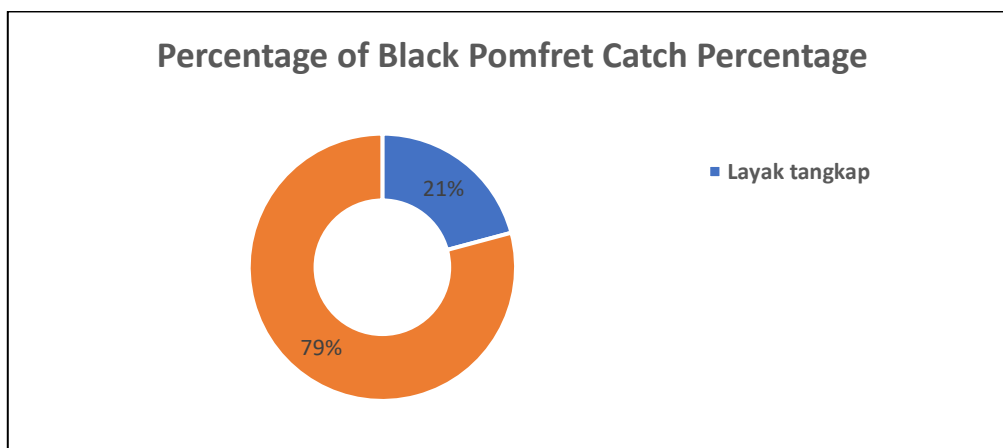


Figure 7. Percentage of Black Pomfret Fish Catchability

DISCUSSION

The results of the study indicate that the majority of *Scomberomorus guttatus* caught remain below the gonadal maturity size (L_m), indicating the low selectivity of the trawl gear used by fishers. This phenomenon aligns with the statement by Barua and Liu (2024), that harvesting *S. guttatus* below L_m can reduce adult stock and hinder the natural recruitment process. This condition is reinforced by findings from Anulekshmi *et al.*, (2018), which explain that juvenile exploitation can cause changes in population age structure and accelerate stock depletion. Biologically, *S. guttatus* exhibits rapid growth and high natural mortality, so fishing pressure on small sizes has the potential to reduce adult biomass within a short period (Pal *et al.*, 2025).

The high proportion of undersized fish in Muara Sabak Timur indicates early signs of overfishing, as fish are caught before contributing to recruitment (Hehanussa *et al.*, 2023). Similar phenomena have also been reported in various regions of Indonesia, such as Pati (Boesono *et al.*, 2017) and the Karimunjawa conservation area (Yuliana & Nurhasanah, 2017), showing that low-selectivity fishing gear contributes to the decline of adult fish stocks. The trawl mesh size used by fishers at the study site also does not meet sustainability standards because it is too small (<2 inches), allowing juvenile fish to be easily caught. The FAO (2023) recommends the implementation of mesh size regulations and minimum landing size policies to reduce fishing pressure on small fish. Moreover, research by Kusnadi *et al.* (2024) emphasizes that the effectiveness of *S. guttatus* fisheries management is influenced by fishing

season patterns and CPUE fluctuations, making season and area regulations important in conservation strategies.

For silver pomfret (*Pampus argenteus*), it was found that two-thirds of the total catch were juveniles, indicating that the exploited population had mostly not reached reproductive maturity. This finding aligns with reports by Prihatiningsih *et al.* (2015) in Tarakan and Prasetyo *et al.* (2020) in Paloh, West Kalimantan, which also recorded dominance of juvenile catches due to high fishing intensity in coastal waters. A study by Al-Mamun *et al.* (2023) in the Bay of Bengal revealed that more than 60% of *P. argenteus* catches below Lm were caused by high fishing pressure in coastal habitats. This species is also known to undertake seasonal migration to shallow waters for feeding (Karim *et al.*, 2020), making it vulnerable to bottom trawl capture. Nurholisah *et al.* (2023) further confirms that silver pomfret tends to concentrate in nursery grounds, which are highly sensitive to active fishing gear. Although *P. argenteus* is a fast-growing species with a short life cycle, fishing pressure on juveniles can trigger a shift in reproductive size as an adaptive response to overexploitation (Widiyastuti *et al.*, 2021), as also reported by Akhter *et al.* (2020) and Muchlis (2023). This condition indicates the potential for long-term evolutionary impacts on population dynamics if fishing pressure is not controlled. From a technical perspective, the use of small mesh sizes (around 1.5 inches) results in very low selectivity for adult fish. Boopendranath *et al.* (2013) demonstrated that gear modifications, such as Square Mesh Codend (SMC) or Bycatch Reduction Device (BRD), can increase the escape probability of small fish by up to 40%. Research by Kurniasih *et al.* (2021) in Kuala Jambi also confirmed that low-selectivity gear leads to a high proportion of small fish in the catch. Therefore, the implementation of selective gear technology should be prioritized to reduce pressure on juvenile stocks. Additionally, the minimum legal size policy (18 cm) recommended by FAO (2023) should be enforced to allow fish to reproduce before capture.

For black pomfret (*Parastromateus niger*), the study also showed a dominance of juvenile and sub-adult catches, meaning most individuals are not yet reproductively mature. These findings are consistent with studies by Islam *et al.* (2021) in coastal Bangladesh and Husna *et al.* (2022) in the Bay of Bengal, which reported that *P. niger* is frequently caught at small sizes due to the use of small mesh nets. This species forms groups on sandy-muddy bottoms and exhibits slow growth, making it highly vulnerable to bottom trawl operations and difficult to recover if adult stocks decline. Karim *et al.* (2020) explained that the low growth coefficient (K) of *P. niger* prolongs the time to reach gonadal maturity, so capturing small-sized fish may lead to recruitment overfishing. A recommended technical solution by Boopendranath *et al.* (2013) is the use of Juvenile Fish Excluder Cum Shrimp Sorting Device (JFE-SSD), which can improve gear selectivity without reducing the main catch. The similarity in the high proportion of undersized fish in both pomfret species indicates that management strategies should adopt species-specific approaches, such as establishing seasonal no-take zones during peak spawning, e.g., April–July for *P. niger* (Al-Mamun *et al.*, 2023).

From an ecological perspective, harvesting fish below Lm reduces natural recruitment because most individuals have not yet reproduced. This impacts adult biomass, slows population regeneration, and decreases fishery productivity (Jamal *et al.*, 2011; Pal *et al.*, 2025). Sustained overfishing may cause community shifts, where short-lived species dominate the ecosystem, replacing economically valuable species. Therefore, fisheries management in Muara Sabak Timur should adopt a size-based approach through the enforcement of minimum landing size, mesh size restrictions, and the establishment of reproductive protection zones. Size-based policies have proven effective in reducing juvenile mortality and accelerating stock recovery in tropical waters (Brinkhof *et al.*, 2022). The success of management implementation also depends on fishers' understanding and participation; therefore, education on minimum catch size, training in selective gear use, and incentives for environmentally friendly fishers should be developed (Hehanussa *et al.*, 2023). Through a combination of technical regulation,

gear innovation, spatial-temporal planning, and increased fisher awareness, the sustainability of fish stocks in Muara Sabak Timur can be ensured while maintaining the economic productivity of coastal communities.

CONCLUSION

This study demonstrates that trawl fishing activities in Muara Sabak Timur are dominated by catches of small-sized fish that have not reached gonadal maturity. The proportion of legally catchable fish is very low, at 10% for *Scomberomorus guttatus*, 32% for *Pampus argenteus*, and 21% for *Parastromateus niger*. This indicates low selectivity of the fishing gear used and high exploitation pressure on juvenile stocks. Such conditions have the potential to cause overfishing and threaten the sustainability of fishery resources in Jambi's coastal waters. Ecologically, harvesting fish below gonadal maturity reduces adult biomass and disrupts natural recruitment. Technically, this is caused by the use of excessively small mesh sizes and trawl operations in coastal areas that function as spawning and nursery grounds. Therefore, this study emphasizes that fisheries management in Muara Sabak Timur should be directed toward size- and ecosystem-based approaches, taking into account the biological characteristics of each target fish species.

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