Comparison of Gilltong Sweeping Methods in South Sorong Waters, West Papua, Indonesia

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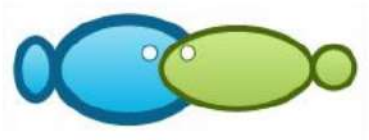

Comparison of *Gilltong* Sweeping Methods in South Sorong Waters, West Papua, Indonesia

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Abstract. Gilltong (bag gillnet/gillnet kantong) is a net consisting of one layer of netting with a net length of 22.4 m and a height of 2.6 m, a mesh size of 1.75 inches and the outside of the net is a cube-shaped mesh frame with a pocket size of 50 x 50 cm which serves to catch the target fish. This fishing tool is called *gilltong*, because of the shape of the body of the net which addresses the arrangement of bags vertically or horizontally when operated. Gillnets can be operated more intensively in the monsoon, usually from December to March, when sea conditions are calm. This research was conducted on a 1 GT *gilltong* operating in South Sorong waters. The data analysis method used was descriptive analysis and quantitative analysis method. In the trial of the *gilltong* fishing gear, six antimical methods were used, namely: (1) Operation method of 1/4 turn sweeping (90^0), (2) Operation method of sweeping 1/2 turn (180^0), (3) Operation method of sweeping 3/4 turn (270^0), (4) Method of operation of sweeping 1 full turn (360^0), (5) Beach Seine operation method, and (6) The towed operation method using 2 boats. Based on 9 trials, the Beach Seine system method which is pulled by using 2 boats was the most effective because leads to the higher catch. The catch obtained in the Gill Net bag trial contained several types of fish which were divided into main catch and by-catch fish. The target species was not catched et al. For bycatch, a total of 4.14 kg of Sin croaker (*Johnius dussumieri*) was obtained, 0.91 kg of Brushtooth lizardfish (*Saurida undosquamis*), 19.76 kg of Gray eel-catfish (*Plotosus canius*), 4.66 kg of long tongue sol (*Cynoglossus lingua*), Savalai hairtail (*Lepturacanthus savala*) as much as 0.23 kg, Chacunda ampela shad (*Anodontostoma chacunda*) 3.26 kg, Fringescale sardinella (*Sardinella fimbriata*) 1.04 kg.
Key Words: Pocket Gillnet, beach seine metode, bycatch, WPP 715.

Introduction. Noija et al (2008) stated that Indonesia has tropical waters which are rich in fish and has a high species diversity. South Sorong Regency is one of the areas where penaeid shrimp is harvested from the sea (Sorong Fishery Academy 2004). Shrimp is an important fishery commodity in South Sorong and produces production at the provincial level and even in Fisheries Management Area (FMA). The types of shrimp found in this area are jerbung shrimp, dogol prawns, and giant prawns (USAID SEA Project 2017). The main catch of bagged gillnet is shrimp, while bycatch other than shrimp is demersal fish such as pufferfish, bilis, tongue fish and sharks. There several species of shrimp are caught: flathead lobster (*Thenus orientalis*), whiteleg shrimp (*Penaeus vannamei*), rainbow shrimp (*Mierspenaeopsis sculptilis*) (Dahuri 2010).

According to Nikijuluw (2002) fish resources are renewable resources, which means that fish that are not caught/released will have the ability to regenerate themselves by reproducing. The large potential of shrimp resources in the waters of South Sorong Regency is a great opportunity for resource users to maximize utilization in these waters, but it must be in accordance with the characteristics of the waters and to follow the basic principles of sustainable management (Munaisah 2008).

Gilltong is a net consisting of one layer of nets with a net length of 22.4 m and a height of 2.6 m, a mesh size of 1.75 x 1.75 inches and the outside of the net is a cube-shaped net frame with a pocket size of 50 x 50 cm which functions to accommodate the

catch. Pala & Yuksel (2010) explain that the size of the gill mesh has a significant effect on the efficiency and composition of the catch. Ahrenholz & Smith (2010) suggest that inappropriate shortening can affect the amount of catch. The outer frame of the net serves to form a codend when the net is operated by blocking the current so that the fish are caught and enter the codend. It is called a bag net, because the shape of the net body resembles the arrangement of bags vertically or horizontally when operated (Puspito 2009).

Gillnets can be operated more intensively in the monsoon, usually from December to March, when sea conditions are calm (Sadhori 1985). Naamin & Uktolsedja (1976) reported that shrimp prefer areas where there is a mixture of river and sea water, because in this area there is a lot of food and nutrients. Nontji (2007) explained that demersal fish have a habitat on the bottom of the water. Figure 1 shows the gillnet operation procedure.

Figure 1. Illustration of Trammel net operation (KKP 2017).

Material and Method

Description of the study sites. The *gilltong* research was carried out from November 2019 to February 2020 by participating in fishing operations in Sorong waters, West Papua Province (Figure 2).

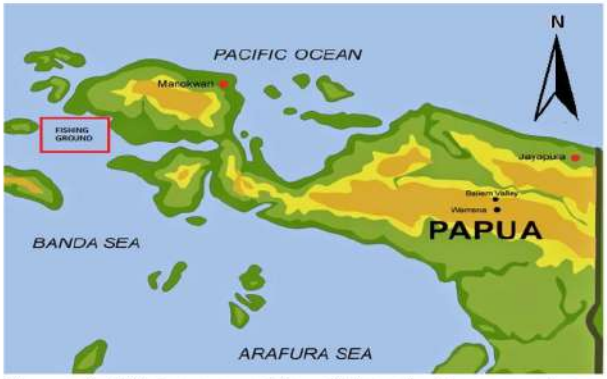

Figure 2. Fishing ground for *gilltong* in Sorong waters.

Data analysis method. The data analysis method used was descriptive analysis and quantitative analysis method. In the descriptive analysis method, direct observation data was obtained from the ship which includes the fishing area, fishing gear operation and catches.

The quantitative analysis method was appled by calculating using percentage calculations. Catch composition was calculated according to Sudirman & Natsir (2011), applying the following equation:

$$\text{Fish composition} = \frac{\sum catch\ per\ species}{Total\ catching} \times 100$$

Gilltong ship. The research was conducted on the *gilltong* board of 1 GT size, operating in the waters of South Sorong (Figure 3).

Figure 3. *Gilltong* fishing boat.

Results and Discussion

Gilltong operation technique. In the trial of the *gilltong* fishing gear, six operating methods were used, including:
1) Operation method of 1/4 turn sweeping (90^0)
2) Operation method of sweeping 1/2 turn (180^0)
3) Operation method of sweeping 3/4 turn (270^0)
4) Operation method of sweeping 1 full turn (360^0)
5) Operation method using 2 towed boats
6) Beach Seine operation method.

1. Operation method of sweeping 1/4 turn (90^0). The *gilltong* that will be lowered is assembled first by connecting to the upper and lower rises, the nets are installed alternately between net 1, net 2 and net 3, alternating with 3 repetitions (Figure 4).

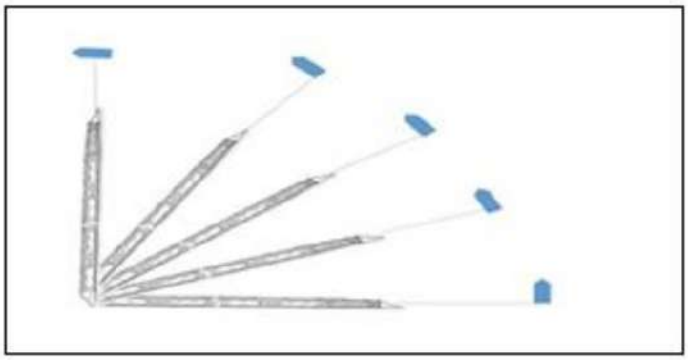

Figure 4. Sweeping quarter turn of 90^0.

Catch composition of the sweeping method of 1/4 turn (90^0). The trial was carried out with 3 repetitions with different positions. The number of *gilltong* used were 8 pieces. The total catch of this first trial is presented in Table 1.

Table 1

Composition of the first trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	3	0.12	12.50
2	Long tongue sole	*Cynoglossus lingua*	7	0.51	29.17
3	Banana prawn	*Penaeus merguiensis*	0	0	0.00
4	Gray eel-catfish	*Plotosus canius*	8	1.75	33.33
5	Fringescale sardinella	*Sardinella fimbriata*	6	0.09	25.00
	Total		24	2.49	100

Based on Table 1, the catch obtained in the first trial was dominated by *Plotosus canius* as much as 33% of the total catch.

2. Operatinon Method of sweeping 1/2 round (180^0). The operation of a 1/2 circle or 1/2 circle *gilltong* sweeping is a continuation of the 1/4 circle operation as shown in Figure 5.

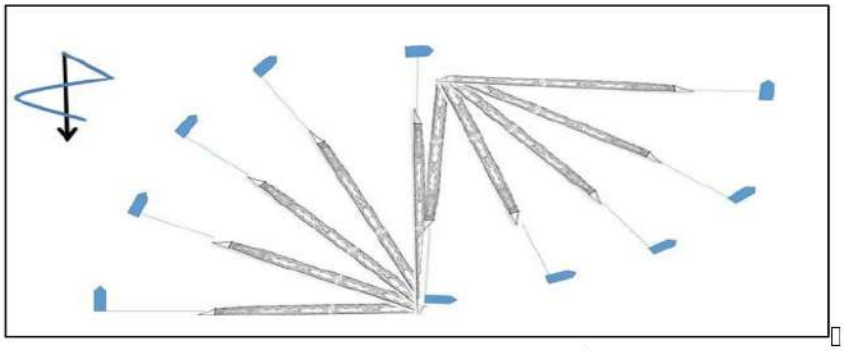

Figure 5. Sweeping 1/2 round 180^0.

Catch composition of sweeping method 1/2 turn (180^0). The trial was carried out by the sweeping 1/2 turn (180°) method with 2 repetitions at different positions in Seremuk Waters. The were number 4 *gilltong* used. The catches comprised 29 individuals with the composition of the catch in the second trial as presented in Table 2.

Table 2

Composition of the second trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	9	0.36	31
2	Gray eel-catfish	*Plotosus canius*	6	1.35	21
3	Banana prawn	*Penaeus merguiensis*	0	0	0
4	Long tongue sole	*Cynoglossus lingua*	12	0.68	41
5	Savalai hairtail	*Lepturacanthus savala*	2	0.23	7
	Total		29	2.64	100

Based on Table 2, the catch obtained in the second trial was dominated by *P. canius* as much as 41% of the total catch. Meanwhile, shrimps were not caught because the boat engine power was not sufficient to pull the *gilltong*.

3. Operation method of sweeping 3/4 round (270^0). The operation of the 3/4 circle *gilltong* sweeping is a continuation of the 1/2 circle operation as shown in Figure 6.

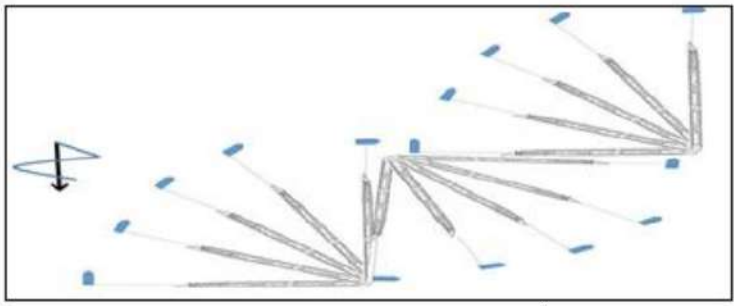

Figure 6. Sweeping 3/4 turn 270^0.

Catch composition of sweeping method 3/4 turn (270^0). The trial was carried out by the sweeping 3/4 turn (270^0) method with 2 repetitions with different positions. The composition of the catch in the third trial is presented in the Table 3.

Table 3

Composition of the third trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	8	0.33	22
2	Gray eel-catfish	*Plotosus canius*	14	3.26	39
3	Banana prawn	*Penaeus merguiensis*	0	0	0
4	Long tongue sole	*Cynoglossus lingua*	9	0.56	25
5	Chacunda gizzard shad	*Anodontostoma chacunda*	5	0.59	14
	Total		36	4.74	100

Based on Table 3, the catch obtained in the third trial was dominated by *P. canius* with 39% of the total catch. Meanwhile, shrimps were not caught because the boat engine power was not sufficient to pull the *gilltong* net.

4. Operation method of sweeping 1 full turn (360^0). The one full turn of sweeping *gilltong* operation is a continuation of the 1/2 round sweeping method (180^0) operation, while the activities are as follows (Figure 7):

1) After the boat finishes the 3/4 circle operation, at the end of the net, a weight is lowered and the end of the tow line is attached with a sign buoy, then lower it into the sea.
2) After that it is connected by a tow rope and the ship moves eastward against the direction of the current, at a speed of 2-3 knots and then forms a 1/4 circle.
3) Then the boat moves to pick up the sign buoy.
4) Hauling by pulling the rope over the boat followed by the pulling of the net.
5) The catch is taken from the net until all the nets get on the boat.
6) The net is lifted onto the boat.

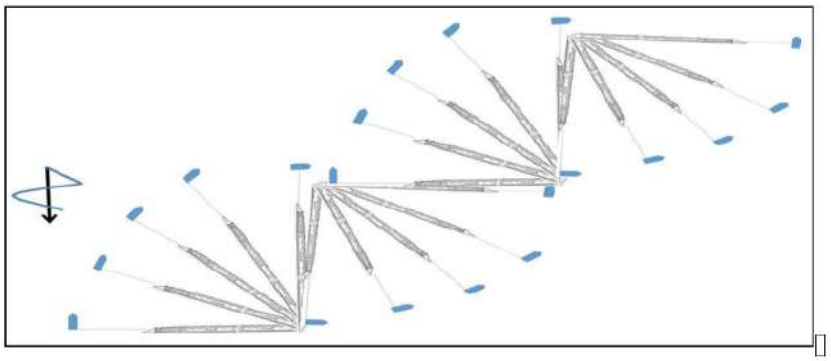

Figure 7. Sweeping one full turn 360^0.

Catch composition of the the 1 round sweeping method (360^0). The trial was carried out by the sweeping method of one turn (360^0) with 2 repetitions with different positions in Seleboi Waters. Four pieces of *gilltong* were used. The composition is presented in Table 4.

Table 4

Composition of the fourth trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	12	0.54	29
2	Fringescale sardinella	*Sardinella fimbriata*	7	2.69	17
3	Banana prawn	*Penaeus merguiensis*	0	0	0
4	Long tongue sole	*Cynoglossus lingua*	9	0.50	22
5	Gray eel-catfish	*Plotosus canius*	13	0.16	32
	Total		41	3.89	100

Based on Table 4, the catch obtained in the fourth trial was dominated by *P. canius* as much as 32% of the total catch. Meanwhile, *Penaeus merguiensis* were not caught because the boat engine power was not sufficient to pull the net.

5. The operation method in a circular pull (Sweeping Beach Seine). The operation of a *gilltong* by means of a circular pull (*Beach Seine*) is a method of operation that is usually carried out by fishermen on the north coast of Java. The method of operating the Beach Seine as follows (Figure 8):

1) Identification of the current direction.
2) Lowering the mark buoys and their weights.
3) The boat departs slightly to the left of the current direction at a slow speed (±2.5–3 knots) followed by lowering the left side rope (100 m) until it runs out.
4) After that the boat changes its direction to the right so that it crosses the current at a constant speed while lowering the net until the nets all fall.
5) Then after the net runs out, the boat changes its right direction so that the bow deviates slightly to the right with the current.
6) While lowering the ship's starboard rope, it is directed to the sign buoy.
7) Then take the mark buoy and the weights and tie the right and left side ropes and tie them at the stern of the boat.
8) After that the boat advances against the current until the right and left end nets unite.
9) Then the net lift up from the right and left side ropes simultaneously from the sides of each hull until the net goes up onto the boat.

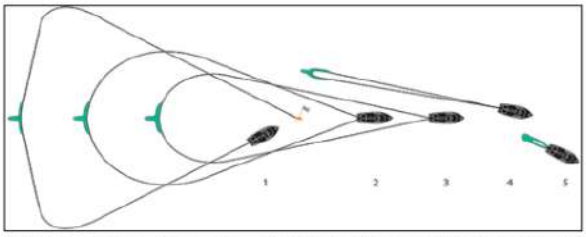

Figure 8. Operation of a circular *gilltong* (Misbah 2017).

Catch composition of the circular pull method (Sweeping Beach Seine). The trial was carried out using the Beach Seine method with 2 repetitions with different positions in Seleboi Waters. Four pieces of *gilltong* were used. The composition of the catch in the fifth trial is presented in Table 5.

Table 5

Composition of the fifth trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	15	0.92	23
2	Gray eel-catfish	*Plotosus canius*	8	1.89	12
3	Brushtooth lizardfish	*Saurida undosquamis*	5	0.69	8
4	Banana prawn	*Penaeus merguiensis*	0	0	0
5	Chacunda gizzard shad	*Anodontostoma chacunda*	7	0.43	11
6	Long tongue sole	*Cynoglossus lingua*	12	0.69	18
7	Fringescale sardinella	*Sardinella fimbriata*	18	0.24	28
	Total		65	4.87	100

Based on Table 5, the number of types of catch obtained in the fifth trial was dominated by *Sardinella fimbriata* as much as 28% of the total catch. Meanwhile, the *P. merguiensis* were not caught because the boat engine power was not sufficient to pull the *gilltong* net.

6. Operation method of 2 boats pulling. Gilltong that will be lowered are assembled first by connecting to the top and bottom risers. The test design is towed using 2 boats as follows (Figure 9):

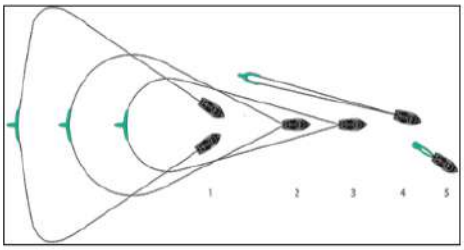

Figure 9. Two boats pulling operation method.

1) Boat 1 determines the fishing ground and observes the direction of the current that the net will lower.
2) Before lowering the buoy, it is given a tow rope 100 meters long to be picked up by the 2nd boat.
3) The net is lowered and stretches the direction of the current then the boat 2 takes the tow rope that is on the buoy.
4) When the tow rope is attached to the stern of the 2 boats then the two boats move apart so that the nets under the water can hit the maximum.

5) After that the two boats moved against the current at a speed of 3 knots for 30 minutes.
6) Then one of the boats returns the tow line to the first boat.
7) The process of drawing and arranging nets on the boat is carried out.

Catch composition of the 2 boats method. The trial was carried out by the Beach Seine method using 2 boats with 1 trial in Seleboi Waters. Four pieces of *gilltong* were used. The composition of the catch in the seventh trial is presented in Table 6.

Table 6

Composition of sixth trial catch

No	*Common name*	*Scientific name*	*Amount (ind.)*	*Weight (kg)*	*%*
1	Sin croaker	*Johnius dussumieri*	13	0.44	22
2	Gray eel-catfish	*Plotosus canius*	17	3.64	29
3	Banana prawn	*Penaeus merguiensis*	0	0	0
4	Chacunda gizzard shad	*Anodontostoma chacunda*	15	0.92	26
5	Long tongue sole	*Cynoglossus lingua*	5	0.42	9
6	Fringescale sardinella	*Sardinella fimbriata*	8	0.12	14
	Total		58	5.55	100

Based on Table 6, the catch obtained in the sixth trial was dominated by *P. canius* as much as 29% of the total catch. Meanwhile, *P. merguiensis* were not caught because the boat engine power was not sufficient to pull the *gilltong*.

***Composition* of *gilltong* trial catch results**. During the trial implementation in the waters of South Sorong, West Papua, the catch obtained was by catch, while the main catch, namely *P. merguiensis*, was not obtained. The types of bycatch were 2.71 kg of *Johnius dussumieri*, 0.69 kg of *Saurida undosquamis*, 12.705 kg of *P. canius*, 3.36 kg of *Cynoglossus lingua*, 0.25 kg of *Lepturacanthus savala*, *Anodontostoma chacunda* 1.94 kg, anddd *Sardinella fimbriata* 3.14 kg. The species of catch can be seen in Figure 10.

Figure 10. Fish species captured through *gilltong* catch.

Conclusions. Based on the trials that the authors followed on a boat that operated a *gilltong* fishing gear, it can be concluded:

1. In the operation of the *gilltong* fishing gear, there are several steps that must be prepared, these stages are the preparation of the fishing gear, lowering the fishing gear (setting), then moving to sweep the bottom of the water (sweeping) and withdrawing the fishing gear (hauling).
2. Based on 9 trials, the operating method of the Beach Seine system which is towed using 2 boats is the most effective because it produces more fish.
3. Catch results obtained in the *gilltong* trial are several types of fish which are divided into main target fish and bycatch fish. The main catch was *P. merguiensis* but was not catched et al. The bycatch obtained were 4,147 g of *J. dussumieri*, 915 g of *S. undosquamis*, 19.767 g of *P. canius*, 4,661 g of *C. lingua*, *L. savala* as much as 235 g, *A. chacunda* 3,260 g, *S. fimbriata* 1,041 g.
4. *P. merguiensis* were not caught because the boat engine power was not sufficient to pull the *gilltong*.

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