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Level of Environmental Friendliness of Bottom Gillnet Fishing Gears in Krueng Raya, Sabang City

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ABSTRACT

Bottom gillnets is one of the most commonly used fishing gear by fishermen because of its ease of use and relatively affordable investment costs. The use of this fishing gear has the potential to cause negative impacts on the aquatic environment. The purpose of this study is to analyze the environmental friendliness of bottom gillnets at Krueng Raya Fish Landing Place in Sabang City. The research method was conducted through observation and structured interviews with fishermen based on a scoring system for the environmental friendliness of fishing gear. The sampling method in this study used purposive sampling. The results of the study indicate that bottom gillnets are classified as less environmentally friendly fishing gear. The main problem occurs due to the low selectivity of fishing gear towards the catch.

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1. Introduction

Sabang is located in the westernmost region of Indonesia, holding great potential in the marine economy sector and considerable natural resources (Setyawati et al., 2021). Food availability plays a crucial role in ensuring the accessibility and utilization of food by the community. The capture fisheries sector is a major provider of animal food, contributing half of total fish production (Susanto et al., 2020). The Krueng Raya fish landing site is one of the active landing sites in Sabang. Fishing activities in this area use various fishing gear, one of the fishing gear that is actively operating is the bottom gillnet. Advances in fishing technology continue to increase, this has a significant positive impact, but also has the potential to cause negative effects (Sanger et al., 2019; Azis, 2021).

The large potential of fishery resources in the sea is accompanied by various threats, such as fishing practices that cause overfishing and destructive fishing, which have the potential to disrupt the sustainability of aquatic ecosystems (Maula et al., 2025). The main characteristics of fish resources are open access and common property, meaning their use is open to all

parties under shared ownership. Uncontrolled competition in fishing activities can lead to overfishing of fish stocks in these waters (Atikasari, 2021).

Fish resources are renewable natural resources, meaning they have the ability to replenish themselves within a certain period of time. The process of renewing natural resources takes a long time. If they are overused, exceeding their natural regeneration capacity, they can become non-renewable (Salamah et al., 2012; Faradizaa et al., 2019). Effective fisheries resource management is achieved by utilizing fish populations optimally without depleting available stocks. Continuous fishing without considering the resource's ability to regenerate can threaten the sustainability and preservation of fish resources (Kartini et al., 2021).

Gillnets are passive fishing gear, meaning their operation does not cause damage to aquatic life. However, they have a relatively low level of selectivity, potentially producing greater bycatch than main catch (Mardhan et al., 2019; Soumokil et al., 2023). The implementation of environmentally friendly fishing activities must be a primary focus when using fishing technology. This can be assessed from the ability of a fishing gear to the water floor, the potential for loss of fishing gear, and the impact on fish resource populations. Differences in the characteristics and operating methods of fishing gear in various regions mean that not all can be classified as environmentally friendly. Based on the problems described above, it is necessary to assess the environmental friendliness of bottom gillnets using the FAO 1995 assessment guidelines.

2. Research Methodology

This research was conducted at the Fish Landing Pier in Krueng Raya Village, Sabang City. This research was conducted from September to November 2025. The data used are primary data and secondary data. Primary data is collected directly by researchers, while secondary data comes from data that is already available (Mazhar et al., 2021). The research method used is a descriptive method with a survey, observation and structured interview approach conducted by distributing questionnaires to respondents. The results of this analysis will provide a comprehensive overview in line with the topic being researched (Ratna, 2015; Nazir, 2014). The sampling method used to assess the environmental friendliness of bottom gillnets was purposive sampling. Respondents were selected based on specific criteria, namely bottom gillnet fishermen, DKP staff, teupin leaders, and panglima la'ot , with a total of 25 people (Sugiono, 2015).

Data analysis of the environmental friendliness of bottom gillnets includes scoring analysis for each criterion of environmental friendliness of fishing gear (FAO, 1995). The environmental friendliness criteria for fishing gear have been formulated into 9 environmental friendliness criteria and further divided into several sub-criteria that can be used as scoring parameters. The weight (value) given is a value of 1 (very poor) to a value of 4 (very good) for each sub-criterion (Monintja & Yusfiandayani, 2001). The final result is then calculated using the formula from (Sima et al., 2014), as follows.

$$X = \frac{\sum X_n}{N}$$

Information:
X = Environmental friendliness score
$\sum X_n$ = Total amount of weight value
N = Total respondents

After obtaining the final score from the environmental friendliness assessment above, the score will then be classified based on the environmental friendliness categories described by (Kurohman et al., 2018).

Table 1. Classification of Environmental Friendliness Categories

Environmental Friendliness Category	Score Range
Very Environmentally Friendly	28 – 36
Less Environmentally Friendly	19 – 27
Not Environmentally Friendly	10 – 18
Very Not Environmentally Friendly	01 – 09

Source: (Kurohman et al., 2018)

3. Result and Discussion

Results

Based on the results of the analysis, the overall average score for the environmental friendliness of bottom gillnets was 27. Based on the classification presented by Kurohman et al. (2018), the bottom gillnet operated by TPI Krueng Raya Kota Sabang is classified as a less environmentally friendly fishing gear. The average environmental friendliness rating for bottom gillnets for each criterion can be seen in Table 2 below.

Table 2. Environmental Friendliness Level of Bottom Gillnet Fishing Gear

No	Criteria	Average
1.	High Selectivity	1
2.	Non-Destructive to Habitats	2
3.	Produces High Quality Fish	3
4.	Safe for Fishermen	4
5.	Produces Products Safe for Consumers	4
6.	Low By-Catch	2
7.	Impact to Biodiversity	3
8.	Does not Catch Protected Fish Species	4
9.	Socially Accepted	4

The table above shows that the lowest average value is in the high selectivity category with an average value of 1, which means that bottom gillnets can catch more than three fish species with widely varying sized variations. Rusmilyansari (2012) states that gillnets are a type of passive fishing gear that does not damage aquatic biological resources during operation, but has a low level of selectivity. Gillnets can catch many types of fish and tend to produce high bycatch compared to main catch (Naila et al., 2025; Firnando et al., 2025). Meanwhile, the criteria of being safe for fishermen, producing products that are safe for

consumers, not catching protected fish species, and being socially accepted received the highest average score of 4.

Discussion

The bottom gillnet fishing operation at the Krueng Raya fish landing site in Sabang City is conducted twice a day, in the morning and afternoon. Setting and hauling the nets takes 2-4 hours per trip. The mesh size used by bottom gillnet fishermen is 2 inch. Based on the results of interviews with respondents, the average response regarding high selectivity criteria was 1, meaning that bottom gillnets can catch more than three species of fish with widely varying sizes. The main catch of bottom gillnets is pisang-pisang fish (Caesionidae sp.), but because this fishing gear is passive and operates by waiting for fish to become entangled in the net, the fish caught often do not match the expected target. This is similar to research conducted by Katiandagho et al. (2023), which found that bottom gillnets with a mesh size of 2 inch were less selective in terms of catch. Gillnet mesh size is a factor that greatly influences catch size.

Low By-Catch Criteria, bottom gillnets do not meet the criteria because the by-catch includes multiple species, and some of these species are marketable. According to Syifannur (2025), the use of bottom gillnets often causes unavoidable bycatch, including low-value fish, non-target species, juvenile fish, protected species, and negative impacts on marine ecosystems. There are four ways fish can be caught by gillnets: gilling (becoming entangled in the gill cover), wedging (the net becoming stuck behind the gill cover and reaching the largest part of the body or around the first dorsal fin), snagging (becoming entangled in the mouth or around the upper jaw or abdomen), and entangling (becoming entangled in the net) (Brinkhof et al., 2023).

Operational bottom gillnets can cause habitat damage in small areas with an average value of 2. Bottom gillnets operated on coral reefs have the potential to cause damage to the aquatic environment. The use of additional weights and anchors can potentially snag on coral reefs, thereby increasing the likelihood of aquatic habitat degradation (Simbolon et al., 2022). According to Tethool et al. (2022), the use of gillnets in coral reef waters has a high potential for the nets to become entangled in the coral on the seabed, which not only causes damage to the coral but also has a negative impact on fish resources.

The catch obtained is dead fish that are still fresh, after being landed the fish will be taken directly to the market, this shows that the criteria for producing high quality fish gets a score of 3. Nanga et al. (2024) explained that gillnet catches are handled immediately after capture by placing the fish in a hold or other storage container equipped with ice cubes to maintain the quality of the catch. According to Diarjo et al. (2025), the duration of net immersion also affects the quality of gillnet catches. The operation of bottom gillnets meets the criteria of being safe for fishermen and producing products that are safe for consumers, receiving a score of 4. Based on information from fishermen, bottom gillnets were previously able to produce fish in a short time, but now show a decline in catch. Bottom gillnets that are operated can cause the death of several species and do not damage the habitat, so they do not meet the criteria for impact on biodiversity, receiving a score of 3. According to Surbakti

& Basri (2024), the use of gillnets has a minimal impact on biodiversity because their operation is passive.

The criterion of not catching protected fish species received a score of 4, based on the results of interviews indicating that bottom gillnets never catch protected fish. The criterion of social acceptance received a score of 4. A fishing gear can be classified as socially acceptable if it is economically viable, has a relatively low investment cost, and does not conflict with the cultural values of the community or applicable regulations (Pramesthy & Mardiah, 2019). However, some fishermen stated that bottom gillnets are prone to damage, such as torn nets, which can potentially cause economic losses for fishermen.

4. Conclusion

Based on the results of the research that has been carried out, it indicates that the bottom gillnet fishing gear is classified as less environmentally friendly fishing gear, because of its low level of selectivity towards the catch with an overall score of 27. Therefore, a review of the net selectivity is needed as an effort to protect non-target catches and maintain ecosystem sustainability.

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