Fisheries Journal, 15 (4), 2298-2306 (2025)
http://doi.org/10.29303/jp.v15i4.1689

EVALUATION OF THE DIMENSION OF DRIFT GILLNET ON THE COMPOSITION AND SELECTIVITY OF CATCH IN THE WATERS OF ATAPUPU, BELU REGENCY, EAST NUSA TENGGARA

Evaluasi Dimensi Jaring Insang Hanyut Terhadap Komposisi dan Selektivitas Hasil Tangkapan di Perairan Atapupu, Kabupaten Belu, Nusa Tenggara Timur

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(Received June 30th 2025; Accepted August 22th 2025)

ABSTRACT

The waters of Atapupu have significant potential in the fisheries sector and play an important role in improving the welfare of coastal communities in Belu Regency. This study aims to evaluate the dimensions of drift gill nets and analyze the composition and selectivity of the catch. A descriptive quantitative method was used through field observations, interviews, and data analysis. The drift gill nets examined had a mesh size of 3.175 cm and a length of 27 meters, with upper shortening of 50% and lower shortening of 48%. The catch was dominated by flying fish (74.09%), with bycatch consisting of halfbeaks, needlefish, and scads. The diversity index (H' = 0.68) and dominance index (C = 0.60) indicate that the nets have low selectivity, as they capture various fish species regardless of size or type. These findings are expected to serve as a basis for more selective and sustainable fishing gear management in the coastal waters of Atapupu.

Keywords: Atapupu, Catch Composition, Drift Gillnet, Gear Dimensions, Selectivity

ABSTRAK

Laut Atapupu memiliki potensi besar di sektor perikanan dan berperan penting *dalam* meningkatkan kesejahteraan masyarakat pesisir Kabupaten Belu. Penelitian ini bertujuan mengevaluasi dimensi jaring insang hanyut serta menganalisis komposisi dan selektivitas hasil tangkapan. Metode yang digunakan adalah deskriptif kuantitatif melalui observasi lapangan, wawancara, dan analisis data. Jaring insang hanyut yang diteliti memiliki mata jaring berukuran 3,175 cm dan panjang 27 meter, dengan shortening tali ris atas 50% dan bawah 48%. Hasil tangkapan didominasi oleh ikan terbang (74,09%), dengan tangkapan sampingan berupa ikan julung-julung, cendro, dan selar. Nilai indeks keanekaragaman (H' = 0,68) dan dominansi (C = 0,60) menunjukkan tingkat selektivitas jaring yang rendah karena menangkap berbagai

jenis ikan tanpa membedakan ukuran atau spesies. Temuan ini diharapkan menjadi dasar pengelolaan alat tangkap yang lebih selektif dan berkelanjutan di perairan pesisir Atapupu.

Kata Kunci: Jaring Insang Hanyut, Dimensi Alat Tangkap, Komposisi Hasil Tangkapan, Selektivitas, Atapupu

INTRODUCTION

The Atapupu Sea is known for its rich fisheries potential. This sector plays a crucial role in supporting the improvement of human resources in Belu Regency, both for those who live and those who depend on work in the coastal areas (Lopo et al., 2022). According to data from the Belu Regency Audit Board, the Atapupu region is located between 124-126°E and 9-10°S. It covers an area of 2,445.57 square kilometers. Strategically located, it borders the Ombai Strait to the north, borders Timor Leste to the east, and is surrounded by the regencies of South-Central Timor and North Central Timor to the west. To the south, the region faces the vast Timor Sea. Belu Regency serves as a major hub for small-scale fisheries, which play a vital role in supporting the local economy (Alamsah et al., 2025).

Small- and medium-scale fishermen prefer to operate gillnets because they are considered easy and can reach fishing areas such as bays, straits, and coastal waters (Samsul et al., 2024). Most fishermen in Atapupu rely on drift gillnets as their primary fishing tool. This fishing gear was chosen because it has proven effective in catching pelagic fish commonly found in local waters (Ismail et al., 2025). The operation of drift gillnets involves following the water current. Drift gillnets have a rectangular shape with a uniform mesh size throughout, so that each section of the net works equally in catching fish (Ruslan, 2012). This fishing gear is designed for use by fishermen, both in coastal and offshore waters, to catch small to large pelagic fish, depending on the type of fish they are targeting. When operated, the net will float or flow according to the direction of the current. The ends of the gillnet must be tied with a rope attached to the boat. Drift gillnets are very commonly used, but this fishing gear has obstacles in adjusting the design of the drift gillnet construction and the way it operates is adjusted to increase efficiency and catch yields in this fishing gear (Ismail et al., 2025). Fishermen in the Atapupu area are still relatively traditional, so in arranging the components of the drift gillnet, fishermen are guided by their experience. This fishing gear is very selective, but there is still a possibility of bycatch being caught when the net is operated (Saputra et al., 2021) in (Sadu et al., 2024). The ability of fishing gear to reduce or release catches that are not the main catch (by-catch) is called gear selectivity. This factor can be influenced by the design of the gillnet construction, which includes the size of the mesh, the elasticity of the thread that can affect the function of the net when used, the type and size of the thread material that plays a role in determining the strength and flexibility of the fishing net. Small pelagic fish species representing approximately 50% of fisheries production in Belu Regency include scad (*Selaroides* sp.), scad (*Decapterus* sp.), scad (*Sardinella* sp.), and flying fish (*Hirundichthys* sp.) (Pandie et al., 2021).

The construction and dimensions of the gillnet components can be adjusted by the fishermen. Before constructing or placing the drift gillnet components, fishermen must understand the target species, including their size, movement patterns, and migration patterns, so that the fishing gear can operate properly and effectively in the waters (Dermawati et al., 2019). Research related to the dimensions of drift gillnets in the Atapupu area has not been specifically studied, previous studies only partially discussed the construction design, operating techniques of drift gillnets, water characteristics, selectivity, catch composition, and different catch targets (Ismail et al., 2025). Therefore, this study will comprehensively examine the dimensions of fishing gear, composition, and selectivity of its catch in supporting sustainable catch productivity for fishermen in the Atapupu waters who use drift gillnet fishing gear.

METHODS

This research was conducted for three months, from April to June 2025, in the waters of Atapupu, Kenebibi Village, Belu Regency, East Nusa Tenggara. Tools and materials included drift gillnets as objects, meter rolls, rulers, mobile phones, scales, stationery, and laptops used for data processing. Sample selection was carried out purposively, based on certain criteria relevant to the research objectives. Primary data were collected through direct interviews with local fishermen who use drift gillnets as fishing gear. Data collection used primary data obtained from interviews with Atapupu fishermen. In addition, researchers were also directly involved in fishing activities to conduct field observations. Information collected included the size and shape of the drift gillnets, the type and quantity of catch, and how selective the gear was in catching fish. The collected data were then analyzed using the Sadhori formula (1984) and the Shannon-Wiener diversity and dominance index methods. The drift gill net size method is obtained using the Sadhori formula (1984) by calculating the upper and lower ris ropes using the formula H = $\frac{I}{L}$ x 100%, the depth of the net using the formula d = n x m $\sqrt{2\,S - S^2}$, the sinking power of the material and the buoyancy of the material using the formula S = W $(1 - \frac{1}{\rho})$, the number of floats needed to be installed along the ris rope using the formula, the number of floats used = $\frac{\text{Length of the upper ris rope}}{\text{Distance between floats}}$, the weight using the formula TB = buoyancy of the float + buoyancy of the upper ris rope + buoyancy of the lower ris rope, and the last is the extra buoyancy formula EB = $\frac{TB-TS}{TB}$ x 100%. To determine the catch composition, use the following formula:

$$\mathbf{p = \frac{ni}{N}\ X\ 100\%}$$

Where:
P : relative percentage of catch (%)
ni : number of species caught (i) (kg)
N : total number of fish species caught (kg)

The Shannon-Wienner diversity index and dominance index formulas use the following formulas:

1. Proportion of Catch

Proportion of Main Catch (HTU) (%)

$$\frac{\text{Number of HTU}}{\text{Total Catch}}\ \text{x } 100\%$$

Proportion of Bycatch (HTS) (%)

$$\frac{\text{Number of HTS}}{\text{Total Catch}}\ \text{x } 100\%$$

2. Diversity Index

$$H' = -\sum_{i=1}^{n} \left(\frac{ni}{N}\right) \text{In} \left(\frac{ni}{N}\right)$$

Where:
H' = Species diversity index

ni = Number of individual species caught
N = Total number of species caught.

3. Dominance Index

$$C = - \sum_{N}^{n} \left(\frac{ni}{N}\right)^2$$

Where:
C = Dominance value
ni = Number of individuals of the species caught
N = Total number of species caught.

RESULTS

Drift Gillnets

The drift gillnet fishing gear used in the Atapupu area is rectangular and made of monofilament, with a mesh size of 1.25 inches, 2,927 meshes, and an empty net weight of 900 grams. Atapupu fishermen use 80 pieces of empty net to construct the drift gillnet. The net body is 27 meters long with a top shortening of 50%. The top line is 46.4 meters long and has 98 rubber floats with a distance of 47 between them. The bottom line is 49.6 meters long, has a bottom shortening of 48%, and has 99 lead sinkers with a distance of 49 cm between them.

Catch Composition

A statistical analysis of six fishing trips in the Atapupu waters shows the following catch composition using drift gillnets:

Table 1. Catch Composition

Types of Fish	Composition of Catch Results
Hemiramphus sp.	22.8%
Selaroides sp.	0.63%
Tylosurus sp.	2.50%
Hirundichthys sp.	74.09%

Catch Proportion and Diversity Index to Determine Fishing Gear Selectivity

Findings regarding the level of fishing gear selectivity were obtained through analysis using the diversity index based on the Shannon-Wiener theory and the dominance index based on Simpson's theory (Odum 1996 in Wiyono 2009).

Table 2. Diversity Index

Species	ni	ni/N	In(ini/N)	(ni/N).In(ini/N)
Hemiramphus sp.	8,730	0.2277	-1.47973	-0.33693
Selaroides sp.	240	0.0062	-5.08321	-0.03151
Tylosurus sp.	960	0.0250	-3.68888	-0.09222
Hirundichthys sp.	28,400	0.7409	-0.29989	-0.22218

Table 3. Dominance Index

Types of Fish	ni	ni/N	$(ni/N)^2$
Hemiramphus sp.	8,730	0.2277	0.05184
Selaroides sp.	240	0.0062	0.000038
Tylosurus sp.	960	0.0250	0.000625
Hirundichthys sp.	28,400	0.7409	0.548932

DISCUSSION

Drift Gillnet Components

1. Rigging

The net's rigging structure consists of two main parts: the upper rigging, which serves as the float attachment point, and the lower rigging, which is equipped with a weight (Dermawati et al., 2019). Fishermen in Atapupu use various types of rope to string drift gillnets, all of which are made of polyethylene (PE). The upper and lower rigging uses 5 m PE rope, weighing 5 grams per meter. The net fibers used should be smooth and soft to avoid being easily detected by fish. Thin fibers are more difficult to see, increasing the chance of fish being caught. Furthermore, the net must have sufficient elasticity to withstand entangled or trapped fish, both while still in the water and when the net is hauled aboard the boat (Ruslan, 2012).

a. Buoy Rope

The rope used for the buoy rope is PE 5, 46.4 m long. The calculation of the Sadhori formula, 1984, that the standard length of the float rope is 46.4 according to the actual length of the gill net used in the Atapupu area. According to Martasuganda (2008) in Kalsum et al. (2019). The installation of the ris rope is carried out in various patterns as an effort to support the smooth fishing process, facilitate the identification of the type of fish to be caught, and help increase the level of selectivity of the fishing gear. Generally, the longer the ris rope used on the net, the greater the chance of getting a larger catch (Suryana et al., 2013). This float rope is inserted between the meshes, at the end of the net will be extended by 1 meter which is useful for connecting 1 net head to 1 other net head, and is used to tie a float made of styrofoam as a marker for drifting gill nets when used. According to Martasuganda (2005) in Ruslan (2012), the upper rope from the end of the gillnet body is extended by 30-60 cm to allow for connection between pieces.

b. Weighted Rope

The weighted rope is made of the same base material and has a larger diameter than the float rope. The weighted rope is 49.6 m long. Calculations using the Sadhori (1984) formula yield a weighted rope length of 40.06 m. The length of each rope can be determined based on the installed net length, resulting in different lengths for the upper and lower ropes (Mardiah & Pramesthy, 2019). This weighted rope serves to secure the webbing during towing (Kim, 2003 in Mardiah & Pramesthy, 2019). The purpose of the weighted rope is to make it longer than the float rope so that the net can be properly stretched in the water (Ruslan, 2012). The Sadhori 1984 formula calculates that the lower ris line is shorter, but the actual length of the upper ris line of the drift gill nets used by Atapupu fishermen is shorter than the lower ris line. The net length is adjusted to facilitate handling on board, taking into account conditions during fishing operations and the availability of supporting facilities. Furthermore, the determination of net length is also influenced by the fishing method used and the capacity of the operating vessel (Ruslan, 2012).

2. Dimensions of Atapupu Fishermen's Drift Gillnets

The principle of drift gillnets is that schooling fish will collide with the net wall when set on the water's surface, causing the target catch to become entangled, tangled, or entangled (Dermawati et al., 2019). The drift gillnets used by Atapupu fishermen have a top shortening of 50% and a bottom shortening of 48%. This data aligns with Sudirman and Mallawa (2004) who stated that shortening influences the catch. The shortening on the top line is intentionally made larger than the bottom line, resulting in the bottom line being longer than the top line. This creates a net shape that supports fishing efficiency. The goal is to ensure optimal fishing gear spread during use in the water, thus maintaining stability and functioning effectively. Martasuganda (2005) in Dermawati et al. (2019) It is recommended that the level of contraction

on the upper ris rope be made slightly larger than on the lower ris rope, so that the net can maintain its shape and position optimally when used in the waters. The shortening value directly affects the height or depth of the net, where the greater the shortening value, the easier it is for fish to be trapped and entangled in the net. In general, there are two main impacts of the application of shortening: the length of the net becomes shorter, but the depth actually increases (Nelwida et al., 2019). The height of the drift gill net in the Atapupu area is 3.5 m. A statement from Nomura & Yamazaki (1978) influences the shortening value on the height or depth of the net where the greater the depth of the net, the greater the value (d). The buoyancy of the upper ris rope is 0.26 g while the lower ris rope is 0.26 g. The length of the upper ris rope used by Atapupu fishermen is shorter than the lower ris rope. According to Nomura & Yamazaky (1975) in Engelbert et al. (2024), net efficiency is influenced by several factors, including the size or dimensions of the net material used and the hanging ratio or net deployment ratio. These two aspects play a crucial role in determining net performance during the fishing process. The depth of a drift gillnet is adjusted to the vertical distribution of fish. In a single section of a drift gillnet, the buoyancy force generated must be greater than the sinking force. The magnitude of these two forces will affect the net's tension during use. The sinking force itself can be derived from the weight of the net, the line, or the type of weight used in the fishing gear (Ruslan, 2012).

3. Composition of the Catch

Fishing activities using drift gillnets are dominated by flying fish (74.09%) and julung-julung (22.8%). During this fishing operation, bycatch of cendro and scad (2.50%) and scad (0.63%), respectively.

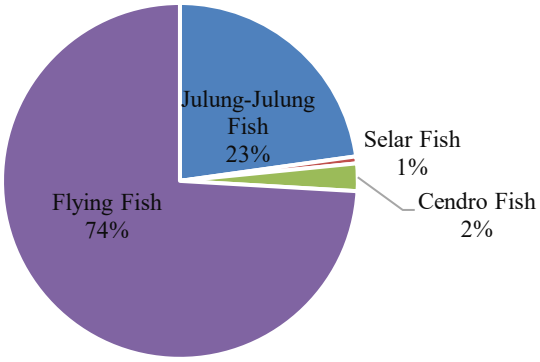

Figure 1. Catch Composition Graph

4. Catch Selectivity

Determining the selectivity of fishing gear can be determined by calculating the catch proportion, diversity index, and dominance index.

a. Catch Proportion

The main fish caught was flying fish, with 28,400 caught in 6 trips, representing 74.09% of the total catch. According to Lee (2016) in Nahak et al. (2023), flying fish fishing activities began in mid-September and continued until the end of April. The largest bycatch caught in drift gillnets was the gillnet, with 8,730 fish, representing 22.8% of the total catch. According to Ninef et al. (2019) in Balukh et al. (2020), the gillnet is a relatively common small pelagic fish species. The fishing season typically occurs twice a year, from September to November and again from March to May. According to Fahik et al. (2022) in Nahak et al. (2023), catch fluctuations are influenced by changes in seasonal weather conditions, which impact fishing

times and directly influence fishing activity. Based on the proportion of catch obtained, the drift gillnets used in the Atapupu area demonstrate a good level of selectivity. This is evident from the predominance of primary catches over bycatch, thus categorizing this fishing gear as quite selective for its primary target fish, with a value of ≥60% according to Suadella (2004) in Dewanti et al. (2023). The catch proportion calculation is conducted to compare the amount of primary catch to bycatch of a fishing gear. This method can determine the effectiveness and selectivity of the gear in catching the target fish species.

Figure 2. Catch Proportion Graph

b. Diversity Index

The catch using drift gillnets by Atapupu fishermen shows a variety of fish species caught during the fishing process, with a diversity index (H') of 0.68. This value indicates that although species diversity is high (because H' ≥ 0.1), the selectivity of this fishing gear is relatively low, as the gear does not specifically catch certain fish species (Dewanti et al., 2023). Paramesty et al. (2020) in Yuliana et al. (2024) state that a fishing gear can be considered highly selective if:

c. Dominance Index

Based on Simpson's Dominance Index calculations (Odum 1996 in Wiyono 2009), the drift gillnet fishing gear used by fishermen in Atapupu shows a dominance value (C) of 0.60. A high C value is considered when C' ≥ 0.5. The drift gillnet catches used in the Atapupu area showed that C ≥ 0.5, with a Simpson dominance index value of 0.60, indicating high dominance. Flying fish dominate the drift gillnet catches in the Atapupu area, but bycatch such as julung-julung, scad, and cendro fish are fish that are accidentally entangled and trapped. Fishermen in the Atapupu area use nets with a mesh size of 3.175 or 1.25 inches. This is what makes the fishermen's catches have different types and sizes (Yuliana et al., 2024).

CONCLUSION

This rectangular drift gillnet has 2,927 1.25-inch meshes and reaches a length of 27 meters. The net is designed to open horizontally in the water through a shortening system on the upper and lower lines equipped with floats and weights. In its use, flying fish are the main catch, while julung-julung, selar, and manuk are recorded as bycatch. The selectivity level of this net is relatively low, with a diversity index of 0.68 and a dominance index above 0.5, indicating the dominance of certain species in the catch.

ACKNOWLEDGEMENT

We would like to thank all our colleagues, supporters who have provided input and parents who have been directly involved in the preparation of this article.

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