

Specifications Of The Payang Fishing Gear And Its Catch Composition In Pasie Nan Tigo Subdistrict, Padang City, West Sumatra Province, Indonesia

Bukhari, Sindy Gemaeka Putri, Suparno, Harfiandri

Fisheries Resource Utilization Study Program, Faculty of Fisheries and Marine Sciences, Bung Hatta University, Padang, Indonesia

Corresponding Author: Bukhari, Sindy Gemaeka Putri. E-mail: bukhari@bunghatta.ac.id



Abstract: This study investigates the technical characteristics and catch composition of payang (*boat seine*) fishing gear operated in Pasie Nan Tigo Subdistrict, Padang City, West Sumatra, Indonesia. Fieldwork was carried out from February to July 2024 using direct measurements of fishing gear components, observation of fishing operations, and systematic sampling of landed catches. Recorded technical parameters included net materials, mesh sizes, codend dimensions, and configurations of the headline and footrope. Catch composition was analysed based on species weight proportions, while the occurrence of juvenile fish was used to evaluate gear selectivity. The results indicate that the payang gear is mainly constructed from polyamide netting with gradually decreasing mesh sizes towards the codend, allowing effective capture of small pelagic species. The catch was dominated by anchovies, scads, and mackerels, although juvenile individuals were present in considerable proportions. Variations in catch composition were associated with fishing time and local environmental conditions. Although payang fisheries provide important socio-economic benefits to coastal communities, the capture of juvenile fish suggests potential risks to stock sustainability. The findings of this study provide baseline information to support selective gear modification and sustainable management of small-scale payang fisheries in Indonesian coastal waters.

Keywords : Payang fishing gear; catch composition; gear selectivity; small pelagic fish; small-scale fisheries; Indonesia

INTRODUCTION

Small scale fisheries play an essential role in food supply, employment, and household income in many Indonesian coastal communities. Fish resources in these areas are commonly exploited using traditional fishing gears that remain widely applied due to their low operational costs, simple technology, and suitability to local environmental conditions (Nurhayati *et al.*, 2021). Along the western coast of Sumatra, one of the most commonly used fishing gears is the payang, a type of boat seine operated actively to target schooling small pelagic fish in shallow coastal waters.

In Padang City, payang fisheries contribute significantly to local fish production and fishermen's livelihoods. However, differences in gear construction, including mesh size, codend length, and operational techniques, may strongly influence catch selectivity and species composition. Previous studies have shown that seine-type fishing gears often capture small-sized fish, including juveniles, which may increase pressure on small pelagic stocks if management measures are not properly implemented (Sari & Pranata, 2022; Oliveira *et al.*, 2021).

Several studies on payang fisheries in Indonesia have been conducted in regions such as Java, Sulawesi, and Nusa Tenggara, highlighting variations in net design, fishing efficiency, and catch composition across locations (Rahardian *et al.*, 2020; Thomas

& Williams, 2023). However, scientific information regarding payang fisheries in Pasie Nan Tigo Subdistrict, Padang City, remains limited, despite the area being an active coastal fishing ground influenced by seasonal changes and oceanographic conditions.

Therefore, this study aims to describe the technical specifications of payang fishing gear and analyse its catch composition in Pasie Nan Tigo Subdistrict. The results are expected to provide scientific evidence to support sustainable management and selective improvement of small-scale payang fisheries.

MATERIALS AND METHODS

1. Time and location of research

This research was conducted from February to July 2024 in Pasie Nan Tigo, Padang City, West Sumatra Province, Indonesia (Figure 1).

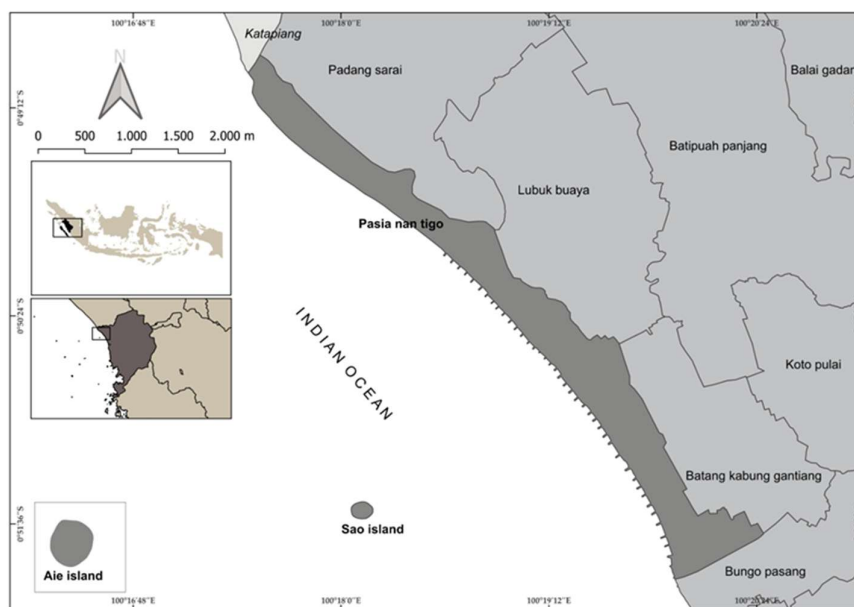


Fig. 1. Research location

2. Data collection

Field data were collected through direct observation and measurement at the fishing site. The technical specifications of the payang fishing gear were recorded by measuring each component of the net, including the codend, body, wings, headline, and footrope. Measurements were carried out using measuring tapes for net length, digital callipers for mesh size, and visual inspection for material identification. The observed variables included net materials, mesh sizes, net dimensions, number and spacing of floats and sinkers, total catch weight per fishing trip, and species composition of the catch. Juvenile occurrence was assessed based on size observations relative to commonly reported length at first maturity for each species (**Sarlan *et al.*, 2024**).

Catch data were obtained from daily fishing operations. All fish landed from each fishing trip were weighed using a digital scale, and species identification was conducted using FAO species identification guides (FAO, 2018). Data collection followed standard approaches commonly applied in catch composition studies of small-scale fisheries (Saber *et al.*, 2022).

3. Data analysis

Catch composition was analysed as the percentage contribution of each species to the total catch weight using the following equation (Saber *et al.*, 2022):

$$\text{Species composition (\%)} = (W_i / W_t) \times 100$$

Where :

W_i = represents the weight of species i (kg)

W_t = represents the total catch weight (kg).

RESULTS

Based on direct observations and field measurements conducted in Pasie Nan Tigo Subdistrict, Padang City, West Sumatra Province, the technical specifications of the payang fishing gear are presented in Table 1.

Table 1. Technical specifications of the payang fishing gear operated in Pasie Nan Tigo Subdistrict, Padang City.

No	Gear component	Specification		Information
1	Codend	Material	Warring	-
		Length	11,5 m	
		Width	9 m	
		Mesh size - Front - Back	0,3-0,6 mm 0.3-0.6 mm	
2	Net Body	Material	Polyamide	Mesh size decreases towards the back
		Length	31 m	
		Width	30 m	
		Mesh size - Front - Back	15 cm 1.5 cm	
3	Wings	Bahan	Polyamide	Mesh size decreases towards the rear
		Length	250 m	
		Mesh size - Front - Back	47 cm 18 cm	

4	Marker float (Cikang)	Material	Sterofoam	Used as net position marker
		Length	40 cm	
		Width	25 cm	
		Quantity	1	
		Shape	Square	
5	Body float	Material	Sterofoam	Maintains surface stability
		Length	50 cm	
		Width	50	
		Quantity	1	
		Shape	Cube	
6	Payang float	Material	Rubbe cork	Installed along the headline
		Length	10 cm	
		Width	4 cm	
		Quantity	± 1500 units	
		Shape	Oval	
		Spacing	9-15 cm	
7	Sinkers	Material	Lead	Attached along the footrope
		Length	1 cm	
		Width	1 cm	
		Quantity	± 1550 buah	
		Shape	Circular	
		Spacing	8-10 cm	
8	Headline rope	Material	Polyetyline	
		Length	510 m	
		Diameter	5 mm	
9	Footrope	Material	Polyetyline	
		Length	486 m	
		Diameter	5 mm	
10	Hauling rope	Material	Polyetyline	Used during hauling process
		Length	± 50 m	
		Diameter	12 mm	
11	Codend binding rope	Material	Polyetyline	Reinforces codend structure
		Length	70- 100 cm	
		Diameter	1 mm	
12	Cikang board	Bahan	Kayu	Additional marker and stabiliser
		Panjang	25 cm	
		Lebar	10 cm	
		Jumlah	2 buah	

The payang fishing gear operated in Pasie Nan Tigo Subdistrict is composed of multiple interconnected components that collectively form a tapered surrounding net system. Each component is constructed using specific materials and dimensions to support efficient herding and capture of pelagic fish in coastal waters.

The codend is made of fine waring netting with a length of 11.5 m and a width of 9 m. The mesh size ranges from 0.3 to 0.6 mm in both the front and rear sections. The net body is constructed from polyamide, measuring 31 m in length and 30 m in width, with mesh sizes decreasing from 15 cm at the front to 1.5 cm at the rear. The wings, also made of polyamide, extend up to 250 m, with mesh sizes gradually reducing from 47 cm at the front to 18 cm at the rear.

The flotation system consists of marker floats, body floats, and payang floats. Marker floats (cikang) are made of styrofoam with dimensions of 40 × 25 cm, while body floats measure 50 × 50 cm and are cube-shaped. Payang floats are made of rubber cork, measuring 10 × 4 cm, and are installed along the headline at intervals of 9–15 cm, with approximately 1,500 units used. Lead sinkers measuring 1 × 1 cm are attached along the footrope at intervals of 8–10 cm, with a total of approximately 1,550 units.

The headline and footrope are constructed from polyethylene with lengths of 510 m and 486 m, respectively, and a diameter of 5 mm. Additional components include a polyethylene hauling rope approximately 50 m in length and 12 mm in diameter, codend binding ropes measuring 70–100 cm with a diameter of 1 mm, and two wooden cikang boards measuring 25 × 10 cm.

2. Fish catch per fishing trip

The catch obtained using payang fishing gear showed considerable variation among fishing trips, reflecting the dynamic nature of fish resources and the effectiveness of fishing operations. These variations are illustrated in Figure 2.

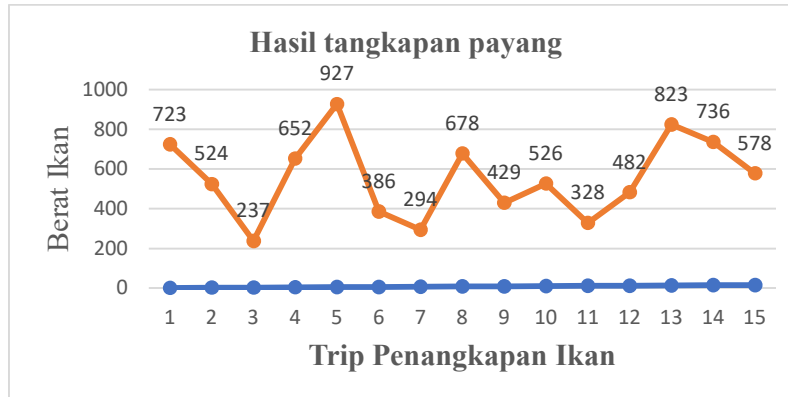


Fig.2. Fish Catch Obtained During 15 Fishing Trips

In general, catch weights per trip ranged from 237 kg to 927 kg, with a fluctuating pattern that showed no consistent upward or downward trend. The highest recorded catch occurred on trip 5, at 927 kg, indicating optimal operating conditions and fish availability during that period. Meanwhile, the lowest recorded catch was found on trip 3, at 237 kg, suggesting possible unfavorable environmental or technical factors, such as oceanographic conditions, the presence of fish schools, or gear settings.

Catch variability was also evident in subsequent trips, for example, a sharp increase from trip 7 (294 kg) to trip 8 (678 kg), followed by a further decrease from trip 10 (526 kg) to trip 11 (328 kg). This shift reflects the mobile and schooling nature of small

pelagic fish stocks, so their success is strongly influenced by fishing time and location. Between trips 12 and 14, catches increased significantly again, peaking at 823 kg on trip 13 before declining to 578 kg on trip 15. This pattern indicates reports of fish in the vicinity of the operation, possibly related to seasonal factors or changes in water conditions.

Overall, catch output indicates that the performance of the payang fishing gear is influenced by a combination of biological (*fish availability*), technical (*fishing operations*), and environmental (*current, weather, and water conditions*) factors. This catch variation is important to consider when evaluating gear efficiency and planning more adaptive operational strategies.

3. Catch Composition

The catch composition indicates that the payang fishing gear is selective, tending toward small pelagic fish and some large pelagic fish. Observation data revealed eight main species caught, which generally reflects the structure of pelagic fish communities in tropical waters. This can be seen in table 2.

No	Nama Ilmiah
1	<i>Katsuwonus pelamis</i>
2	<i>Euthynnus. Sp</i>
3	<i>Rastrelliger sp</i>
4	<i>Trichiurus lepturus</i>
5	<i>Selaroidesleptolepis</i>
6	<i>Leiognathidae.sp</i>
7	<i>Stoleporus sp</i>
8	<i>Loligo sp</i>

The dominant species caught included *Katsuwonus pelamis* and *Euthynnus* sp., both of which are large, schooling pelagic fish that move in dense aggregations. The presence of these two species in the catch indicates that the payang can catch highly mobile fish, especially when operating during schooling periods at relatively shallow depths.

In addition, several small pelagic fish species were also found in abundance, such as *Rastrelliger* sp., *Selaroides leptolepis*, and *Stolephorus* sp. These groups are common targets of payang fishing gear because their body size is suitable for the mesh dimensions and their swimming patterns tend to school near the surface. The presence of these small pelagic species is also related to seasonal upwelling, water productivity, and food availability.

The catch also includes economically valuable species such as *Trichiurus lepturus* and *Loligo* sp..*Leiognathidae* sp., a small fish that lives in shallow waters in schools, is often caught as bycatch, ecologically indicating that the payang operation area is in the pelagic zone. Overall, the diversity of species caught reflects the characteristics of the payang as a versatile tool for catching small to medium-sized pelagic fish. This composition suggests that payang operations are influenced by schooling behavior, local oceanographic conditions, and net selectivity, which allows the inclusion of various non-target species. These findings provide insight into the dynamics of the fish community at the study site and can serve as a basis for evaluating the sustainability of payang operations in the future.

DISCUSSION

1. Operation of payang fishing gear

The payang fishing gear operated in Pasie Nan Tigo employs a tapered netting design that is commonly applied in small pelagic fisheries to maximise fish herding and capture efficiency. The codend, constructed from fine waring netting with small mesh sizes (0.3–0.6 mm), functions as the final retention chamber, ensuring effective retention of small to medium-sized fish. This characteristic is consistent with the findings of **Hapsari et al., (2020)**, who reported that small codend mesh sizes play a crucial role in enhancing the retention of small pelagic species.

The net body and wings are constructed from polyamide, with mesh sizes gradually decreasing from the front section (47 cm) towards the rear (1.5 cm). This progressive narrowing reflects a design strategy aimed at guiding fish efficiently towards the codend. According to **Sari et al., (2019)**, tapered net structures improve herding effectiveness by reducing escape opportunities as fish move along the net pathway.

The use of long wings extending up to 250 m, supported by a dense arrangement of floats and sinkers, increases the effective sweeping area of the gear while maintaining vertical net opening during fishing operations. **Khairunnisa et al., (2021)** emphasised that closely spaced float–sinker configurations are essential for preserving the geometric stability of fishing nets, thereby maintaining capture efficiency under varying surface current conditions. Overall, the construction specifications of the payang fishing gear in Pasie Nan Tigo indicate that it has been specifically designed to accommodate the schooling behaviour and high mobility of small pelagic fish inhabiting surface waters.

2. Catch Results

The total catch obtained from 15 fishing trips varied markedly, with recorded weights ranging from 237 kg to 927 kg. Such variability illustrates the combined influence of fish stock availability, environmental conditions, and operational performance during fishing activities. The maximum catch was achieved during the fifth trip, reaching 927 kg, which suggests favourable fishing conditions coinciding with the presence of dense pelagic fish schools and effective setting and hauling operations. In contrast, the lowest catch was observed during the third trip (237 kg). This reduction may be attributed to less favourable oceanographic conditions, deeper vertical distribution of fish, or smaller school sizes. Previous studies have shown that abrupt decreases in catch often occur in response to changes in sea surface temperature and current dynamics that alter the spatial behaviour of pelagic fish schools (**Pratama & Purnomo, 2017**).

A pronounced increase in catch was recorded between trip 7 (294 kg) and trip 8 (678 kg), indicating a short-term rise in fish abundance within the fishing grounds, potentially linked to seasonal variability. **Maulida et al., (2022)** reported that enhanced catches of small pelagic species are frequently associated with increased primary productivity following seasonal transitions. Further increases were recorded during trips 12–14, with the highest value observed in trip 13 (823 kg), before declining again in trip 15 (578 kg). This pattern suggests a cyclical fluctuation in fish availability that corresponds with ecological processes affecting pelagic fish distribution. Such variability is characteristic of pelagic fish stocks, which are known to respond rapidly to environmental changes (**Suryanti et al., 2021**).

As shown in Table 2, eight fish species dominated the payang catches during the study period, including skipjack tuna (*Katsuwonus pelamis*), frigate tuna (*Euthynnus* sp.), Indian mackerel (*Rastrelliger* sp.), largehead hairtail (*Trichiurus lepturus*), yellowstripe scad (*Selaroides leptolepis*), ponyfish (*Leiognathidae* sp.), anchovy (*Stolephorus* sp.), and squid (*Loligo* sp.). This species composition reflects the effectiveness of payang fishing gear in targeting pelagic assemblages. Within the Pasie Nan Tigo fishing area, the captured species are consistent with typical payang fisheries, which predominantly exploit small to medium-sized schooling fish occupying surface and upper water column layers. Similar findings were reported from Gorontalo Bay, where payang

fishing gear captured species such as *Trichiurus lepturus* and *Loligo* sp. across different fishing seasons, highlighting the adaptability of this gear in targeting both pelagic and semi-demersal species (Asruddin *et al.*, 2021; Asruddin *et al.*, 2023).

The presence of *Rastrelliger* sp. and *Euthynnus* sp. in payang catches is further supported by studies conducted in East Java, which demonstrated that catch composition and spatial distribution are strongly influenced by the availability of small and medium-sized pelagic fish (Sambah *et al.*, 2022). Local observations in Pasie Nan Tigo also indicate temporal variation in species dominance, with anchovies (*Stolephorus* sp.) prevailing in morning catches, while frigate tuna (*Euthynnus* sp.) and skipjack tuna (*K. pelamis*) become more dominant during afternoon operations. This pattern suggests a time-dependent shift in species composition related to fishing activity (Yuspardianto *et al.*, 2023). From a management perspective, the observed species composition has important implications. The payang fishery targets species with a wide range of economic values, including high-value commercial species such as skipjack tuna as well as smaller species such as anchovies and ponyfish. Consequently, fisheries management strategies should incorporate sustainability considerations, as excessive fishing pressure on small-sized species may result in long-term ecological and economic consequences if not adequately controlled (Susanto *et al.*, 2023).

CONCLUSION

The technical specifications of the payang fishing gear operated by fishers in Pasie Nan Tigo include a net length of 220–260 m, a net depth of 12–18 m, wing mesh sizes of 1½–2 inches, and cod-end mesh sizes of ¾–1 inch, constructed using PE multifilament material. Overall, the gear construction is generally consistent with FAO guidelines for fishing gear descriptions; however, the cod-end section exhibits relatively low selectivity. The catch composition was dominated by small pelagic species, particularly Indian mackerel (*Rastrelliger* sp.), anchovy (*Stolephorus* sp.), and scad (*Selaroides* sp.), and size structure analysis indicated that a proportion of the catch consisted of individuals below the legal catch size, especially for Indian mackerel and scad.

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