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Composition of Trap Net (Gombang) Catch Based on Tidal Conditions in Insit Village, Meranti Islands Regency

Komposisi Tangkapan Jaring Perangkap (Gombang) berdasarkan Kondisi Pasang Surut di Desa Insit, Kabupaten Kepulauan Meranti

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Abstract

Trap nets (gombang) are passive fishing gears that utilize tidal currents to capture fish and shrimp in coastal waters. This study aims to identify the composition of catches from trap nets based on tidal conditions in the waters of Insit Village, Meranti Islands Regency. The research method used was a survey method through direct observation and interviews with fishermen. Data analysis was carried out using catch-proportion analysis, including main catch, by-catch, and discards. The results showed that penaeid shrimp and small pelagic fish such as anchovies dominated the catch composition. Catch composition was influenced by tidal conditions, where catches during high tide were higher than during low tide. The catch proportions indicate that trap nets still exhibit low selectivity, as evidenced by the high by-catch rate. Therefore, better management is needed to improve the efficiency and sustainability of trap net fisheries in the area.

Keywords: Trap Net, Tides, Catch Composition

Abstrak

Jaring perangkap (gombang) adalah alat tangkap pasif yang memanfaatkan arus pasang surut untuk menangkap ikan dan udang di perairan pesisir. Penelitian ini bertujuan untuk mengidentifikasi komposisi tangkapan dari jaring perangkap berdasarkan kondisi pasang surut di perairan Desa Insit, Kabupaten Kepulauan Meranti. Metode penelitian yang digunakan adalah metode survei melalui observasi langsung dan wawancara dengan nelayan. Analisis data dilakukan dengan menggunakan analisis proporsi tangkapan, meliputi tangkapan utama, tangkapan sampingan, dan pembuangan. Hasil penelitian menunjukkan bahwa udang penaeid dan ikan pelagis kecil seperti ikan teri mendominasi komposisi tangkapan. Komposisi tangkapan dipengaruhi oleh kondisi pasang surut, di mana tangkapan saat air pasang lebih tinggi daripada saat air surut. Proporsi tangkapan menunjukkan bahwa jaring perangkap masih menunjukkan selektivitas yang rendah, sebagaimana dibuktikan dengan tingkat tangkapan sampingan yang tinggi. Oleh karena itu, diperlukan pengelolaan yang lebih baik untuk meningkatkan efisiensi dan keberlanjutan perikanan jaring perangkap di daerah tersebut.

Kata kunci: Jaring Perangkap, Pasang Surut, Komposisi Tangkapan

1. Introduction

Statistical data from the Marine and Fisheries Service of the Meranti Islands Regency showed a decrease in the number of fishermen using belat, gombang, and pengerih fishing gears from 2015 to 2017 (BPS, 2017). The

use of gillnets is considered quite effective because their operation is relatively simple and does not require advanced technology. However, scientific information regarding the fishing units, operating methods, and catch composition of this gear remains limited. Furthermore, the use of less selective fishing gear can result in significant by-catch, which could impact the sustainability of fishery resources. Therefore, a more in-depth study is needed to understand the characteristics of wave-driven fishing gear and the catch yields obtained.

The issues addressed in this study include a lack of data on the components of wave-capture units, field operational processes, and the composition and proportions of catch under different tidal conditions. This information is crucial for evaluating the effectiveness and selectivity of fishing gear and for informing sustainable fisheries management. This study aims to describe the wave-catching gear unit, identify the composition of the catch, and analyze the proportions of the main catch, by-catch, and discards. The results of this study are expected to provide scientific contributions to the development of more environmentally friendly and selective fishing technologies. Additionally, this study is expected to serve as a reference for the government, academics, and fishermen in efforts to improve fishing efficiency and preserve coastal fishery resources.

2. Material and Method

2.1. Time and Place

This research was conducted for 14 days, from May 7 to May 21, 2025, in the waters of Insit Village, Meranti Islands Regency, Riau Province. This area is one of the places where gombang fishing gear is caught.

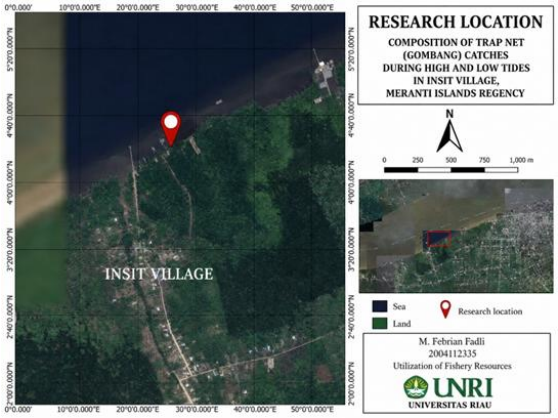

Figure 1. Research location map

2.2. Methods

The method used in this study is the survey method, which involves direct observation of the fishing gear used by fishermen in Insit Village, Meranti Islands Regency, and data collection is conducted after the fishermen complete the fishing process. The data collected includes primary and secondary data. Primary data is obtained through observation, measurement, and direct interviews with fishermen and owners of gombang fishing gear in Insit Village, while secondary data is obtained from government agencies and related literature (Jhonnerie & Yani, 2018; Yuliawati et al., 2019).

2.3. Data Analysis

The data were collected from the research results through both fieldwork and interviews with informants. The collected data are presented in tables, images, and graphs, and analyzed using inferential statistics.

2.3.1. Composition of Catch Results

According to Susanti (2013), the calculation of the composition of catch results can be calculated as follows:

$$P\ (\%) = (Ni / N) \times 100\%$$

with: P = percentage of catch type (%); Ni = weight of catch type (kg); N = total catch (kg)

Analysis of fisherman's catch composition data using the formulation from Akiyama (1997), employing the method of comparing main catch and by-catch, namely:

$$\text{Main catch } (\%) = \frac{\sum \text{maincatch}}{\sum \text{total catch}} \times 100$$

$$\text{By-catch } (\%) \frac{\sum \text{by-catch}}{\sum \text{total catch}} \times 100$$

$$\text{Discard } (\%) \frac{\sum \text{discard}}{\sum \text{total catch}} \times 100$$

The results of the presentation of descriptive and quantitative analysis data will illustrate the proportion (%) of main catch, by-catch, and discard

3. Result and Discussion

3.1. Fishing Gear

Based on the research results, approximately 10 vessels are operating in the waters of Insit Village. Of this number, 8 units are motorized boats, and 2 units are non-motorized boats. During the research activities, the boat used was KM. Asan has a size of 1 GT, 6 m in length, and 1 meter in width. The fleet is powered by a Dong Feng engine with a capacity of 1.75 HP. According to the study by Rachmattullah et al. (2015), the gombang fishing fleet boats are made of wood and use dompeng-brand diesel engines. They have various sizes, namely boats with a length of ±5-8 m, a width of ±1.30-2 m, a hull height of ±1 m, a wood thickness of 7.3 cm, and 9 ribs with a thickness of 4.5 cm.

Gombang is a fishing gear in the form of a bag, where the opening of the gombang at both wings is connected with a fixed anchor. Its development started with a simple form without wings. Over time, the gombang was equipped with 2 wings. Mr. Asan owns 4 fishing gear units, but only 2 were operated during the research activities, both of which were similar in size. One of the fishing gears used is the gombang, which is operated at a distance of 100–200 meters from the coastline. This gear operates on a line connected to previously installed pegs. The determination of fishing locations is based on the knowledge and local experience of fishermen who use the gombang fishing gear. This fishing gear is equipped with four floats, consisting of one main float and three auxiliary floats, as well as two weights that function as openers for the gombang mouth. The following are the main components of the wave-catching tool.

Table 1. Main components of the wave-catching tool

No	Specification	Material	Quantity and Size
1	Net body	PE	Length 30 m; Green net color ; Width 9 m
2	Mesh size	PE	Mesh sizes: 15 cm, 9, 7, 3.5, 3, 2.5, 2, 1.5, 1
3	Main rope	PE	Length 8–9 m; Z-twist; Diameter 3.5 cm; White color
4	Marker float	Drum	Length 93 cm; Weight 8.6 kg; Diameter 58 cm; Total: 1 unit
5	Main float	Plastic bottles (Aqua bottles)	21 bottles (1.2 L each); Length 30 cm; diameter 7 cm
6	Sinker	Natural stone	Weight 10 kg per unit; Diameter 15–20 cm; Total: 2 units

The gombang fishing gear is operated in shallow waters near the coast of Insit Village. The installation process begins with driving a 6-meter stake into the seabed during calm tide conditions. The time needed for fishermen to reach the fishing ground is 15-30 minutes at a distance of 600 meters from the coastline. After that, the fishermen tie the float rope to the upper line and the weight rope to the lower line, then gradually lower the gombang fishing gear (Khairunnisa et al., 2017).

After the fishing gear is installed, the soaking stage is the period during which the gear is left in the water to catch fish or other marine animals. At this stage, the gear is not actively operated but operates passively by utilizing currents, fish movement, or other natural conditions. The catch is routinely collected when the ebb tide weakens or when the flood tide begins to decline. Fishermen wait for 6 hours while the gombang fishing gear is in operation. At 16:00, the gombang fishing gear is lifted again. The gombang gear is lifted at 10:00 p.m. and 04:00 in the morning.

The gombang catch is collected every 5–6 hours, following the semi-diurnal tidal pattern in the waters of Desa Insit. In one day, the catch is collected four times according to the tide cycle. This process occurs when the ebb tide begins to weaken, during the transition phase from high tide to low tide. In one day, there are two high tides and two low tides, with the high-tide water level almost equal to the depth of the water. The waters of Insit Village have a brownish color and a slight odor, influenced by the presence of peat soil and mud material at the bottom of the waters.

3.2. Composition of Catch Results

Each of these periods is then categorized based on the four phases of tidal seawater, namely high tide I, low tide I, high tide II, and low tide II. The following table shows the total catch results of the gillnet gear. The use of gombang fishing gear in Insit Village, Meranti Islands Regency, yields three main categories of catch: main catch, bycatch, and discards. The main catch consists of 4 species, namely lomek (*Harpodon nehereus*), mantis shrimp (*Lysiosquilla maculata*), white shrimp (*Litopanaeus vannamei*), and red shrimp (*Parhippolyte uveae*). The total main catch during high tide waters amounted to 443.18 kg with a total of 14,940 individuals, and during low tide waters amounted to 772.26 kg with a total of 30,554 individuals. Meanwhile, the by-catch consisted of 7 species, namely giant freshwater prawn (*Macrobrachium rosenbergii*), cutlassfish (*Trichiurus lepturus*), ilisha (*Ilisha elongata*), fringescale herring (*Thryssa mystax*), mackerel fish (*Scomberomorini*), pomfret (*Bramidae*), and ariid catfish (*Ariidae*). Among these groups, the total by-catch during high tide waters was 129.34 kg with a total of 7,981 individuals, and during low tide waters, it amounted to 195.37 kg with a total of 12,933 individuals. The catch that falls into the discard category is pufferfish (*Tetraodontidae*) and horseshoe crabs (*Limulidae*). The total discard catch during high tide waters was 6.15 kg, with the number of species reaching 352 individuals, and during low tide waters, it was 5.61 kg, with the number of species reaching 354 individuals.

Table 2. Total gillnet catch results

No	Fish Name	Scientific Name	Total			
			High Tide		Low Tide	
			Weight (kg)	Number of Individuals	Weight (kg)	Number of Individuals
1	Lomek	*Harpodon nehereus*	416.93	9,927	732.94	17,451
2	Mantis shrimp	*Lysiosquilla maculata*	12.45	415	18.13	6,043
3	White shrimp	*Litopenaeus vannamei*	8.81	2,935	11.78	3,925
4	Red shrimp	*Parhippolyte uveae*	4.99	1,663	9.41	3,135
5	Ribbonfish	*Trichiurus lepturus*	63.99	3,555	86.81	4,823
6	Anchovy	*Thryssa mystax*	19.32	2,147	36.37	4,041
7	Biang fish	*Ilisha elongata*	15.65	326	24.05	501
8	Catfish (Duri)	*Ariidae*	16.30	286	21.66	380
9	Spanish mackerel	*Scomberomorini*	7.96	419	14.35	755
10	Giant freshwater prawn	*Macrobrachium rosenbergii*	5.43	905	10.90	1,816
11	Pomfret	*Bramidae*	0.69	343	1.23	617
12	Pufferfish	*Tetraodontidae*	5.71	204	5.10	182
13	Horseshoe crab	*Limulidae*	0.44	148	0.51	172

Table 3. Main catch

No	Fish Name	Scientific Name	High Tide		Low Tide	
			Weight (kg)	Number of Individuals	Weight (kg)	Number of Individuals
1	Lomek	*Harpodon nehereus*	416.93	9,927	732.94	17,451
2	Mantis shrimp	*Lysiosquilla maculata*	12.45	415	18.13	6,043
3	White shrimp	*Litopenaeus vannamei*	8.81	2,935	11.78	3,925
4	Red shrimp	*Parhippolyte uveae*	4.99	1,663	9.41	3,135
Total			443.18	14,940	772.26	30,554

Table 4. By-catch

No	Fish Name	Scientific Name	High Tide		Low Tide	
			Weight (kg)	Number of Individuals	Weight (kg)	Number of Individuals
1	Ribbonfish	*Trichiurus lepturus*	63.99	3,555	86.81	4,823
2	Anchovy	*Thryssa mystax*	19.32	2,147	36.37	4,041
3	Biang fish	*Ilisha elongata*	15.65	326	24.05	501
4	Catfish	*Ariidae*	16.30	286	21.66	380
5	Spanish mackerel	*Scomberomorini*	7.96	419	14.35	755
6	Giant freshwater prawn	*Macrobrachium rosenbergii*	5.43	905	10.90	1,816
7	Pomfret	*Bramidae*	0.69	343	1.23	617
	Total		129.34	7,981	195.37	12,933

The main catch refers to the type of fish the fishermen expect to catch during the fishing operation. The following table shows the composition of the main catch in terms of weight (kg) and number (individuals) for the gillnet gear. Based on the catch data, lomek is the dominant species with a total catch during the high tide phase of 416.93 kg (9,927 individuals) and during the low tide phase reaching 732.94 kg (17,451 individuals). Based on the data collection results, the species contributing the most to the total catch is the ribbonfish (*T. lepturus*), which during the high tide phase reached 63.99 kg (3,555 individuals) and increased to 86.81 kg (4,823 individuals) during the low tide phase. In addition, several other species also showed fairly high catch results, including the fringe-lipped anchovy (*T. mystax*) with a total of 19.32 kg (2,147 individuals) during high tide and 36.37 kg (4,041 individuals) during low tide, and the *I. elongata* with 15.65 kg (326 individuals) during high tide and 24.05 kg (501 individuals) during low tide.

Table 5. Discard catch

No	Fish Name	Scientific Name	High Tide		Low Tide	
			Weight (kg)	Number of Individuals	Weight (kg)	Number of Individuals
1	Pufferfish	*Tetraodontidae*	5.71	204	5.10	182
2	Horseshoe crab	*Limulidae*	0.44	148	0.51	172
	Total		6.15	352	5.61	354

The observation results showed variation in the numbers of pufferfish (Tetraodontidae) and horseshoe crabs (Limulidae) caught between high and low tide conditions. During the high tide phase, the total catch was 6.15 kg with 352 individuals, while during the low tide phase, the total catch was 5.61 kg with 354 individuals. The catch proportion is used to determine the percentage of catches for each type, thereby estimating the proportions of main catch, by-catch, and discards. The following table shows catch proportions for gombang fishing gear (Table 6).

Table 9. Catch proportion

No	Fish Name	Scientific Name	High Tide		Low Tide	
			Weight (%)	Number of Individuals (%)	Weight (%)	Number of Individuals (%)
1	Lomek	*H. nehereus*	71.43	34.62	74.59	37.15
2	Mantis shrimp	*Lysiosquilla maculata*	2.13	14.47	1.84	12.86
3	White shrimp	*Litopenaeus vannamei*	1.50	10.23	1.19	8.35
4	Red shrimp	*Parhippolyte uveae*	0.85	5.80	0.95	6.67
5	Ribbonfish	*Trichiurus lepturus*	10.96	12.39	8.83	10.26
6	Anchovy	*Thryssa mystax*	3.31	7.48	3.70	8.60
7	Biang	*Ilisha elongata*	2.68	1.13	2.44	1.06
8	Catfish (Duri)	*Ariidae*	2.79	0.99	2.20	0.80
9	Spanish mackerel	*Scomberomorini*	1.36	1.46	1.45	1.60
10	Giant freshwater prawn	*M. rosenbergii*	0.93	3.15	1.10	3.86
11	Pomfret	*Bramidae*	0.11	1.19	0.12	1.31
12	Pufferfish	*Tetraodontidae*	0.97	0.71	0.51	0.38
13	Horseshoe crab	*Limulidae*	0.07	0.51	0.05	0.36

The catch results show dominance of the main catch group, namely lomek, with an average total catch weight of 208.467 kg (71.43%) during high tide and 366.471 kg (74.59%) during low tide. Of the total weight, ribbonfish contributed the most among the by-catch, with an average proportion of 10.96% in the high tide phase and 8.83% during the low tide phase of the total catch. Shrimp commodities also support the catch structure, although with a relatively small proportion, ranging from 0.85% to 2.13% under high tide conditions and slightly decreasing or remaining stable under low tide conditions. In the discard category, there are two recorded types, namely pufferfish (*Tetraodontidae*) and horseshoe crabs (*Limulidae*). The catch amount of horseshoe crabs (Limulidae) is relatively low, with an average proportion of 0.08% during the rising tide phase and 0.05% during the ebb tide phase. Overall, the catch proportions indicate dominance of Lomek fish, indicating that this species' stock remains in the research waters and supports commercial-scale fishing activities. However, the relatively high by-catch rates for some shrimp species indicate the need to implement more selective fishing gear or modify gear to reduce by-catch in line with the principles of sustainable fisheries.

In addition to the composition aspect of the catch, environmental factors such as depth, temperature, salinity, and tidal currents also affect the distribution and abundance of target and non-target species (Hidayat et al., 2022). In this study, differences in catch between high and low tides indicate that target fish are more active and easier to catch during low tide. This is suspected because during low tide, fish tend to concentrate in shallower waters, making fishing operations easier (Nurdin et al., 2021). In addition, technical aspects such as mesh size and the way fishing gear is operated contribute to the high by-catch rate. Using fishing gear with an appropriate mesh size can increase catch selectivity, allowing small or non-target species to be avoided (Rachmawati & Nugroho, 2018).

3.3. Differences in Catch Results between Day and Night

The following is a stacked bar chart showing the composition of fish weight by time of catch, grouped by the top 10 fish and shrimp species. Analysis of fish weight composition based on the time of capture shows that the highest yield was obtained during the nighttime low tide with a total biomass of 377.20 kg, followed by the daytime low tide at 355.74 kg. Conversely, lower catches were found during the nighttime high tide (219.61 kg) and daytime high tide (197.31 kg). This indicates that the low-tide phase, both during the day and at night, yields

larger catches than the high-tide phase. During low tide, the volume and area of water decrease, causing aquatic organisms to gather in smaller areas. The ebb current then drives the biota towards deeper channels or towards the fishing gear, increasing the chance of being caught. The restriction of movement space and the tendency of organisms to follow the water flow during low tide also increase the potential for entanglement in passive fishing gear.

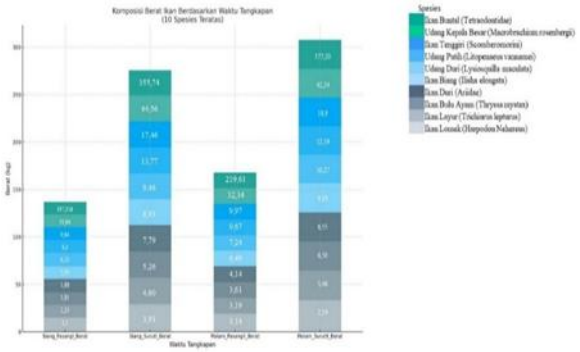

Figure 3. Stacked and bar diagram

4. Conclusions

The total main catch during the ebb and flood phases reached 1,215.44 kg with 45,494 individuals, or about 75.92% of the total catch. Meanwhile, by-catch was recorded at 324.71 kg with 20,914 individuals, or about 22.15%. The discard group contributed only 11.76 kg with 706 individuals, equivalent to approximately 1.06% of the total catch. Thus, the nighttime ebb phase is the period with the highest catch during gombang fishing gear operations.

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