A Study of mono multifilament bottom gill net in Rembang waters

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Abstract. The mono multifilament bottom gill net was an alternative design to the monofilament bottom gill net for Rembang waters. Monofilament bottom gill net was legal fishing equipment but its use by traditional fishermen in Rembang waters was minimal and this number is now decreasing. This research aimed to analyze effective fish catch of monofilament and mono multifilament bottom gill nets with the addition of swivel and baits. This research employs experimental fishing by comparing fish catch effectiveness between the two types of bottom gill nets. It was conducted in Rembang waters in Central Java from May to June 2018. Treatment variables involved consist of bottom gill net design and fishing time. The ANOVA two-way data analysis was then used to compare results. Results show that fish catch effectiveness of mono multifilament bottom gill net is 66.01%, higher than monofilament bottom gill net, which has 33.99%. It was also found that the highest fish catch effectiveness was attained when the mono multifilament bottom gill net was operated at night (60.08%). Furthermore, the ANOVA analysis (sign 0.05) shows that the design of fishing equipment and fishing time also influence fish catch effectiveness. Hence, it can be concluded that the mono multifilament bottom gill net with swivel and bait operated at night does better at catching demersal fish, compared to its monofilament gill net without swivel and bait counterpart operated during the day.

1. Introduction
Gill net is one of the allowed fishing equipment to be used in the waters of The Republic of Indonesia based on the Decree of the Marine and Fishery Minister number 71 the year 2016. This device is passive and non-destructive in operation against the environment, especially water bed substrates. This makes gill net a fitting alternative to the seine net that has been prohibited for use with the decree of the Ministry of Marine and Fisheries of the Republic of Indonesia number 2 the year 2015 [1][2][3].

Seine net is prohibited for use as it has unwanted impacts regarding biology, ecology, and economy. Biological and ecological impacts will affect the availability of resources for demersal fish to continue its life-cycle, and well-maintained water beds proper ecological condition. On the other hand, demersal biota such as shrimp has shorter life-span [4] compared to fish. This means that untimely and improper exploitation of this resource is wasteful [5][6].

This research has designed a gill net modification using mono multifilament material able to catch demersal fish including crab with the addition of swivel. The purpose is easier setting and hauling, and the addition of bait attractors on the webbing will also make more effective catching. The day and night fishing time is aimed at analyzing the most effective fishing time.

2. Method
This research was conducted from May to June 2018 in the waters of Rembang in Central Java, Indonesia (Figure 1). It employed the experimental fishing method. The equipment used were modified gill net called mono multifilament bottom gill net and monofilament bottom gill net as a control. The latter is the type of gill net commonly used by fishermen in Rembang (Figure 2 and Figure 3).

Figure 1. Research location in the waters of Rembang in Central Java in Indonesia

Figure 2. Design of monofilament bottom gill net
Figure 3. Design of mono multifilament bottom gill net

The addition of swivel on the upper float line is meant to prevent winding round during setting and hauling and to make it easier for the fishermen to get their catch. Baits as attractants were placed 30 cm away from the weight each separated 1 m away from one another. The reason for the earlier was that shrimps as the target have a swimming layer of 30 cm from the bottom of the waters [7][8][9][10]. The reason for the latter is to allow the baits as chemical attractants to have reasonable dispersion area as to result in more effective catchment [11]. Placement of swivel and bait on the mono multifilament bottom gill net is shown in Figure 4.

Figure 4. Design of mono multifilament bottom gill net with swivel and bait

Setting for both bottom gill net designs was performed using the simple random method. The simple random method is shown in Figure 5.

(i) Sequenced net pieces ordering for the monofilament and single multifilament

(ii) Sandwiched net pieces ordering for the monofilament and single multifilament
Data of fish caught were analyzed using the ANOVA two-way statistical test. Analysis of fish catch effectiveness uses the following formula:

\[ E_f = \frac{H_d}{H_t} \times 100\% \]  

\( E_f \): demersal fish catch effectiveness (%), \( H_d \): demersal fish catch (kg), \( H_t \): total fish catch (gr)

3. Results and Discussion
The mono multifilament gill net was able to catch more fish composition than the monofilament gill net (20 types to 9 types). Total fish catch during research with the monofilament and single monofilament in is 86 fish (weight 10,096gr) and 167 fish (weight 16,782gr) respectively (Figure 6 and Figure 7). Swim crab was caught with the monofilament design as it allows for a trammel-net-like webbing that causes biota like finfish to be caught from winding round. The twine multifilament design tends to catch biota from winding round, especially for the crab group [12][9][13][14][15][16].

(i) individual composition of monofilament bottom gill net
**Figure 6.** Individual and weight composition of monofilament bottom gill net

(i) individual composition of mono multifilament bottom gill net
(ii) weight composition of mono multifilament bottom gill net

**Figure 7.** Individual and weight composition of mono multifilament bottom gill net

The number of fish caught using mono multifilament bottom gill net is more compared to its monofilament counterpart, both in the day and at night (Figure 8). This proves that the mono multifilament bottom gill net is more capable of catching demersal fish compared to the monofilament bottom gill net. The fact that the number of fish caught during the night is more than it is during the day is perhaps due to the environment, which is the habitat of nocturnal fish [17]. Nocturnal fish dominate the demersal fish group [18] [19]. Moreover, more activities at night is also affected by the attractants put at the bottom of the gill net. Baits as attractants are beneficial in that they help with more efficient immersion time and hence, more fish catch will be obtained [19]. Baits serve as chemical stimuli that are usually aimed at attracting olfactory organs in fish biota, elasmobranch, and crab [10] [20] [18] [21].

Fish catch effectiveness value is affected by the number of fish catch. Results show that fish catch effectiveness of mono multifilament bottom gill net is 66.01%, higher than monofilament bottom gill net, which has 33.99%. The highest fish catch effectiveness value is for the mono multifilament bottom gill net operated at night, at 60.08% (Figure 9).
Figure 8. Total catch of monofilament and mono multifilament bottom gill net at day and night

Figure 9. Effectiveness of monofilament and mono multifilament bottom gill net

The result of ANOVA analysis (sign 0.05) shows that equipment design and fishing time affect the number of fish catch (Table 1). This means that mono multifilament bottom gill net with added swivel and bait which is operated at night, will result in more fish catch compared to monofilament bottom gill net without added swivel and bait which is operated during the day.

Table 1. ANOVA two-way analysis

| Source            | Type III Sum of Squares | Df  | Mean Square | F       | Sig. |
|-------------------|-------------------------|-----|-------------|---------|------|
| Corrected Model   | 3210.688*               | 3   | 1040.229    | 30.316  |      |
| Intercept         | 4000.562                | 1   | 4000.562    | 116.592 | .000 |
| X1                | 410.062                 | 1   | 410.062     | 11.951  | .000 |
4. Conclusion
The composition of fishing using mono multifilament bottom gill nets is more varied than using monofilament bottom gill net, because crabs are the only catches obtained using the latter. This proves that mono multifilament bottom gill net construction was more effective than monofilament bottom gill net construction. The highest effectiveness of catching fish was obtained using mono multifilament bottom gill net which are operated at night, which can be recommended to fishermen for catching time.

Acknowledgments
The writers wish to thank the Indonesian Ministry of Research and Technology for the competitive grant via Penelitian Terapan Unggulan Perguruan Tinggi/PTUPT (University Excellent Applied Research). The writers are also indebted to Desca Estiyani, M. Fatikul Umam, and Putra for their contribution in collecting and analyzing the data.

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| X2 | 2280.062 | 1 | 2280.062 | 66.450 | .005 |
| X1 X2 | 430.562 | 1 | 430.562 | 12.548 | .000 |
| Error | 411.750 | 12 | 34.312 | .004 |
| Total | 7533.000 | 16 |
| Corrected Total | 3532.438 | 15 |