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Analysis Of The Level Of Environmental Friendliness Of Boat Trawls Based On Catch Selectivity At Carocok Beach Fishing Port Tarusan Beach, West Sumatra

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Abstract— Carocok Tarusan Coastal Fishing Port (PPP) is a regional landing port under the supervision of the West Sumatra Provincial Marine and Fisheries Service. Bagan boats are the most widely used fishing fleet. This study aims to determine the level of environmental friendliness of Bagan Boats based on the selectivity of the catch at the Carocok Tarusan coastal fishing port. This study aims to analyze the level of environmental friendliness of bagan boat fishing gear based on the selectivity of the catch at the Carocok Tarusan Coastal Fishing Port (PPP), West Sumatra. The research method used was a survey with sampling using the purposive sampling method on bagan boats measuring 1-10 GT, 11-20 GT, and 21-30 GT. The results showed that ship size had a positive effect on the total catch, with larger ships producing more catches. Balaki banana tuna dominated the catch, reaching 89% of the total catch. The suitability of the catch varied, with ships 1-10 GT having the highest percentage of catchable fish, namely 68%. In general, the bagan boat fishing gear at PPP Carocok Tarusan is categorized as environmentally friendly based on selectivity criteria, with relatively high final values for all vessel sizes. This study indicates that efforts to increase the selectivity of bagan boat fishing gear at the Carocok Tarusan Coastal Fishing Port can ensure the sustainability of fisheries.

Keywords— Level of Environmental Friendliness, Selectivity, Boat Chart, Coastal Fishing Harbor

I. INTRODUCTION

Carocok Tarusan Beach Fishing Port (PPP) is a regional landing port under the supervision of the Department of Marine Affairs and Fisheries of West Sumatra Province. This port is located in the State Fisheries Management Area of the Republic of Indonesia (WPPNRI) 572 precisely in the area west of Ampang Pulai Koto XI Village, Pesisir Selatan Regency, West Sumatra (UPTD PPP Carocok Tarusan, 2014). It is known that the Carocok Tarusan coastal fishing port (PPP) has several types of fishing gear in operation, namely, boat bagan, Gillnet, Payang, and tonda. According to research data from Armarenti et al (2024) there are several fishing fleets operating in the Carocok Tarusan Coastal Fishing Port (PPP), namely 359 units, with 171 units of boat bagan fishing gear, 113 units of tonda, 45 units of payang, and 30 units of gillnet.

Based on the provisions of FAO (1995) environmentally friendly fishing gear is a fishing gear that meets nine criteria including having high selectivity, not destroying habitats, producing high quality fish, not endangering fishermen, caught fish does not harm consumers, low by-catch, no impact on biodiversity, not catching protected fish and socially acceptable. Referring to this statement, it can be explained that a fishing operation requires environmentally friendly fishing gear for the sustainability of fisheries, especially

the selectivity of a fishing gear. Selectivity is one of the main categories in determining the level of environmental friendliness of fishing gear, the importance of selectivity of fishing gear is because it can avoid overfishing where the fishing gear can select target catches based on type and size. According to Sudirman et al., (2011) a fishing gear is said to have high selectivity if in operation it only catches target fish of a certain size. In this case, the selectivity of the boat bagan is a fishing gear that attracts attention because it catches a large number of fish.

The boat chart is a fishing tool that is classified into a group of lift nets, the boat chart is also a fishing gear that utilizes lights in the fishing process, besides that the boat chart also produces a large number of catches with various types of pelagic fish (Adam et al., 2018). According to Soleha, et al., (2021) The catch on the Bagan boat fishing gear is several types, such as skipjack (Katsuwonus pelamis), cumicumi (Loligo), fly fish (Decapterus), mackerel (Rastrelliger), anchovies and tuna (Euthynnus affinis). The waters in the Carocok Tarusan Coastal Fishing Port (PPP) area are waters that have abundant fishery resources, these waters are a place for various types of fish, both pelagic fish and demersal fish from the main and bycatch. Based on the description above, it is necessary to conduct research on the level of environmental friendliness of boat mules based on the selectivity of catches in the Carocok Tarusan Coastal Fishing Port, because boat mules are the most widely operated fishing gear in the waters of the Carocok Tarusan Coastal Fishing Port. This study aims to determine the level of environmental friendliness of Bagan Perahu based on the selectivity of catches in the Carocok Tarusan coastal fishing port.

II. METHODS

A. *Place and Time*

This research was conducted at Carocok Tarusan Beach Fishing Port, West Sumatra, from December 15, 2024 - January 15, 2025.

B. *Materials and Equipment*

The material in this study is the catch of bagan boats consisting of the main catch, and bycatch. The equipment used in this research is a boat bagan consisting of sizes 1 - 30 GT, cutting mat, camera, and stationery.

C. *Reseach Methods*

The method used in this research is the survey method, which is to make direct observations in the field and interview boat bagan fishermen at the Carocok Tarusan Coastal Fishing Port, West Sumatra. The sampling method uses Purporsive sampling method. Kusuma (2014) explains that purposive sampling is a sampling method based on certain criteria set by researchers objectively. These criteria can also provide reasons why a study uses a certain number of samples. with predetermined criteria, namely the criteria for boat bagan vessels with sizes 1 - 10 GT, 11 - 20 GT, and 21 - 30 GT each totaling 11 vessels, and also the dominant catch of boat bagan caught such as tuna and anchovies.

III. DATA ANALYSIS

A. *Length Measurement of Main Catch*

Fish samples from the boat bagan catch will be measured the length of each type and grouped into several lengths to see which fish from the boat bagan catch are worthy of being included in the catchable category. In determining catchable fish, namely through scientific journals in accordance with the types of fish in the research sample. Wudji et al., (2013), explain how to calculate the percentage (%) for fish worth catching or even not worth catching is:

$$Percentage\ (\%) = (Number\ of\ catchable\ fish) / (Amount\ number\ of\ samples) \times 100$$

$$Percentage\ (\%) = (Number\ of\ fish\ not\ fit\ for\ fishing)/(Amount\ number\ of\ samples) \times 100$$

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B. Abundance of Species

To determine the species composition of Bagan boat catches and the frequency of occurrence of Bagan boat catches during 1 (one) month of fishing according to data per fishing trip using the following formula (Hadinata et al, 2015):

$$pi = \frac{\text{ni}}{\text{N}}\ x\ 100\%$$

Description:

pi: Relative abundance of catch (%)

ni : Amount species catch (Kg)

N : Amount catch (Kg)

C. Percentage of Maincatch, and Bycatch

The percentage of main catch, and bycatch from the boat bag catch was measured by weight per total catch using the Akiyama formula (Setiabudi et al., 2019) as follows:

Main Catch (%) = Main Catch / Amount Catch x 100%

By Catch (%) = By Catch / Amount Catch x 100%

D. Environmental Friendliness Level Analysis

Fishing gear that is said to be environmentally friendly is when the bycatch is minimum and prioritizes the main catch. The friendliness factor is used as an assessment to see the level of environmental friendliness in a fishing unit (Bintang et al, 2015). In this case it is necessary to analyze the level of environmental friendliness of boat bagan fishing gear through the criteria that have been determined.

Table 1. Catch Selectivity by Level of Environmental Friendliness

Observation	Percentage (%)	Criteria	Value
Main Catch (%)	81-100	Very Eco-Friendly	4
	61-80	Environmentally Friendly	3
	41-60	Less Environmentally Friendly	2
	1-40	Not Environmentally Friendly	1
Eligibility of main catch (%)	81-100	Very Eco-Friendly	4
	61-80	Environmentally Friendly	3
	41-60	Less Environmentally Friendly	2
	1-40	Not Environmentally Friendly	1
By Catch (%)	1-40	Very Eco-Friendly	4
	41-60	Environmentally Friendly	3
	61-80	Less Environmentally Friendly	2
	81-100	Not Environmentally Friendly	1

Conclusion:

If the total score is between 3 and 5: Not environmentally friendly

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If the total score is between 6 and 8: Less environmentally friendly

If the total score is between 9 and 11: Environmentally friendly

If the total score is 12 : Very environmentally friendly

Source: Modified from (Yuda et al., 2012)

In determining the level of environmental friendliness based on the selectivity of catchment results, we also use the formula (Ilan et al., 2022):

$$X = Xn / N$$

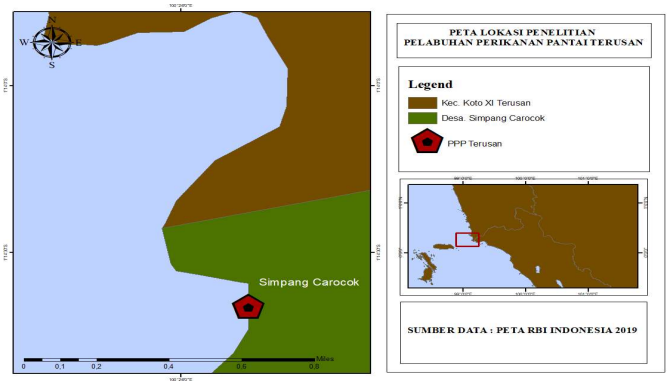
Description:

X : Weight value

Xn: Amount number of weighted values from the data obtained

N : Amount respondents

IV. RESULTS AND DISCUSSION



Carocok Tarusan coastal fishing port is one of the three fishing ports in West Sumatra Province built in 1997 with the designation of Fish Landing Base (PPI) with an area of 2.19 Ha. In line with the facilities owned by PPI became a coastal fishing port (PPP) and was inaugurated by the Minister of Marine Affairs and Fisheries in 2003. The distance between the location of the Fishing Port and the sub-district center is 4 km, to the center of Pesisir Selatan regency is 20 km and to the center of the capital of West Sumatra Province, namely Padang City is 65 km. Carocok Beach Fishing Port is a Regional Technical Implementation Unit (UPTD) at the West Sumatra Province Marine and Fisheries Service. UPTD Carocok Tarusan Beach Port has the main task of carrying out as operational technical activities and technical activities supporting the agency in the field of coastal fishing ports.

Carocok Tarusan coastal fishing port (PPP) has several fishing fleets, namely, bagan boats, gillnet boats, and also tonda fishing boats. However, of the several fishing fleets, boat nets are the most widely used fishing fleet by local fishermen. Bagan boats are very promising fishing gear for fishermen because of the large number of catches, while the types of fish obtained from the operation of bagan boat fishing gear are pelagic fish. The fish caught by the bagan boat at the Carocok Tarusan Beach Fishing Port (PPP) are various types of anchovies, balaki banana tuna, tembang and also peperek.

A. Catch

The catch is the species of fish and aquatic biota caught from a fishing gear used by fishermen, either the main catch, bycatch, or discard. Ramadhan (2008) explains that the catch is the number of caught fish species and other aquatic animals caught during fishing, the catch can be divided into two, namely the main catch and bycatch.

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Table 2 Composition of Bagan Boat Catches by Boat Size

Catch		Boat Size			Conclusion
Lokal Name	**Scientific Name**	**1-10 GT**	**11-20GT**	**21-30GT**	
Tongkol Pisang Balaki	*Auxis rochei*	415	745	11703	Main Catch
Teri Belang	*Stolephorus indicus*	266	266	446	Main Catch
Teri Putih	*Anchoa hepsetus*	135	75	66	Main Catch
Peperek	*Leoignathus equulus*	86	150	106	By Catch
Cumi - Cumi	*Loligo sp.*	0,614	0	0	By Catch
Talang - Talang	*Scomberoides lysan*	0	0	4,2	By Catch
Black Marlin	*Istiompax indica*	0	0	42,7	By Catch
Amount (Kg)		902,614	1.236	12.367,9	

The type of fish caught by bagan boats in a body of water generally consists of small pelagic fish, some of these fish such as tuna and anchovies which are mostly caught by bagan boat fishing gear (Amrullah et al., 2022). Based on Table 2, all boat bagan vessels of various GT sizes in Carocok Tarusan Coastal Fishing Port (PPP), the larger the size of the vessel, the more the total catch increases. Research (Yulianto et al., 2021) says that ship size has a positive effect on catch. The larger the size of the ship, the farther the fishing area will be and the more catches. This is indicated by the boat chart with a size of 1 - 10 GT, which obtained a total catch of 902.614 Kg with the types of fish, namely Tongkol pisang balaki, Teri belang, teri putih, peperek, talang-talang and black marlin. Chart boats with a size of 11 - 20 GT obtained a total catch of 1,236 Kg with fish species namely tongkol pisang balaki, teri belang, teri putih, and peperek. Bagan boats with a size of 21 - 30 GT obtained a total catch of 12367.9 Kg with fish species namely tongkol pisang balaki, teri belang, teri putih, peperek, talang-talang, and marlin.

From all categories of bagan boats that have been determined, it is explained that tongkol pisang balaki is the most caught fish with a total of 11,703 kg from bagan boats of 21 - 30 GT. In contrast to the research of Kadir et al., (2019) which states that the type of catch of bagan boats shows that the dominant fish caught is anchovy as much as 86.295% of all types of fish caught. However, according to Sudirman & Natsir (2011) anchovies are very responsive to light so they are concentrated at the surface, while several other small pelagic fish species are at a depth of 20-30 meters. The gathering of anchovies around the boat chart will trigger the gathering of other fish with larger sizes that can be caught by the boat chart fishing gear.

Table 3. Eligibility of catch of 1 - 10 GT

Species	Boat 1 - 10 GT	
Local Name	Worth A Catch	Not Worth A Catch
Tongkol Pisang Balaki	108	168
Teri Belang	249	62
Teri Putih	135	4
Amount (Tail)	492	234
Percentage	68%	32%

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Table 4. Eligibility of catch of 11 - 20 GT

Species	Boat 11 - 20 GT	
Local Name	Worth A Catch	Not Worth A Catch
Tongkol Pisang Balaki	67	196
Teri Belang	183	78
Teri Putih	106	11
Amount (Tail)	356	285
Percentage	56%	44%

Table 5. Eligibility of catch of 21 - 30 GT

Species	Boat 21 - 30 GT	
Local Name	Worth A Catch	Not Worth A Catch
Tongkol Pisang Balaki	135	297
Teri Belang	147	68
Teri Putih	63	14
Amount (Tail)	492	234
Percentage	48%	52%

The measurement of the length of the fish caught is used to determine the eligibility of the main catch from the boat lift net fishing gear, the main catches are tongkol pisang balaki, teri belang, and teri putih. According to (Asrial & Rosadi, 2020), the eligibility of catching tongkol pisang balaki, which is often referred to as tongkol lisong, is seen from the length of maturity of the tongkol lisong that is suitable for catching, namely the FLm size of more than 24.63 cm. for teri belang, the length of suitable for catching ranges from 6.2 to 9.2 cm (Firia et al., 2021). Meanwhile, for teri putih, it refers to Fish Base (Lm = 6.0 cm) (Dewanti et al., 2023).

Based on the image above, the most catchable fish were obtained from 1-10 GT with a total of 68% of the total catch from 1-10 GT size bagan boats. For 11-20 GT size bagan boats, the total catchable fish was 56%, in contrast to the two categories of bagan boats above, 21-30 GT size bagan boats only got 48% of catchable fish, where more uncatchable fish were caught on the bagan boats.

B. Catchability

The relative abundance of fish caught is a method that can determine the dominant fish species caught from the boat net at the Carocok Tarusan Coastal Fishing Port (PPP). Relative abundance can also be interpreted as a comparison of the abundance between one species and another species from the boat net catch (Saleky et al., 2021). By knowing the abundance of the fish species caught, it can also be known which fish dominate the catch from the boat net with a ship size of 1 - 30 GT at the Carocok Tarusan Coastal Fishing Port (PPP).

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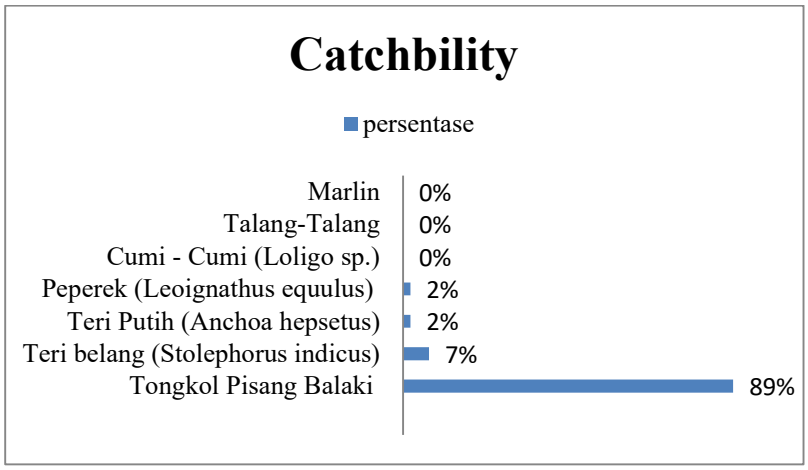

Teri and peperek dominate the catch of boat nets. teri, barracuda peperek, and sardines have high abundance, both from catches with fixed nets and boat nets (Surbakti & Sir, 2021). Based on Figure 5. It is explained that there are seven species of fish trapped in the boat net fishing gear, including tongkol pisang balaki, teri belang, teri putih, peperek, cumi-cumi, talang-taang, and black marlin. Of the seven species of fishtongkol pisang balaki is the dominant fish caught with 89% of the total catch. This is indicated by the statement of Eli et al., (2021) which states that the total catch of mackerel from the total catch of boat nets is 57% of all types of pelagic fish caught.

C. Eco-Friendliness Level of Boat Chart

The selectivity of a fishing gear is seen in the design parameters of a fishing gear, such as the mesh size, elasticity of the thread used, type of material and size of thread, hanging ratio and also the speed of pulling the fishing gear (Dewanti et al., 2020). Selectivity is the nature of fishing gear that catches fish of a certain size and species from the distribution of the population. This property mainly depends on the principle used in fishing and also depends on the design parameters of the fishing gear such as the mesh size (Tambunan, 2010). In this case, the mesh size of the boat bagan at the Carocok Tarusan Coastal Fishing Port showed that ships measuring 1 - 30 GT used the same mesh as the waring material and measuring 0.5 cm.

Table 6. Catch Selectivity by Level of Environmental Friendliness

Observation	Boat 1 - 10 GT		Boat 11 - 20 GT		Boat 21 - 30 GT	
	Score	Value (%)	Score	Value (%)	Score	Value (%)
Main Catch	39	90	41	88	42	99
Eligibility of main catch (%)	33	68	24	56	18	48
By Catch	42	10	44	12	44	1
Amount	114		109		104	
Amount of category values	10,36		9,9		9,45	

Based on the observations made, it was found that the proportion of the main catch was greater than the proportion of the bycatch. According to Dewanti et al., (2023) the proportion of the main catch (HTU) and bycatch (HTS) is one of the indicators in determining the selectivity of fishing gear. Determination of the selectivity of this fishing gear is done by calculating the proportion of weight and number of catches (Dewanti et al., 2023). According to Atikasari, (2021) the high level of selectivity can be seen from the percentage of the main catch (HTU), bycatch (HTS). Based on Table 4, it can be explained that the boat lift net fishing gear at the Carocok Tarusan Coastal Fishing Port is categorized as environmentally friendly, because it only gets a final score ranging from 9.45 - 10.36 from three boat lift net categories, namely sizes 1 - 10 GT, 11 - 20 GT, and 21 - 30 GT. According to Kaduk and Mustafa, (2020) the

selectivity of a fishing gear includes selective properties regarding the types and sizes of fish that are suitable for catching as the target of fishing.

INFERENCE

Based on the results of the research conducted, it can be concluded that the size of the bagan boat has an effect on the total catch. The larger the size of the boat, the higher the total catch obtained. This is likely due to the ability of larger boats to reach wider fishing areas. Banana skipjack tuna dominates the bagan boat catch at the Carocok Tarusan Coastal Fisheries Port (PPP), especially on bagan boats measuring 21-30 GT. The level of catch eligibility varies based on boat size, with bagan boats 1-10 GT having the highest percentage of catchable fish (68%), and bagan boats 21-30 GT having the lowest percentage (48%). Based on the selectivity assessment criteria, the bagan boat fishing gear at the Carocok Tarusan Coastal Fisheries Port is generally categorized as environmentally friendly. This is indicated by the relatively high final selectivity value for all boat sizes (ranging from 9.45 - 10.36).

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