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Catching Efficiency of Multiple Handline Operated in Payaw Areas

FACUNDO B. ASIA and RODAN R. GARCIA
Mariano Marcos State University
College of Aquatic Sciences and Applied Technology
Currimao 2903, Ilocos Norte, Philippines

Abstract

Multiple handline fishing was carried out in payaw-deployed areas in waters off the Northwestern Ilocos coast. Three handlines with varying hook distances (50, 75, and 100 cm) attached to the mainline baited with red and silver artificial lures were used in the study. Fishing operations were done in the morning and in the afternoon. The main objective was to determine which of the artificial lures, hook distances and time of fishing oper ation are effective catch rates of handlines. Results showed that handlines with hook spacing of 100 cm, baited with red lure operated in the morning performed better in terms of catch and income. Landings of Yellowfin tuna (*Thunnus albacares*, Scombridae) was highest in the landings, followed by roundscad (*Decapterus macarellus*, Carangidae) and Skipjack (*Katsuwonus pelamis*, Scombridae).

Introduction

Municipal fishermen in the country use several fishing methods, which they employ for their daily subsistence. One kind of a simple and easy to operate fishing gear is a multiple hand line. This is a type of handline composed of a single vertical line with a small series of barbed hooks attached to it by spreaders at regular intervals. Each branchline has a length of 15 cm and is attached to the mainline at intervals of 30 cm (Umali 1950). Baits used are either natural or artificial lures. The gear is generally operated during the day for catching species of fish on coral reefs and more recently, pelagic species of fishes such as tuna, tuna-like species, swordfish and others.

Multiple handline is the third most popular fishing gear used by the local fishermen in Ilocos Norte (Asia et al. 2001). Accordingly, this fishing gear is also one of the most productive and profitable fishing gears and contributes much to the fishermen's income. With the introduction of fish aggregating devices (locally known as "payaw") in the Ilocos provinces in the 1980s, line fishing has been found to be effective for harvesting fish in payaw deployed areas. Troll line was the first fishing gear used by local fishermen

*Corresponding Author :
Email address : dong_asia@yahoo.com

in payaw areas and in the early 1990s, multiple handline fishing was introduced by the local fishermen.

Choosing the right lure or bait is one of the biggest problems of fishermen (Evanoff 1974). Most fishermen consider hand line fishing using artificial lures as one of the best ways of catching fish. Artificial lures are designed to simulate natural prey of the target fishes (Evanoff 1961) and has the advantage of being reusable.

This study was undertaken to determine (1) the catch composition and relative abundance of fish caught by multiple handline fishing in payaw areas; (2) the catch per unit of effort per gear per fishing operation; (3) the most effective color for the artificial lure; (4) optimum distance between hooks in the handline; (5) best time of the day to operate the fishing gear; and (6) assess the economic profitability of multiple handlines.

Materials and Methods

Location of the study area

The study was conducted in fish aggregating devices (locally known as "payaw") set in the waters off the Northwestern Ilocos coast, Philippines from February to April 2000. Fig. 1 shows the approximate location of the payaw units where the experimental fishing operations were conducted.

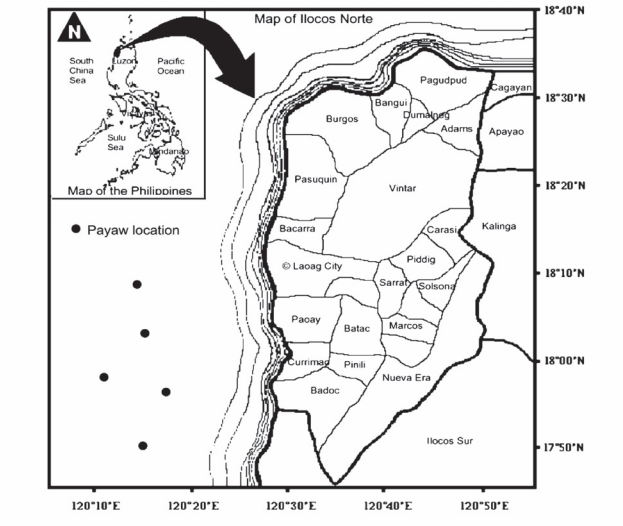

Figure1. Approximate location of payaw units where the study was conducted.

Experimental design

Three multiple handlines, each with a length of 25 meters consisting of 9 hooks per fishing gear, were used in the study. The first handline had a 50 cm distance in between hooks, the second, a 75 cm distance and the third, a 100 cm distance. Each hook was covered with colored lure (red or silver). The lures were kept in motion through the water by jigging (an up and down movement of the arm) while drifting. Structure and operation of a typical handline are given in Fig. 2. Comparative fishing trails with the experimental handlines with different rigging and lure colors were conducted during 06:00-10:00 h in the morning and 14:00-18:00 h in the afternoon. Details of experimental design used for the comparative fishing trials are given in Table 1.

Table 1 Details of experimental design

Sl. No	Hook spacing	Colour of lure	Time of operation	Replicates
I.	50 cm	Red	06:00-10:00 h	3
		Red	14:00-18:00 h	3
		Silver	06:00-10:00 h	3
		Silver	14:00-18:00 h	3
II.	75 cm	Red	06:00-10:00 h	3
		Red	14:00-18:00 h	3
		Silver	06:00-10:00 h	3
		Silver	14:00-18:00 h	3
III.	100 cm	Red	06:00-10:00 h	3
		Red	14:00-18:00 h	3
		Silver	06:00-10:00 h	3
		Silver	14:00-18:00 h	3

Analysis of data

Catch composition and relative abundance were determined in terms of number and weight using the following formula:

$$\text{Relative abundance (\%)} = \frac{\text{Catch (kg or number) species-1 gear-1}}{\text{Total catch (kg or number) of all species gear-1}} \times 100$$

Catch per unit of effort was also determined using the following formula:

$$\text{CPUE} = \frac{\text{Total catch (kg) day-1}}{\text{Fishing time (h)}}$$

Analysis of Variance (ANOVA) was employed to determine the differences in yield with respect to hook spacing, colors of lure and time of the day. F-test was used to test the null hypothesis of no differences among treatment means. A *t*-test using the Duncan's Multiple Range Test (DMRT) was further employed for multiple comparisons among treatments when the result of the F-test showed a significant difference.

A simple cost and return analysis was done for each of the three multiple hand lines with different colored lures to assess their profitability.

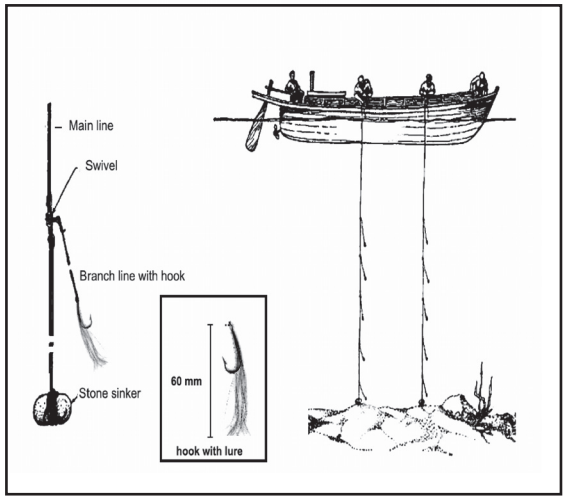

Figure 2. A typical multiple handline (after Umali, 1950) and structure experimental lure (inset)

Results

Species of fish caught and their relative abundance

The fishing gear mainly caught three species of fish, namely; yellowfin tuna (*Thunnus albacares*, Scombridae), roundscad (*Decapterus macarellus*, Carangidae) and skipjack (*Katsuwonus pelamis*, Scombridae). Yellow fin tuna dominated the catches both in terms of weight and number (Figures 3 and 4). Yellowfin tuna and skipjack belong to the large pelagic species of fish while the round scads belong to the small pelagic species of fish. Total catch during the experimental operations were 250 kg (545 nos).

The yellowfin tuna had the highest relative abundance of 53.64 % and 51.38 % in terms of weight and number, respectively, followed by round scads (33.96 % by weight and 36.33 % by number) and skipjacks (12.40% by weight and 12.29% by number).

Catches of yellowfin tuna ranged from 22 cm to 36 cm in total length with an average of 29.73 cm while the round scads also ranged from 22 cm to 36 cm but with an average of 31.06 cm. The catches of skipjack ranged from 22 cm to 37 cm with an average of 28.76 cm.

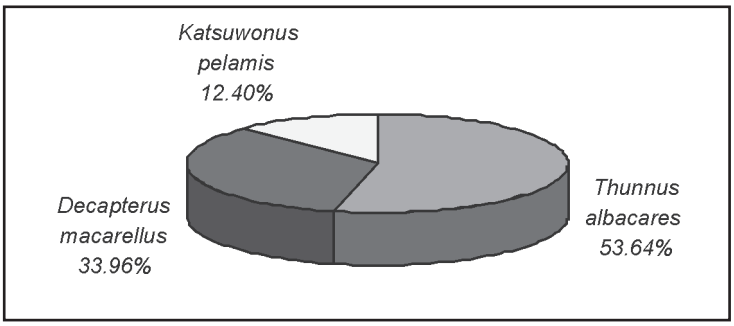

Figure 3. Catch composition of experimental multiple handlines (in terms of weight)

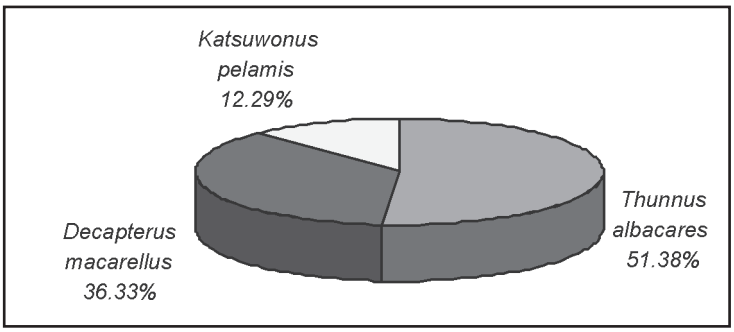

Figure 4. Catch composition of experimental multiple handlines (in terms of numbers)

Catch per unit of effort

Table 2 shows the catch per unit of effort (CPUE) for each set of experimental handline. Results show that, although there was no significant difference observed, the multiple handline with 100 cm hook spacing baited with red lure had the highest CPUE of 2.04 kg h-1, followed by silver lure (1.43 kg h-1). The CPUE of the multiple handlines tended to increase with increasing hook distances and red lures obtained comparatively higher CPUE than silver lures.

Table 2. Catch per unit of effort (kg hr-1) of experimental multiple handlines.

Hook spacing	Lure colour		Mean	Difference
	Red	Silver		
50 cm	0.365 [a]	0.293 [a]	0.329 [a]	0.072
75 cm	0.675 [a]	0.416 [a]	0.545 [a]	0.259
100 cm	2.043 [a]	1.428 [a]	1.735 [a]	0.615

Means with same superscript in a column are not significantly different at 5% level

Effect of color of lure on yield

Results show that there is no significant difference in catch between the red and silver lures used in different experimental multiple handlines, both in terms of weight (Table 3) and number (Table 4). However, the catch from handlines with the red lure was generally performed better compared to the silver lure.

Table 3. Mean catch per day (kg) by different experimental handlines

Hook Distance	Lure		Mean	Difference
	Red	Silver		
50 cm	5.833 [b]	4.667 [b]	5.250 [b]	1.167
75 cm	10.800 [b]	6.667 [b]	8.733 [b]	4.133
100 cm	32.667 [a]	22.833 [a]	27.750 [a]	9.833

Effect of time of fishing operation on yield

Catch (kg) obtained by the handlines was significantly different ($p < 0.05$) between the two fishing periods (morning and afternoon) and the yield was comparatively higher in the morning. However, the fishing gears baited with silver lure had no significant difference in catches in both morning and afternoon fishing operations (Table 5). This means that the fishermen can have a better catch in the morning using the fishing gears baited with red lure and with the 100 cm distance in between hooks.

Table 5. Average catch per operation (kg) of experimental handlines at different times of the day.

Fishing time	Lure		Mean	Difference
	Red	Silver		
06:00-10:00 h	10.67 [a]	6.17 [a]	8.42 [a]	4.50
14:00- 18:00 h	5.77 [b]	5.22 [a]	5.50 [b]	0.55

Means with same superscript in a column are not significantly different at 5% level

Profitability analyses of the different multiple handlines

Results of the profitability analyses showed that the 50 cm distance in between hooks multiple handline with both the red and silver lures had negative returns of investment (ROI) of –41.90 and –53.40, respectively (Table 6). This means that this fishing gear is not economically viable for the fishermen. On the other hand, handline with 75 cm distance between hooks with red lures performed better with ROI of 7.40 but the gear with silver lure had a negative ROI of –33.70. The highest ROI among the experimental handlines evaluated was given by the handline with 100 cm distance in between hooks with red lures (225.12), followed by the design with silver lures (127.90). The ROI of the multiple handlines with 30 cm distance in between hooks with different lures which is generally used by fishermen in the province is 6.70 (Asia et al. 2001). The overall result of the study shows an increasing ROI of the fishing gears with increase in the distance between hooks and the red lure gave a higher value of ROI.

Table 6. Efficiency indicators of the different experimental handlines.

Fishing gear	Efficiency Indicators			
	Gross margin	Cash Requirement	Gross margin per Unit of Cash Expense	Return on Investment (ROI)
50 cm Hook Distance				
a. Red Lure	-252.69	603.09	-0.419	-41.90
b. Silver Lure	-322.29	603.09	-0.534	-53.40
75 cm Hook Distance				
a. Red Lure	44.91	603.09	0.074	-7.40
b. Silver Lure	-203.49	603.09	-0.337	-33.70
100 cm Hook Distance				
a. Red Lure	1357.71	603.09	2.251	225.10
b. Silver Lure	767.31	603.09	1.272	127.20

Discussion

Two species of large pelagic fish, *viz*., yellowfin and skipjack and one species of small pelagic fish (round scad) comprised the catch of the experimental fishing using multiple handlines. Data show that yellowfin tuna was the most abundant both in terms of number and weight. Catch per unit of effort was also highest with this species. Hence, multiple handline fishing can be advantageously used for selective fishing for yellowfin tuna.

Lure with red color obtained better catch during comparative fishing. Multiple handline design with 100 cm distance in between hooks showed higher catching efficiency than those with lesser distances in between hooks. Further studies on the maximum distance between hooks in order to improve the efficiency of multiple handline fishing are required.

Profitability analyses showed an increasing trend of profitability with increase in distance between hooks. Multiple handlines baited with red lure gave the highest return on investment compared to those baited with the silver lure.

Based on this study, it can be concluded that multiple handline with 100 cm distance between hooks and baited with red lure are more efficient and profitable. The fishermen operating multiple handline can have a better catch in the morning compared to afternoon.

Conclusion

Multiple handline with 100 cm distance in between hooks baited with a red lure has proved to be an efficient gear and may be advocated for profitable operation by fishermen for fishing in payaw deployed areas. However, a more detailed study may be undertaken in order to further optimize the distance between hooks in multiple handlines that would maximize the catch and profits. It can also be concluded that morning time is more rewarding for operation of multiple handline in payaw-deployed areas than afternoon.

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