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Percentage of the bycatch and discard composition in artisanal bottom trap fisheries

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ABSTRACT

Data on bycatch in the fishing effort required to manage fisheries resources. Unfortunately, the data on small-scale and traditional fisheries is still lacking. It makes it challenging to make fishing policies and regulations. Survey activities and experimental fishing were conducted to determine and analyze the composition of the main catch, bycatch and discarded by the local fisher's bottom traps in Sibolga, North Sumatra, Indonesia. Five units of the trap with a size of 150 cm x 100 cm x 50 cm (length x width x height) were used to collect fish data. These five trap units operated in the fishing ground, where local fishers usually operate their fishing gear. The fishing operation carried out within 1 mile of the coastline with water depths ranging from 7-10 meters. The duration of trap setting around 5-7 days for each fishing operation. A motorboat operated with a weight of 5.8 GT. The results showed that the total bottom trap catch consisted of 329 individuals with a total weight of 151.4 kg and 12 demersal fish species. The main catch was 148 individuals (88.9 kg), or 44.7% of the total catch during the experiment i.e. *Chepalapholis urodeta*, *Ephinephelus areolatus*, *Epinephelus chlorostigma*, *Plectropomus leopardus*, *Ephinepelus coioides*, *Lates calcarifer*, *Lutjanus malabaricus*, and *Lutjanus erytropterus*. The bycatch was 151 individuals (57.1 kg) or 46.1% i.e. *Lethrinus obsoletus, Lutjanus ehrenbergii, Acanthurus auranticavus, Platax teira, Nemipterus japonicus, Scarus rivulatus, Lutjanus johnii, Siganus canaliculatus, Caesio cuning, and Taeniura lymma.While the discarded catch amounted to 30 individuals (5.4 kg) or 9.2%* i.e. *Naso brevirostris, Diodon holocanthus, and Diadema setosum.* The bycatch utilization obtained by fishers was 83.4%, and the unutilized was 16.6%. The percentage of fish sizes worthy for consumption was 135 individuals (74.6%), and the size unworthy for consumption was 46 individuals (25.4%).

Introduction

The bycatch and discard are part of the catch, not the main catch target. The incidental catch is also part of the bycatch accidentally caught during a fishing operation. Usually, the catch is decent, but some are suitable for high economics, some are bycatch, some are used, and some are wasted because the fishing catches have no value or some regulations exploit this biota, so they throw them away. Overall, bycatch is a critical issue worldwide, so matters relating to the fisheries environment are significant as estimates in stock assessments (Broadhurst, 2000).

Globally, it is estimated that 40% of marine catches are bycatch (Rudershausen et al., 2016). The many bycatches are essential in fisheries because of their impact on marine ecosystems, so a management effort is needed (Wardhani, 2012; Montero et al., 2020) to suppress bycatch, one of which is by using selective fishing gear on the fishing catches. This opinion is corroborated by Hall et al. (2000) that catching fish not targeted will affect species diversity and aquatic ecosystems because bycatch not consumed or disposed of if continuously exploited will affect the food web. If the food web is disrupted, the primary relationships in a community are also disrupted (Sofyan and Nofrizal, 2005).

Since the prohibition of operating trawl by the Minister of Fisheries and Maritime Affairs as stated in PERMEN – KP No. 2 of 2015, the bottom trap is an alternative for Sibolga fishers. Bubu is one of the

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fishing gears that plays a vital role in utilizing demersal fish resources in Sibolga. This condition can be seen from the production data of the Sibolga Archipelago Fisheries Port Statistics in 2017, showing that the exploitation of demersal fish with bottom traps reached 145.56 tons (6.31%) of the total catch that entered the port with 22,933 tons with catches. Grouper and snapper amounted to 85.6 (58.8%) tons. This condition is good but cannot be said to be significant because, according to personal communication with (Zega, 2019) as sub coordinator of the harbormaster, PPN Sibolga, many fishers do not land their catch at the port due to a large number of private companies around the port and having the same activities as the port (Simatupang, and Lubis, 2012). It means that the utilization of the fishing port in Sibolga is not yet optimal. They refer to Lubis (2011) that the number of fish landing sites is very influential and creates competition if there is no regulation, especially on facilities, quality, and price. So there needs to be fish quality development for fishers, so fishers are interested in landing fish at PPN Sibolga. So the number and composition of the catch in each fishing gear are known with certainty. It is not yet clear what composition is caught in the bottom trap, especially in the bycatch; it is necessary to study more deeply the composition of the bycatch in the bottom trap to ensure sustainable fish resources for generations to come (Komoroske and Lewison, 2015; Zhang et al., 2016; Juan-Jordá et al., 2018; Abdulqader et al., 2020). The aim is to see to what extent the bottom trap is effective in catching the target fish, bycatch and discard, and the ratio of the catch trapped in the trap estimating the selectivity of fishing gear for the catch, so it deserves to be said to be environmentally friendly under the code of conduct for responsible fisheries.

Materials and Methods

Research site

A survey was conducted to follow the activities of fishers from preparation to landing. Identify fish and count the number of species caught on the bottom trap. The research was carried out from December 2018 to January 2019 in Sibolga in the fishing area of Pulau Poncan Sibolga. (Figure 1).

Determination of the research location by following the fishers' habit, where the coastal waters of the small islands that line the West Coast of Sumatra are fishing grounds for fishers, one of which is the fisher's bottom trap. The bottom trap was operated at three fishing area positions. The position of the first fishing ground was at coordinates 01° 43' 0.005"N-098° 45' 0.047"E; the coordinates of the second fishing ground were 01° 42' 0.024" LU-098° 45' 0.036" E, and the coordinates of the third fishing ground were 01 ° 42' 0.022"N-009° 52' 0.037"E. The bottom trap used by Sibolga fishers in exploiting demersal fish resources is rectangular, wire material with a length of 150 cm, a width of 100 cm, and a height of 50 cm (Figure 2). Constructing various traps and designs has the same goal: fish entering through one or more funnels with a conical shape (Chalim, 2017).

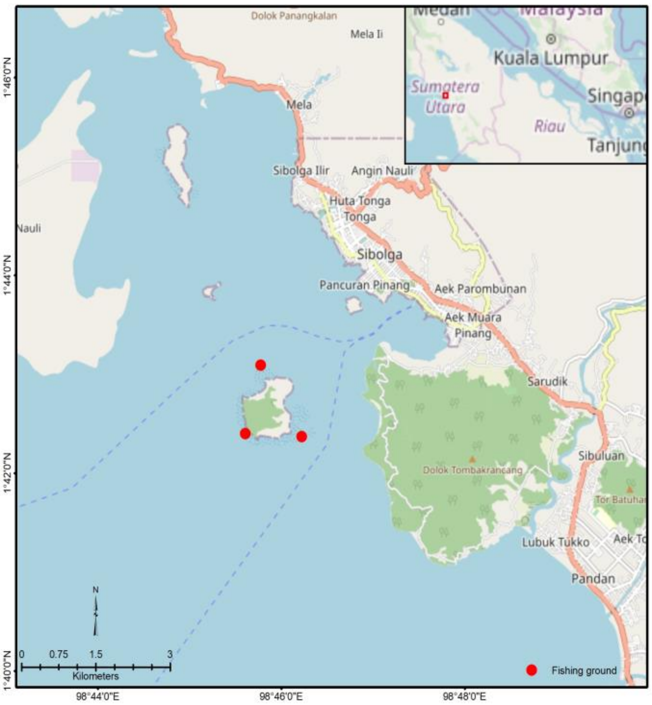

Figure 1. Map of the research site shaded polygons showing the estimated fishing operation area.

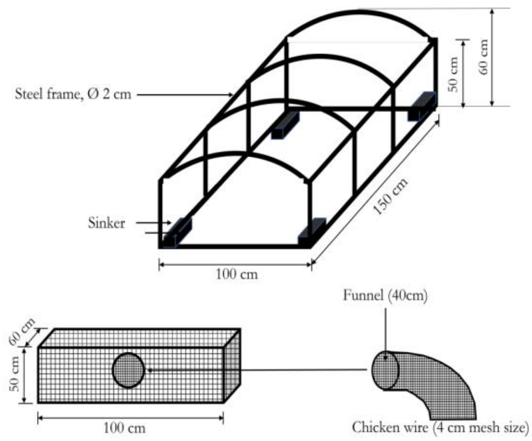

Figure 2. Construction of bottom trap used by Sibolga fishers in the fishing area on the West Coast of Sumatra.

Method of collected data

The data collected directly during five trips and five hauling times, includes the composition of the main catch, such as drankfin hind, grouper, barramundi, and snapper, and bycatch, such as orange-striped emperor, blackspot, surgeonfish, batfish, threadfin bream, parrotfish, spinefoot, and redbelly yellowtail fusilier. The percentage of the number and weight of the catch used and not utilized, the percentage of the feasibility of the size of the catch by referring to the metadata (www.fishbase.org) and constructing the base trap and the method of operation of the bottom trap. Fish catches were measured using Body Length (BL), a measurement from the tip of the mouth to the base of the tail fin. At the same time, the echinoderms species was measured as the body diameter. The bycatch consists of utilized and discarded bycatch (Rainaldi et al., 2017; Nofrizal et al., 2018). The catch thrown away is usually because the species has no value or some regulations prohibit the exploitation of certain species (Vestergaard. 1996; Yani et al., 2020).

The fishing area is approximately 0.1 miles from the shoreline with approximately 5-10 meters in depth. Referring to Kritzer and Sale (2006), the brightness at a depth of 2-7 is perfect for the growth of coral reefs where herbivorous fish and other predatory species grow and thrive. Malik (2013) also added that the fishing grounds were based on fishers' experience, where it was estimated that demersal fish are in coral reef areas. So this area is perfect to be a fishing ground for the bottom trap. Motorboats size 10 m in length overall, 1.50 m in broad, and 1.55 m in depth were used for transportation.

Data analysis of fishing catches

Before analysis, all bottom trap fishing catches were identified and classified according to species, number, and weight of individuals caught. Fish identification made by matching identified specimens such as images with morphological characters in the Fishbase metadata to obtain information on the fish caught by fishers (Khaerudin et al. 2014). The catch composition was obtained by comparing the main catch, bycatch, and discard by several individuals and weights (kg). The length of each individual measured calculation of a percentage of the species number for bycatch and discarded. It was used to see the appropriateness of the size of the fish caught.

Analysis of catch composition was required for the relative abundance of bottom trap catches. It was analyzed using the equation, the number of individuals of one species divided by the number of individuals of all species, then multiplied by 100%. All bycatch caught in the trap will be given a percentage to discover how much of the catch is utilized and discarded using $P = \sum xi / Nx100\%$, where P is the percentage of fish species to $-i$ (i= 1,2,3,... n), $\sum xi$ is the number of individuals of all fish species to i (i = 1,2,3...n), Ni is the number of individual fish species. The data processing results will be presented in percentages processed using Microsoft Excel software.

Bycatch and discard size

The results of measuring the length of the entire species are presented in a frequency distribution to make it easier to analyze the size interval for each species that is worthy or unworthy of catching from the entire bycatch using the equation $K = 1 + 3.3 \log N$ (Nugroho et al., 2015), which where K is the number of classes and N is the numbers of data. The equation P = R/K was used for getting the class interval, where P is the class interval, R is the length of the highest fish minus the length of the lowest fish, and K is the number of classes.

The percentage in the length size class was determined by the equation $P = Ki / K.100\%$, where P is the percentage of fish size-i.... (i = 1,2,3...n). Meanwhile, to determine the maturity level of fish from all bycatch, it was guided by the metadata www.fishbase.org. The identification results was a benchmark in determining whether the species is worthy of being caught to be a guide to finding solutions in suppressing bycatch.

Proportion of bycatch

This study analyzed the proportion of bycatch by comparing the utilized species and discarded ones. The fishing catches used the same as distributing the catch divided by all the bycatch and multiplied by 100%. Meanwhile, the catch discarded is the same as the share of the catch thrown away, divided by all bycatch, then multiplied by 100% (Nofrizal et al. 2018). All percentages obtained were tabulated in tables and graphs.

Results

Table 1 shows the total trap catch during the observation, which consisted of 21 species with 329 tails weighing 151.4 kg. The main catch was 148 individuals, with the dominant species being *P. leopardus*, *L. calcarifer*, and *E. areolatus*. Meanwhile, the bycatch were 151 individuals (46.1%), with the dominant catch species being *S. rivulatus*, *L. johnii*, and *A. auranticavus*. Meanwhile, the discarded catch was 30 individuals (9.2%), the most species being *N. brevirostris* and *D. holocanthus*. The total weight of the fish caught by the bottom trap of 58.9% is the main catch, and 37.4% is the bycatch. While the catch discarded was only 3.7%.

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Table 1. The composition of bottom trap fishing catches;* main catch, **bycatch, and ***discard.

No.	English name	Scientific name	Weight		Number	
			(kg)	(%)	(individual)	(%)
1	Darkfin hind *	*Chepalapholis urodeta*	4,9	3,3	12	3,6
2	Areolate grouper *	*Ephinephelus areolatus*	12,6	8,3	23	6,9
3	Brownspotted grouper *	*Epinephelus chlorostigma*	12,3	8,1	19	5,7
4	Leopard coralgrouper *	*Plectropomus leopardus*	9,2	6,1	27	8,3
5	Orange-spotted grouper *	*Ephinepelus coioides*	5,4	3,6	14	4,2
6	Barramundi *	*Lates calcarifer*	18,9	12,5	26	7,9
7	Malabar blood snapper *	*Lutjanus malabaricus*	8,8	5,8	11	3,3
8	Crimson snapper *	*Lutjanus erytropterus*	16,8	11,2	16	4,8
	Sub total		**88,9**	**58,9**	**148**	**44,7**
9	Orange-striped emperor **	*Lethrinus obsoletus*	3,6	2,4	10	3,2
10	Blackspot snapper **	*Lutjanus ehrenbergii*	3,7	2,5	19	5,7
11	Orange-socket surgeonfish **	*Acanthurus auranticavus*	7,4	5,1	21	6,4
12	Longfin batfish **	*Platax teira*	1,1	0,7	8	2,4
13	Japanese threadfin bream **	*Nemipterus japonicus*	2,8	1,9	6	1,8
14	Rivulated parrotfish **	*Scarus rivulatus*	15,1	9,3	33	10,1
15	John's snapper **	*Lutjanus johnii*	15,7	10,4	25	7,6
16	White-spotted spinefoot **	*Siganus canaliculatus*	4,1	2,7	19	5,8
17	Redbelly yellowtail fusilier **	*Caesio cuning*	1,6	1,1	7	2,2
18	Ribbontail stingray **	*Taeniura lymma*	2	1,3	3	0,9
	Sub total		**57,1**	**37,4**	**151**	**46,1**
19	Spotted unicornfish ***	*Naso brevirostris*	3,8	2,6	16	4,8
20	Longspined porcupinefish***	*Diodon holocanthus*	1,3	0,9	10	3,1
21	long-spined sea urchin ***	*Diadema setosum*	0,3	0,2	4	1,3
	Sub total		**5,4**	**3,7**	**30**	**9,2**
	Total		**151,4**	**100**	**329**	**100**

Figure 3 shows that the number of main catches of bottom traps was lower than bycatch; however, when viewed from the weight viewpoint, the main catch has a higher percentage of bycatch. So, the efforts were required to be made to suppress bycatch. Most bycatch causes a decline in fish stocks globally. For resources to remain sustainable and sustainable, we must keep trying to keep fish resources from the threat of extinction, as has been carried out by fishing experts worldwide.

Composition of bycatch utilized and discarded

Figure 4 shows the percentage of catches used and discarded. The bycatch utilized was higher than the catch discarded. The catch utilized had 83.4%, while the catch discarded had a percentage of 16.6% (Figure 4). This condition proves that the catch of the bottom trap has good quality.

Size of bycatch worthy for catching and not worthy for catching

The size of the bycatch obtained during the study varied from each species caught. The variation in the size of the bycatch shows in Table 2.

Table 2 shows that the largest catch size was found in the Dasyatidae family, which was 62.1 cm, and the lowest was found in the Diadematoida family with a size of 3 cm with an average catch size of each species in Figure 5.

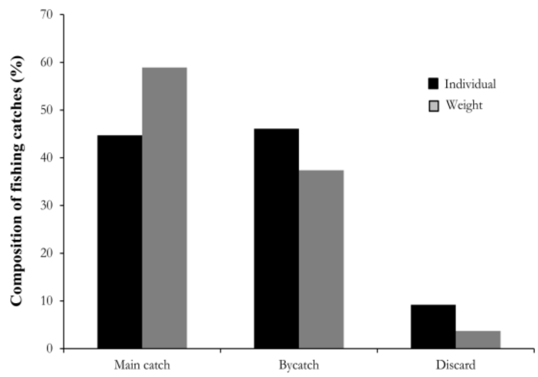

Figure 3. Percentage of main catches, bycatch, discarded in individual and weight during fishing operation.

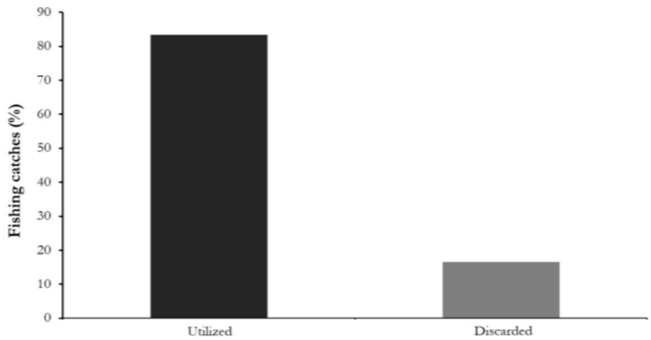

Figure 4. Average of bycatch utilized and discarded.

Table 2. Sizes of several species of catches that are worthy and unworthy for catching.

No.	English name	Family	Species	Size (cm)
1	Orange-striped emperor	Lethrinidae	*Lethrinus obsoletus*	18 - 38
2	Blackspot snapper	Lutjanidae	*Lutjanus ehrenbergii*	21 - 28
3	Orange-socket surgeonfish	Acanthuridae	*Acanthurus auranticavus*	20 - 28
4	Longfin batfish	Ephippidae	*Platax teira*	18 - 21
5	Japanese threadfin bream	Nemipteridae	*Nemipterus japonicus*	31 - 36
6	Rivulated parrotfish	Scaridae	*Scarus rivulatus*	20 - 36
7	John's snapper	Lutjanidae	*Lutjanus johnii*	20 - 27
8	White-spotted spinefoot	Siganidae	*Siganus canaliculatus*	21 - 27
9	Redbelly yellowtail fusilier	Caesionidae	*Caesio cuning*	23 - 29
10	Ribbontail stingray	Dasyatidae	*Taeniura lymma*	42 - 67
11	Spotted unicornfish	Acanthuridae	*Naso brevirostris*	22 - 28
12	Longspined porcupinefish	Diodontidae	*Diodon holocanthus*	13 - 17
13	Long-spined sea urchin	Diadematoida	*Diadema setosum*	3 – 3.3

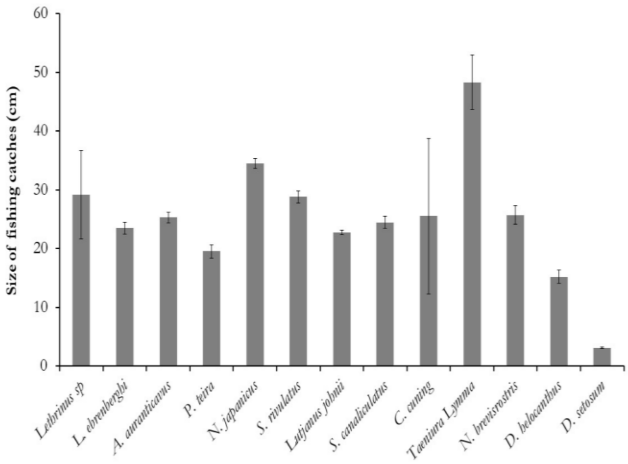

Figure 5. The average size of the bottom trap bycatch.

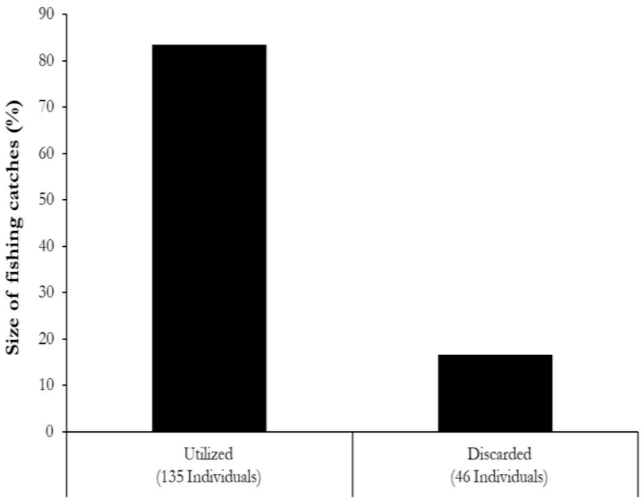

Figure 6. Percentage of the worth bycatch size from the bottom trap fishing catches.

N. brevisrostris with an average of 25.6±1.5 cm, *D. helocanthus* with an average of 15.2±1.1 cm, *D. setosum* with an average length of 3.1±0.1 cm. The percentage of non-target catch sizes that are suitable for catching and not suitable for catching caught in bottom traps were listed in Figure 6. The overall results of non-target fishing catch during the research on bottom traps carried out for five trips and five hauling times were obtained with good catches 74.6% (135 fish), and not suitable for catching obtained 25.4% (46 fish). There was a significant difference in the percentage of size in the bycatch obtained during the study. This situation is related to the design of the mouth of the trap, which has a large enough size. So large fish can enter the trap. Ttrap's mesh size also affects the catch's size because the trapped small fish will more easily escape.

Figure 7 shows ten *Lethrinus* sp. with a length range of 18.1-38.2 cm in the bottom trap during the fishing operation; this species has a first maturity size of 25 cm. The size worthy of catching was six fish (60%), and four (40%)were unworthy of catching. The fishing catches of *L. ehrenberghi* were 19 individuals, and none of the size worthy for catching with a body length range of 21.1-28.1 cm. . The length at first maturity was 20 cm. *A. auranticavus* totaled 21 tails with a length range of 20.1-28.3 cm, while the length at first maturity is 13.8 cm. The condition of the total of *A. auranticavus* was worthy of catching (100%). The catch of *P. teira* in bottom traps was eight fish, with a long-range between 18.3-21.2 cm. Condition 100% not worth catching. The length at first maturity is 24 cm. During the fishing operation, the fishing catches of *N. peronii* were six individuals, with a body length of 30.9-36.4 cm. According to the length at first, maturity was 45 cm. This condition indicates that the overall *N. peronii* was not classified the criteria for harvesting. During the fishing operation, the fishing catch of *S. rivulatus* was 33 tails, with a body length between 20.1-36.3 cm. According to the criteria for length at first maturity was 18 cm. This situation shows that the *S. rivulatus* caught have spawned.

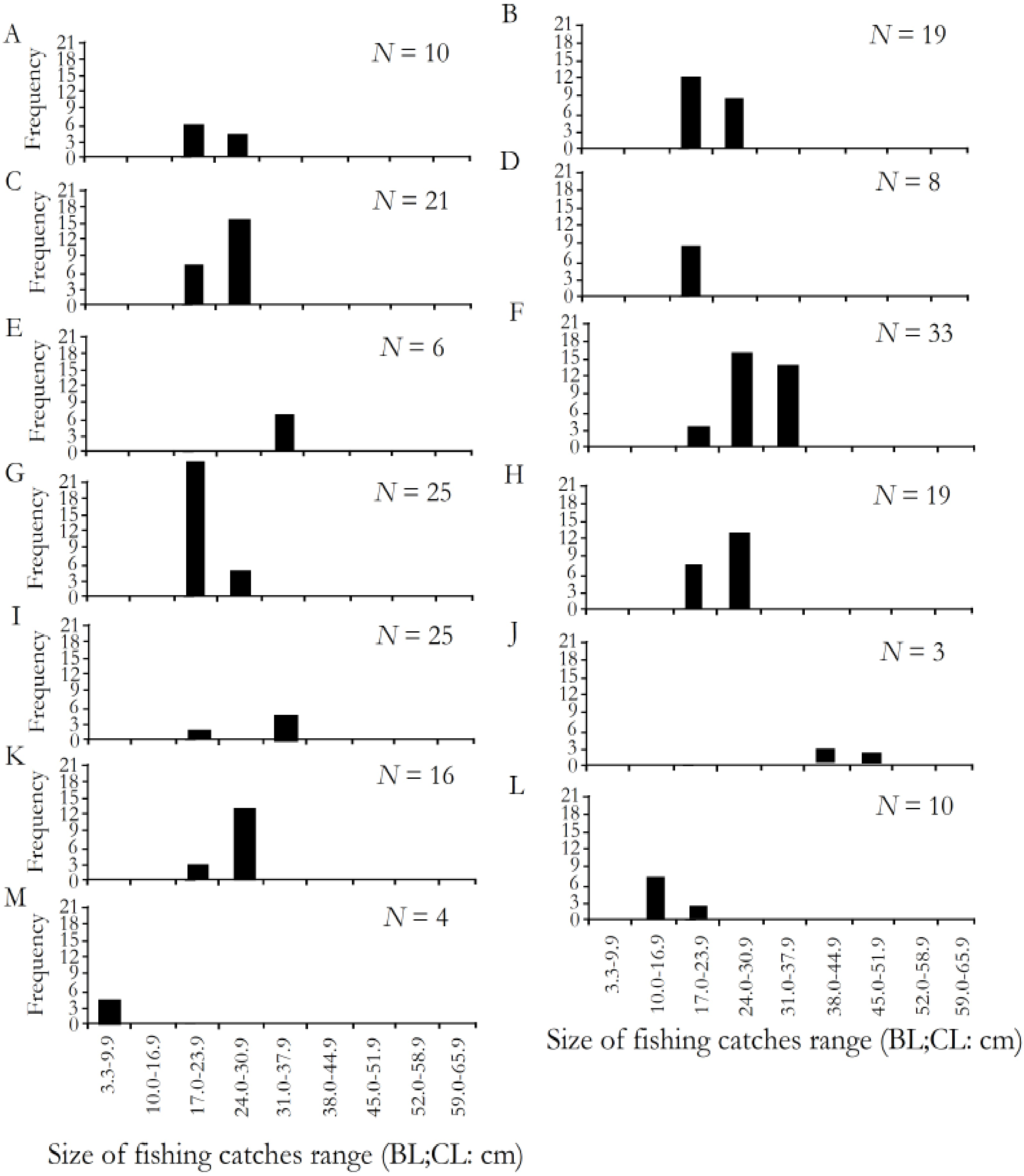

Figure 7. Distribution Size of fish caught by bottom traps during the study. (A) *Letrinus* sp; (B) *L. ebrenberghi*; (C) *C. auranticavus*; (D) *P. teira*; (E) *N. japanicus*; (F) *S. rivulatus*; (G) *L. johnii*; (H) *S. canaliculatus*; (I) *C. cuning*; (J) *T. Lymma*; (K) *N. brevisrostris*; (L) *D. helocanthus*; (M) *D. setosum*.

The fishing catches of *L. Johnii* were 25 individuals, with a body length was 19.2-24.2 cm. According to the length at first maturity criteria, which is 39 cm. This situation shows that all *L. Johnii* fish are not in good condition to catch. *S. Canaliculatus* was caught in 19 individuals with a 21.1-27.3 cm body length. Criteria for length at first maturity, which is at a size of 11.6 cm. This situation shows that the *S. Canaliculatus* fish are 100% worthy of catching. During the fishing operation, the total catch of *C. cuning* amounted to seven individuals, with a body length was 23.1-27.0 cm. The criteria for length at first maturity are 23 cm. Therefore, all *C. cuning* is worth catching. There were three *T. lymma* during the fishing operation, with a long-range was 41.2-62.1 cm and unworthy for catching. Their length at first maturity of about 70 cm. Sixteen *N. brevisrostris* were caught, with a body length of 22.2-28.0 cm; the *N. brevisrostris* caught were in good condition. The first maturity of *N. brevisrostris* length at first maturity is around 14 cm. There were ten *D. helocanthus* with a body length was 12.7-17.2 cm. The body length size at first maturity was 12 cm. This condition shows that all *D. helocanthus* caught are in

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good condition for catching. The catch of *D. setosum* was four tails, with a size of 3-3.3 cm, of which the size at first maturity was 4 cm.

Discussion

The bottom trap fishery in Sibolga is one fishing unit that improves the fishers' economy and the local government. Financially, demersal fish species have a relatively high economic value than other fish resources. This condition positively impacts the community's welfare, especially the fishers of Sibolga. The temperature of the Sibolga area is tropical climate, with the temperature ranges from 24.0-32.3°C, making the coral reefs around the islands that line the West Coast of Sumatra rich in demersal fish and reef fish resources for looking for food and a place to grow. Demersal fish resources that live on coral reefs and become targets for trap fishing gear were families of Serranidae, Lutjanidae, Lethrinidae, Acanthuridae, Mullidae, Siganidae, and Haemullidae, Labridae, Nemipteridae, Carangidae, Sphraenidae (Iskandar, 2009).

The potential economic value of demersal fish is high (Scales et al., 2018), as evidenced by the many seafood restaurants that serve demersal fish on the main menu. According to interviews with fishers and fish traders, the target catches from the bottom trap, such as grouper and snapper, when it reaches a size of 5 kg each, are usually exported to foreign countries, such as Hong Kong and Singapore. It encourages fishers to always increase their catch in various ways to get maximum fishing catch results.

The overall composition of the bottom trap catches shows that the bycatch is more dominant than the target catches. Referring to Mallawa (2006), in assessing the environmental friendliness of fishing gear, it must meet the criteria with the main catch reaching above 61%. If it is related to the catch during the study where the trap catches were dominated by bycatch, namely 55.3% bycatch and 44.7% main catch, it means that the bottom trap catches did not classify the criteria as environmentally friendly. Therefore, it is necessary to minimize bycatch and discard for resource sustainability (Dirk and Pauly, 2005). One measure to minimize bycatch is to use environmentally friendly fishing gear. Because destructive fishing gear will catch fish that are not the target, this condition harms the community and population in an ecosystem (Gilman et al., 2019), and ultimately the fish stock in the waters is threatened with extinction (Nofrizal et al. 2018; Ferrette et al., 2020).

Calculation data from the bycatch composition showed that the highest number of trap catches was occupied by *S. rivulatus,* amounting to 33 (10.1%). Its related to the life cycle of the Scaridae family that lives around coastal coral reefs on small islands, one of which is Poncan Island, there are become a habitat for *S. rivulatus* (Nanlohy and Timisela., 2017). This species of *S. rivulatus* is a bycatch because, according to Sibolga fishers, this fish is easy to decompose, and its value is low compared to the main catch. Khalifa (2011) stated that *S. rivulatus* species are not economically important fish species. *S. rivulatus* have economic value after being processed into salted fish. In contrast to the opinion of Lestari et al. (2017), which states that *S. rivulatus* is one of the catch commodities with crucial economic value because they have soft and smooth meat (Adrim, 2008). It proves that not all species in an area become the target catch, but it can be different in other areas.

The lowest number of catches was *T. lymma* which amounted to 3 fish (0.9%). It is thought to be under the habit of stingrays more often on the surface and usually solitary or in small groups. Allen (2000). Besides, the *T. lymma* has a flattened body shape, and widens, so it is difficult to trap. It is likely that the *T. lymma* was trapped in the trap while looking for food and saw prey, so the ray tried to enter the trap. Urbinas (2004) also added that the number of *T. lymma* trapped in the trap was relatively small.

The discard in this study has a percentage of 9.2%; this number is relatively small. However, this catch must be handled well, so it is not wasted. Tzanotos et al. (2007) state that poor handling of the catch would cause the catch to be discarded. One example of the *N. brevisrostris* is one of the commercial fish with a moderate price, but because it contains poison, the fishers of Sibolga throw it away. The United States has a law on the conservation and management of marine fisheries that require business actors to minimize bycatch; if it is impossible to avoid bycatch, then strive for the bycatch not to die. Understand fishing methods, and determine the time and location of fishing (Harrington et al. 2005).

The bycatch species consists of the bycatch that can be utilized and the catch not utilized (Rainaldi et al., 2017). In this study, the used bycatch had 83.4%, and the discarded catch was 16.6%. The significant percentage difference indicates that the bottom trap catches only a few fish not utilized. The size of the catch obtained during the study had various variations, and size fluctuations were not much different from each species caught. It is presumably from reef fish living in schooling according to species and size to avoid preying on each other, so the catch on the bottom trap is the same. Urbinas (2004) also stated that the species caught in the traps have almost the same size.

The properly bycatch fit for catching has a percentage of 76.6%. Meanwhile, the bycatch that is not suitable for catching is 25.4%. It indicates that the bycatch of the bottom traps caught is dominated by adult fish that have spawned before. It is suspected that the biota around the coast of Poncan Island is still in good condition but needs to be considered because bycatch is a threat to the sustainability of fish resources. Internationally, FAO, 1995 recommends that fish resources use environmentally friendly fishing gear and remain guided by the Code of Conduct for Responsible Fisheries (CCRF).

Conclusion

In sustainable fisheries resources, it is necessary to pay attention to the principles of sustainable management by increasing attention, especially to catches and the aquatic environment. The total catch of bottom traps during the study consisted of 21 species totaling 329 fish weighing 151.4 kg; the main catch consisted of 8 species with 148 fish (44.7%) weighing 88.9 kg (58.9%), i.e. darkfin hind (*C. urodeta*), areolate grouper (*E. areolatus*), brownspotted grouper (*E. chlorostigma*), leopard coral grouper (*P. leopardus*), orange-spotted grouper (*E. coioides*), barramundi (*L. calcarifer*), malabar blood snapper (*L. malabaricus*), and crimson snapper (*L. erytropterus*). Bycatch was caught 10 species totaling 151 tails (46.1%) with a weight of 57.1 kg (37.4%) i.e. orange-striped emperor

(*L. obsoletus*), blackspot snapper (*L. ehrenbergii*), orange-socket surgeonfish (*A. auranticavus*), longfin batfish (*P. teira*), Japanese threadfin bream (*N. japonicus*), rivulated parrotfish (*S. rivulatus*), John's snapper (*L. johnii*), white-spotted spinefoot (*S. canaliculatus*), redbelly yellowtail fusilier (*C. cuning*), and ribbontail stingray (*T. lymma*). The discard was caught 3 species with 30 (9.2%) weighing 5.4 kg (3.7%) i.e. Spotted unicornfish (*N. brevirostris*), longspined porcupinefish (*D. holocanthus*), and long-spined sea urchin (*D. setosum*) They were utilized as a percentage of 83.4% and discarded by 16.6%. According to length at first maturity, suitable for catching are 135 fish (74.6%); not yet suitable for catching are 46 (25.4%).

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