

Innovative Design of Bottom Hand Line to Increase the Catch of Demersal Fish around Manado Bay

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ABSTRACT

The bottom hand line is one of the fishing tools commonly used by fishermen around Manado Bay. This fishing gear is classified as environmentally friendly and selective because it does not damage the ecosystem, and the hook

size of the fishing line used is adjusted to the target catch. The making of this fishing gear is straightforward, as in the construction of fishing rods in general. The branch line is tied on the main line and given a hook and a weight. This old construction, when operated, often occurs twisting of the branch line on the main line, so the catching success rate is low. Based on these problems, this study aimed to create a new design that minimizes twisting of the branch line on the main line, which in turn can increase the catch. The method used in this research is an experimental fishing method. In this experiment, four boats used fishing lines with the old construction, and the other four ships fishing lines with the new structure. The results obtained during the 15 trips of experimental fishing were 38 for the old construction fishing line and 80 for the new construction fishing line.

Keywords: Vertical handline, new construction, experimental fishing, Manado Bay

INTRODUCTION

Traditional fishing communities in the Manado Bay waters utilize the potential of fisheries resources by catching fish using simple fishing gear (ex. bottom fishing) and using FADs (Tatanging et al., 2019). Manado Bay waters is a aquatic area that has potential fishery resources such as pelagic and demersal resources. Specifically, for demersal fisheries, the waters of Manado Bay store several economically significant demersal fish resources (Allen, 1985; Suman, 2011) such as ruby snapper (*Etelis carbunculus*), red snapper (*Lutjanus* sp.), grouper (*Ephinepelus* spp), emperor (*Lethrinus* sp). These fish are often caught by fishermen around Manado Bay using fishing gear such as bottom gillnet, traps, and bottom handline. Basic fishing lines are the most common fishing gear among the fisherman communities around Manado Bay. It is estimated that each fisherman has 3-4 units of this fishing gear on average. An interesting thing that needs to be studied in this fisheries (bottom fishing line) is the design of the fishing gear itself, both old and new design. The old design used by fishermen to catch bottom fish is the main line connected directly to the branch line. The problem encountered so far in the old design is that during operation (stretching), there is often a twisting between the branch line and the main line, causing a less maximal stretch of the branch line so that the catch obtained by fishermen is less. Based on the above problems, a design of a new bottom fishing rod was tried.

This study aims is to create a new design that minimizes twisting of the branch line on the main line, which in turn can increase the catch.

To realize sustainable fisheries capture following the provisions of responsible fisheries implementation (FAO Code of Conduct for Responsible Fisheries/ CCRF), the exploitation of marine biological resources must be carried out in a responsible manner (responsible fisheries). Data from SOFIA (The State of World Fisheries and Aquaculture) states that 5% of the world's fisheries are in a state of depletion or a continuous decline in production, 16% have been overexploited, 61,3% have been fully exploited, and 10% in the moderate stage, which means that the output can still be increased even though in a small amount (Pauly & Zeller, 2016).

The natural wealth of the sea in North Sulawesi is classified as abundant with promising fishery production. It is used as one of the superior products to spur an increase in local revenue. However, most of the utilization of demersal fishery production, which is thought to be quite potential, has not received much serious attention. After all, appropriate technology has not been found to exploit these resources without causing social and environmental problems, because most of the demersal fish live in relatively deep water habitats. Its presence and abundance are still difficult to detect (Pangalila, 2015).

OBJECTIVE OF THE STUDY

This study aimed to create a new design that minimizes twisting of the branch line on the main line, which, in turn, can increase the catch.

MATERIALS AND METHODS

The location of the fishing ground in this study is located in a geographical position: 01028'10.3"-1028'21.5" N; 124049'20.0"-124049'28.0"E. This location is a fishing spot for fishermen around Manado bay. A vertical line is a line set vertically with one or more baited hooks attached. Vertical lines are also called drop lines or buoy gears. A buoy is usually attached to the line at the surface to indicate position, but the line can also be attached to the boat. A weight is attached to the bottom end of the line (He et al., 2021).

The materials used in the bottom fishing line are wooden rollers and monofilament fishing line, eyes iron hooks, and weights. This research was conducted using survey, descriptive, and experimental fishing methods, a study

based on a descriptive approach. The survey method is an investigation carried out to obtain facts from existing symptoms and seek factual information on the subject under study whose results can be used in making plans and decisions in the future. The descriptive method is a method of examining the status of a class of events in the present. Its purpose is to provide a systematic, factual, and accurate description or description of facts and characteristics of the nature as well as the relationship between the phenomena under investigation (Nasir, 1983) while the experimental fishing method is carried out by operating the design of new and old basic fishing rods. Operation of fishing rods simultaneously in relatively the same water depth. In this experiment, four ships used bottom fishing line with the old design, and the other four used bottom fishing line with the new design.

Data collection was done by recording all the catches during experimental fishing. Catch data on the old and new design primary fishing line recorded by according to the table that has been prepared previously. During experimental fishing, this gear (old and new) was operated by as many as eight units (four units of ancient design and four units of contemporary design). The bait used is the same for the two fishing gear designs, namely the scad fish (*Decapterus macarellus*). Each bottom fishing gear has three hooks.

Data analysis was performed by comparing two different treatment designs. The test used is the t-test. The t-test is a parametric difference test on two paired data. Following this definition, it can be explained in more detail that this test is intended for different or comparative tests. This means that we will compare whether the difference in the mean or mean of the two paired groups is other or not. Paired implies that the data source comes from the same subject. For this test, the paired observation t-test is used (Steel and Torrie, 1993) as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_D}} ; \quad S_D = \frac{\sum D^2 - (\sum D)^2/n}{n-1}$$

atau

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sum D^2 - (\sum D)^2/n}{n-1}}}$$

Where :

\bar{x}_1 = the catch of the new design basic fishing rod

\bar{x}_2 = the net of the old design base fishing rod

RESULTS AND DISCUSSION

Bottom-hand line description and specifications

The fishing rod is a simple fishing tool commonly known by the fishing community. Generally, this fishing lines consists of two main components, namely the line and hook (Subani and Barus, 1989; Nedelec & Prado, 1990; He et al., 2021). The bottom fishing gear made by fishermen consists of a spool, main line, branch line, swivels, hooks, weights, and bait. Where making branch lines directly made a knot. Meanwhile, the bottom-hand line parts of the new design are the same as those made by fishermen, only that each branch line is given a swivel tied with beads, so that the branch line can rotate plenary on its axis.

Specifications of the bottom-hand line old design are presented in Table 1 below, and the old image (design) is shown in Figure 1.

Table 1

Specifications for the old design of the bottom-hand line

No.	Part	Material	No	Dia.(mm)	Lgth (m)	Wght (gr)	Jlh (bh)
1.	Roller	Wood	-	33	-	200	5
2.	Main line	PA Mono	1000	1	300	-	1
3.	Branch line	Damyl	60	0,6	1,10	-	3
4.	Hooks	SST	5		-	-	3
5.	Swivel	SST	1	-	-	10	1
6.	Weight	Iron	-	18	0,30	500	5

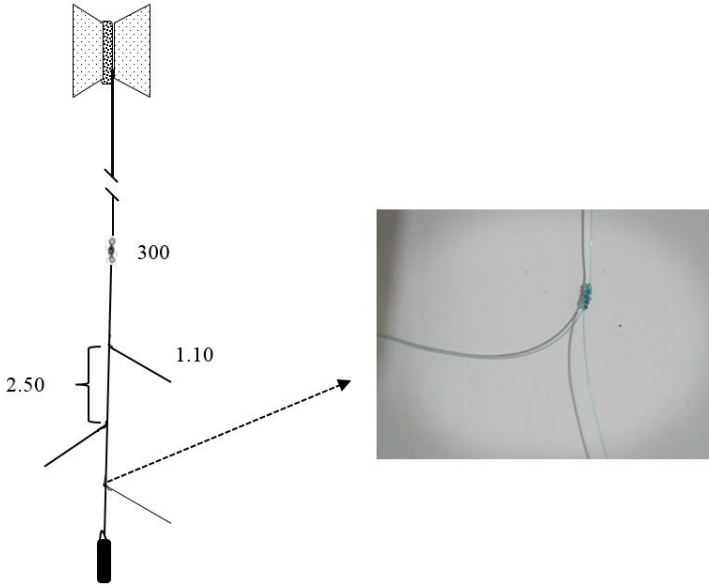


Figure 1. Construction of the old design bottom hand line.

For old design, bottom hand line do not use beads and swivels on the branch line because the branch line is tied directly (knotted directly). The beads made of plastic (Pls) with a diameter of 0,9 mm are attached to the newly designed bottom hand line strings with swivels. The function of the beads is to hold the swirls from moving or moving from the desired position, but the swirl itself can rotate freely. The new design bottom hand line specifications are presented in the Table 2 and the new (design) drawings are presented in Figure 2.

Table 2

Specifications of the bottom hand line of the new design (modification)

No.	Bagian	Material	No	Dia.(mm)	Lgth (m)	Wght (gr)	Jlh (bh)
1.	Roller	Wood	-	33	-	200	5
2.	Main line	PA Mono	1000	1	300	-	1
3.	Branch line	Damyl	80	0,6	1,10	-	3
4.	Hooks	SST	5	-	-	-	3
5.	Swivel	SST	1	-	-	10	1
	Swivel	SST	0.4	-	-	5	3
6.	Beads	Plastic	0.3	0.9	-	0.05	2
7.	Weight	Iron	-	18	0,30	500	5

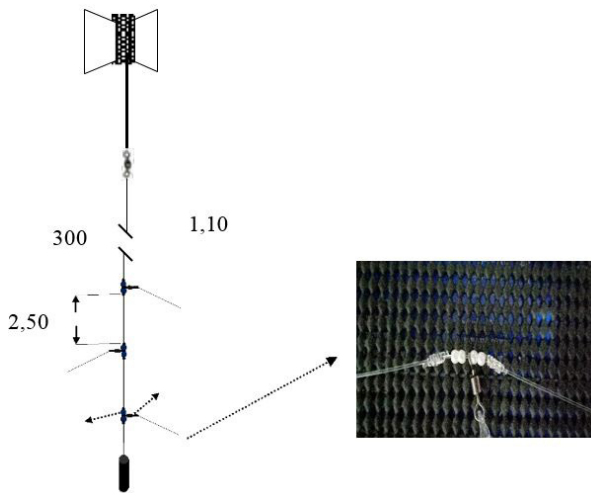


Figure 2. The new design of bottom hand line (modification).

The catch

The success of baited bottom fishing gear is largely determined by the living activities of the fish in term of finding and catching food. The knowledge gained through the studies of fish foraging behaviour will be helpful for understanding the interaction of target species with baited gear (Lokkeborg, 1994). Feeding behaviour of fish is classified by Atema (1980) into four phases, namely: being aroused by the smell of the bait (arousal), finding its position (search location), taking food (food uptake) and putting it in the mouth or swallowing it (food ingestion). Several previous studies on bottom fishing (Pangalila, 2015; Ontoni et al., 2017) reported that bottom fishing results were also influenced by the type of bait used.

The catch obtained during the operation of the old and new design bottom hand line amounted to 96 fish, of which 38 were caught using the old design bottom hand line and 58 others were caught using the latest design bottom-hand line. The average weight per fish catch of the bottom fish is 2 kg. The types of fish identified during the study were deep water ruby snapper (*Etelis carbunculus*), pale snapper (*Etelis radiosus*), greater amberjack (*Seriola dumerili*), grouper (*Epinephelus* sp.) (Froese and Pauly, 2000).

The catch data was obtained from conducting experimental fishing several times, from fishermen using old and new fishing gear. Catch data between January

to August 2019, as many as 15 successful fishing operations trips, are presented in Table 3.

Table 3

Catch data (tail) of both bottom-hand line designs between January-August 2019

Trip (<i>experimental fishing</i>)	Bottom-hand line	
	New Design	Old Design
1	3	2
2	4	2
3	5	4
4	3	1
5	6	4
6	4	3
7	3	2
8	5	4
9	4	3
10	3	2
11	4	3
12	3	2
13	4	2
14	3	2
15	4	2
Total	58	38

Unit: tail

The catch data in Table 3 above has been analyzed using the SPSS application for the paired t-test (t-Test: Paired Two Sample for Means). The test results are presented in Table 4.

Table 4

The results of the calculation of the paired t test (t-Test: Paired Two Sample for Means)

	Old design	New design
Mean	2.53	3.87
Variance	0.84	0.84
Observations	15	15
Pearson Correlation	0.86	
Hypothesized Mean Difference	0	
df	14	
t Stat	-10.58300524	
P(T<=t) one-tail	2.30483E-08	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	4.60966E-08	
t Critical two-tail	2.144786688	

The results of the above calculations are obtained $t_{hit} = 10.58$ and $t_{table} = 2.14$. It means that there is a significant difference between the old design's bottom-hand line and the new design in increasing the catch. So, the new design bottom-hand line is more effective in catching demersal fish. This is because, in the old design bottom hand line, the branch line often has problems (twisted on the main line) when it is operated. On the other hand, the new design bottom hand line does not occur in the branch line because it is designed in such a way, namely by adding a bead and a swivel on the branch line (Figure 2).

CONCLUSIONS

The result of experimental fishing for fifteen trips over several months resulted in a significant catch of old and new construction bottom hand line. In the analysis of the t-test using the SPSS application, it can be concluded that: (1) The new construction fishing line (modified) is better than the old construction. This is because the old construction fishing line frequently twists when it is stretched to the bottom of the water, while the modified construction fishing line does not; and (2) The types of bottom fish that were often caught during the study were identified, namely ruby snapper (*Etelis carbunculus*), pale snapper (*Etelis radiosus*), amberjack (*Seriola dumerili*), grouper (*Epinephelus* sp.).

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