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CATCH COMPOSITION OF *AMBAI* NET IN KRUENG JAMBO AYE TIDAL CANAL FISHERIES, NORTH ACEH – INDONESIA

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ABSTRACT

Increasing the amount of by-catch has become one of the causes of the decline in fish stocks that can threaten the sustainability of world fisheries. It may occur in small local brackish-water fisheries, especially in one of the tidal canals of North Aceh, i.e., Krueng Jambo Aye. Therefore, the investigation composition of the main catch and by-catch in a tidal channel of Krueng Jambo Aye is an essential indicator to describe the ecosystem impact by these fisheries. This study aims to determine the comparison of the composition of the main catches and by-catches, to determine the types of by-catches, and to identify the catch rate. The method used in this study is a field data collection and survey methods. The data analysis used was a capture rate analysis. The results showed that the main catches are more dominated by 72% while the by-catch by 28%. There are five species of by-catch with high economic value and nine species with low commercial value. The catch rate of the two catches are 0.42 kg per hour for the main catch and 0.16 kg per hour for the by-catch. It is expected that the results of this study can be used as necessary information to develop the fisheries improvement program in this area.

Keywords: Main catch; by-catch; discard; catch rate

INTRODUCTION

Tanah Jambo Aye is one of the sub-districts in the North Aceh District located on the coast of the Malacca Strait waters. It has a relatively large river, flowing into the estuary of Krueng Jambo Aye. Some residents in this area work as fishermen, who use the river as the fishing ground. In general, fishers in this area use *Ambai* net fishing gear. This fishing gear uses a comparatively small net so that many other types of aquatic organisms are caught as a by-catch. Even though the *Ambai* net is one of the fishing gears used to catch shrimp as the main target of fishing, the unintended catches are also trapped.

Generally, it is known that almost all fishing activities produce by-catch. According to Rainaldi *et al.* (2017), by-catch has been the most important fisheries problem and issue in the world since the 1990s. This increased volume of by-catches has become one of the causes of the decline in fish stocks that can threaten the sustainability of global fisheries (World Bank, 2017). The same problem occurred with the use of fishing gear that has a relatively small mesh net so that many other types of aquatic organisms that are not the primary target are caught (Bonanomi *et al*., 2017).

Previous studies have been carried out in different places by comparing the composition of main catch and by-catch with various types of fishing gear (Dharmadi *et al.,* 2017 with stow nets; Morin *et al*., 2014 with gill nets; Hartarti *et al.,* 2004 with fish trap). An example was a study conducted by Wahyu *et al.* (2008) in the waters of West Java on small-scale demersal trawling fisheries. The results showed that the composition of the by-catch was nearly the same as the composition of the main catch. That study concluded that by-catch causes the problem of species survival. Another study was the composition of by-catch of small-scale shrimp trawl fisheries in the bay waters of Mukomuko district (Rainaldi *et al*., 2017), where the by-catch yield was higher than the main catch. Firdaus (2010) also studied the ratio of main target species and by-catch; the results found that the target catch was smaller than by-catch at

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any rate of trawling. Patrick & Benaka (2013) correspondingly concluded their finding that by-catch was economically profitable compared to the primary target species, that was why fishers still used the gears. Referring to the comparison of catch composition that has been done, it can be seen that some by-catch results have exceeded the main catches with sizable economic value (Pascoe, 1997; Kim *et al*., 2011). However, if it was viewed from the conservation side, the catch has reached an alarming stage for the sustainability of the species (Glass *et al*., 2015; Gislason, 2015).

Furthermore, information about the main catches and side catches of the *Ambai* fishing net in the Krueng Jambo Aye canal is still not clear because it does not have any information about the study regarding the subject in this region. Although the catchment area is small, it has a significant influence on the survival of the existing species. For this reason, the comparison study between by-catch and main catches by identifying the composition and types of by-catch caught by the *Ambai* net is the key focus.

Based on the preliminary research, the small net fishing gear, which is often used by the fishermen of Tanah Jambo Aye, is a shrimp catching tool that has shrimps as the main catch target. However, this fishing gear also contains by-catch. Therefore, the researcher wants to look at the comparison of the composition between the by-catch and the main catch, and we also want to know which species are high-economic and low-economic by-catch and how the catch rate occurred in the study area.

MATERIALS AND METHODS

Data Collection on Catch

This research was conducted in June 2019 in Krueng Jambo Aye canal, North Aceh District (Figure 1). The data was collected from field data collection of *Ambai* net fishing gear and survey methods. It was done by following the fishers activities when landing catches and participating in the process of sorting catches according to species. The research location consists of three villages. The first village is Geulumpang Umpung Unoe, which was the deepest point of the canal, the closest to the sea, and had 7 units of *Ambai* net fishing gear with 2 data repetitions collected. The next village is the Rantoe Panyang, which was the midpoint of tidal canals and has 5 units of *Ambai* net fishing gear with 2 data repetitions collected. The last village was Tanjong Dalam, which was the outermost point of the tidal canal and had 2 units of *Ambai* net fishing gear with 3 repetitions observation of data collection.

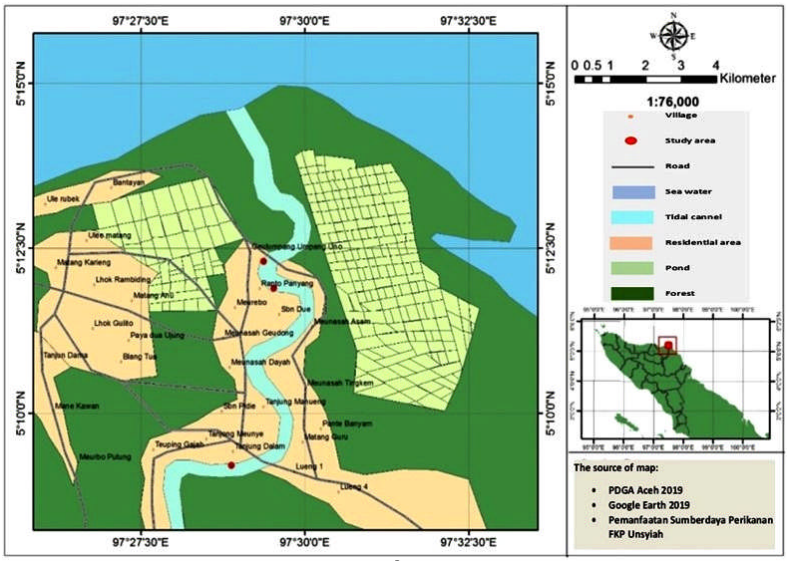

Figure 1. Map of study sites.

The data taken out of the field includes the identification of the composition of the catch, the sorting of by-catch species with high and low economic value, as well as the calculating of catch rate *Ambai* nets fishing gear.

Data Analysis

Catch Composition

The identification of the *Ambai* nets catch was made directly in the research area by counting the number of species and weight of the main catch and

by-catch together with interviewing based on a questionnaire submitted to the fishermen to get more information about the catch. The high economic value by-catches are the non-target catches that have a relatively high selling value; in contrast, low economic value by-catches are the non-target catches that have relatively low commercial value. To know the number of by-catches of high and low economic value, the counting was carried out directly at the study site by calculating the weight and selecting the types of catches. The species were morphologically identified using Fish ID (Mossman & Heath, 2004).

The Catch Rate

Catch rate describes the capture ability of a fishing gear per capture attempt. The capability of a fishing gear represents the catch in kilograms per unit time. For catch rate analysis, the following formulation is used (Aidoo *et al*., 2016).

$$C = \frac{w}{t} \quad \text{.....(1)}$$

where:
C = catch rate (kg/hour)
W = the weight of the catch (kg)
t = unit time (hour)

RESULT AND DISCUSSION
Results

The Geulumpang Umpung Unoe village is the deepest point in the catching area and has a high level of mangrove density. In this location, it had a total catch of 41.8 kg with 30.3 kg of main catch and 11.5 kg of the by-catch from 7 units of fishing gear. Meanwhile, in Rantoe Panyang, located in the midpoint of the tidal canal that still has a high density of mangrove ecosystem, the catch was 18 kg of total catch with 13 kg of main catch and 5 kg of by-catch from 5 catching units. The Tanjong Dalam is the last place where the mangrove density has decreased compared to the other two sites. The location is the outermost point of the fishing area, and it got 9.8 kg of total catch with 6.7 kg of main catch and 3.1 kg by-catch from 2 units of fishing gear.

Table 1. Quantity and percentage of catches at three research sites

No.	Species	Quantity (kg and %) in Study Site			low/high economic value
		G. Umpung Unoe	Rantoe Panyang	Tanjong Dalam	
A	**Main Catch**				
1	*Metapenaeus ensis*	10.9 (26.08)	7.4 (41.11)	3.5 (35.71)	H
2	*Penaeus merguiensis*	8.1 (19.38)	2.3 (12.78)	1.3 (13.27)	H
3	*Penaeus monodon*	1.5 (3.59)	0.8 (4.44)	1.9 (19.39)	H
4	*Penaeus sp*	9.8 (23.44)	2.5 (13.89)	-	H
B	**By-catch**				
1	*Scatophagus argus*	0.1 (0.24)	-	-	H
2	*Siganus sp*	0.3 (0.72)	-	-	H
3	*Eubleekeria splendens*	0.3 (0.72)	-	-	H
4	*Leiognathus sp*	-	0.4 (2.22)	-	L
5	*Ambassis nalua*	1.7 (4.07)	-	-	L
6	*Oxyeleotris microlepis*	1.3 (3.11)	0.9 (5.00)	0.6 (6.12)	L
7	*Oxyeleotris marmorata*	1.3 (3.11)	-	0.3 (3.06)	L
8	*Grammoplites sp*	0.3 (0.72)	-	0.5 (5.10)	L
9	*Chanos chanos*	0.9 (2.15)	-	-	H
10	*Gerres filamentosus*	0.2 (0.48)	-	-	L
11	*Terapon jarbua*	0.2 (0.48)	-	-	L
12	*Cynoglossus lida*	-	0.5 (2.78)	-	L
13	*Scylla serrata*	-	0.2 (1.11)	-	H
14	*Portunus pelagicus*	0.5 (1.2)	0.9 (5.00)	-	H
C	**Discard**	4.1 (9.81)	2.1 (11.67)	1.7 (17.35)	
	Total	**41.8**	**18**	**9.8**	

In addition to shrimp as the primary target, there are several organisms caught and categorized as by-catch. Various types of these organisms also have varying amounts and species, such as Spotted Scat (*Scatophagus argus*), Gold-spotted Rabbitfish (*Siganus sp*), Splendid Ponyfish (*Eubleekeria splendens*), Common Ponyfish (*Leiognathus sp*), Scalloped Perchlet (*Ambassis nalua*), Goby (*Oxyeleotris microlepis*), Marbled Goby (*Oxyeleotris marmorata*), Spotfin Flathead (*Grammoplites sp*), milkfish (*Chanos chanos*), Whipfin Mojarra (*Gerres filamentosus*), Tiger Perch (*Terapon jarbua)*, Roundhead Tonguesole (*Cynoglossus lida*), mud crab (*Scylla serrata*), and blue crab (*Portunus pelagicus*). All fish and crustacean caught are presented in Table 1.

Discussion

The main catch in Krueng Jambo Aye has various types of shrimp obtained, namely greasy back shrimp (*Metapenaeus ensis*), banana prawn (*Penaeus merguiensis*), tiger prawn (*Penaeus monodon*), and tiger shrimp (*Penaeus sp*). Almost all species of shrimp were found in all three study sites, except tiger shrimp that were not caught in the Tanjong Dalam village. According to Tirtadanu *et al*. (2017), the existence of mangrove ecosystems is essential in the growth of tiger shrimp. Shrimp are generally found in irrigation that leads to the sea with tidal fluctuations so that tiger shrimp is rarely found in the Tanjong Dalam village because it is far from the coast and has a low mangrove ecosystem.

The variation of by-catch was also affected by the three research locations, which are the farthest from the coast, the less the catch. This difference is because of the habitat of different fish species. Each fish has its level of salinity to be able to survive, Splendid Ponyfish (*Eubleekeria splendens*) live only in the high salinity, while the whitefish adapts well in the sea, brackish, or even freshwater (White *et al*., 2013; Gjoseter *et al*., 2012).

The fishing gear also has 'discards', which is also part of the by-catch. The 'discards' are wasted and do not have economic value (Firdaus, 2010; Lobo *et al*., 2010). Some of the 'discards' are small crabs (*Brachyura*), yellow pike conger (*Congresox talabon*), mudskippers (*Periophthalmus sp*), pistol shrimp (*Alpheus digitalis*), and other small fish, which are the dominant by-catch in the study area. The small size of crabs, for example, is a species that has no economic value and is also not for consumption. However, these small crabs are not directly thrown or discarded into the water but collected to be put into the pond to be cultivated and later can be sold at high prices after reaching enough size.

The Comparison of Catches

The total of main catches and by-catches has a significant difference in number, where the main catch is more dominant than by-catches. The percentage amount can be seen in Figure 2. The total number of main catches reached 72% so there was 28% of by-catch with 4% of 'discards'. The resulting amount of catches has a high level of effectiveness as shrimp catching equipment and also has quite good selectivity (Hartati *et al*., 2004). The selectivity of this passive fishing gear only depends on the tidal current so that larger fish, which are fast swimmers, are able to quickly escape from the trap (Dwivedi *et al*., 2017).

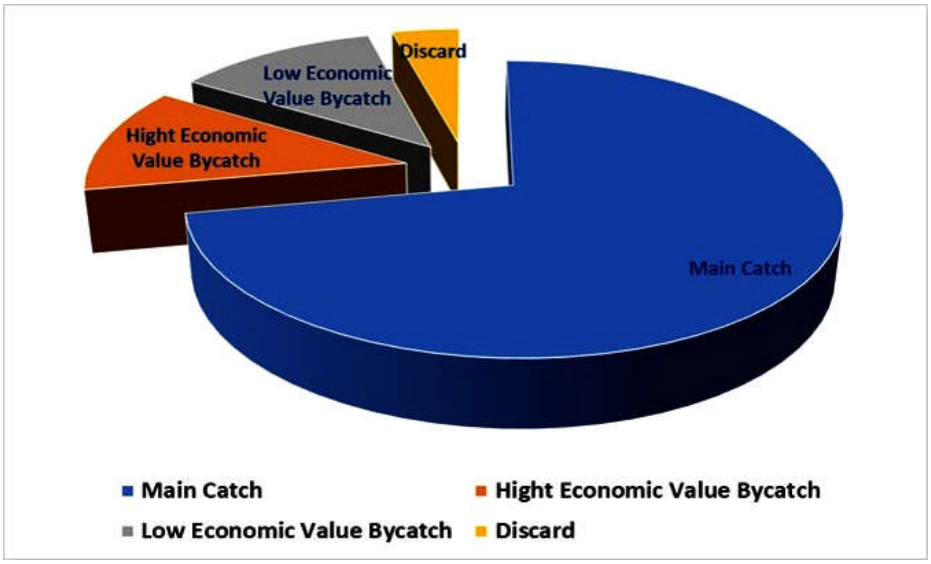

Figure 2. Comparison of the number of main catch and by-catch.

Low and High Economic By-catch

The types of low economic value by-catch caught by the *Ambai* nets were ponyfish (*Leiognathus sp*), yellowtail scads (*Atule mate*), marble goby (*Oxyeleotris marmorata*), common pony fish (*Leiognathus equulus*), whipfin silver-biddy (*Gerres filamentosus*), tongue fish (*Cynoglossus lingua*), and jarbua terapon (*Terapon jarbua*). The utilization of these catches by fishers was limited to daily consumption. Those above species were not landed in large quantities for sale. Moreover, the types of high economic value by-catch caught by the *Ambai* net in Krueng Jambo Aye are rabbitfish, milkfish, and crabs; however, these catches were mainly for consumption only and not to be sold because the amount of this high economic catch is small. In the opinion of fishers in the village of Geulumpang Umpung Unoe and Rantoe Panyang, there were high-economic by-catch that can be sold, such as snappers and groupers trapped in the *Ambai* nets. However, these fishes were rarely caught because they can go against the flow and can escape easily from the slow rate gear.

The Catch Rate Analysis

Before the catch rate was obtained, first, the average number of by-catch per unit of fishing gear was calculated. The value was obtained from the number of total by-catch divided by the number of total fishing gear and the number of repetitions from data collection in the field. After getting the average value of the catch, to get the catch rate value, the average value of the by-catch was divided by the immersion time of the fishing gear, which was four hours. Table 2 is the component of catch rate value from the *Ambai* nets fishing gear.

Table 2. Components of catch rate values and their comparisons

No.	Study Site	Amount of fishing gear	Avg. haul time	Main catch (kg) A	by-catch (kg) b	The ratio (a:b)
1	Glp. Umpung Unoe	7 unit	14	30.30	11.50	2.6 : 1
2	Rantoe Panyang	5 unit	10	13.00	5.00	2.6 : 1
3	Tj. Dalam	2 unit	6	6.70	3.10	2.2 : 1
Total			30	50.00	19.60	2.6 : 2
The average of catches				1.67	0.65	2.6 : 2

The catch rate analysis for this study included the variables of the duration of hauling, duration of removal, and duration of harvest that were converted to units of time (Firdaus, 2010). *Ambai* net fishing gears that were operated at Krueng Jambo Aye had a low catch rate, less than 1 kg per hour (Martell *et al*., 2015). In the study areas, the by-catch rate was 0.16 kg per hour; this was much less than the main catch rate, which was 0.42 kg per hour. Subsequently, it can be concluded that the ability of *Ambai* net fishing gear to catch shrimp as the main target is higher and relatively effective with low by-catch (Zimmerhackel *et al*., 2015). These results indicate that conservation of the *Ambai* net fishing gear is still feasible in this area.

The comparison of catches is also made by comparing the number of by-catches with the number of main catches obtained from the three study sites. The value obtained in the Geulumpang Umpung Unoe village and the Rantoe Panyang village, is 1:2.6, meaning that in 1 kg of by-catch, there is 2.6 kg of the main catch. However, the ratio value is quite different from the site of Tanjung Dalam, which only got 1:2.2, smaller than the others. It is understandable since the location of Tanjung Dalam, about 9 km from the river mouth (estuary), where the supply of saline water from the sea depends on the high tide to provide enough salinity. This location also has low mangrove density due to salinity-deficient soils. A research conducted by Wu & Kam (2009) in brackish water areas to evaluate the condition of the mangrove environment concluded that mangroves are arduous to grow due to the influence of salinity-deficient soils. (Wu & Kam, 2009).

CONCLUSIONS

The main catch was more dominant than the by-catch. The proportion of the main catches reached 72%, so 28% of by-catches. It was found that there were five species of high-economic by-catch and nine species of low-economic by- catch. The catch rate value obtained for by-catch was low, which was only 0.16 kg per hour per unit of fishing gear effort, compared to the main catches of 0.42 kg per hour.

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