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Analysis of fish catches by traditional and mechanized handline in Ambon Island waters, Maluku, Indonesia

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Abstract. Handline is the most popular fishing gear used by fishers inhabits coastal area in Ambon Island, Maluku, Indonesia. In the recent years, catches by handline fishers tend to decrease, therefore they try to modify the gear through mechanization to improve their catches. This research was conducted in the waters of Ambon Island to compare catches between traditional and mechanized hand liner. Totally, there were 18 species consist of 88 individuals with 98.61 kg in weight caught during the research. Mechanized handline caught more species and more weight but less in duration of hauling compare to traditional one. Mean weight and mean length of the fishes caught were significantly different in relation to duration of hauling for both types of handlines.
Key Words: Fishing, traditional fishing, mechanized fishing, fish species.

Introduction. Ambon is one of the islands in Maluku Province located in eastern part of Indonesia. This island has an area of 775 km^2 with the coastline of 1,256 km. Estimated potential of fish resource in this area is 484,532 ton year^{-1}, but the utilization of fish resource is about 41,307 ton year^{-1} (BPMD Maluku 2007).

Most of the communities which inhabit coastal area in Ambon Island are traditional fishers. Their fishing operation is limited and their fishing gear is the traditional one. Most of the fishers in Ambon Island use handlines for fish catching. According to Von Brandt (1984), handlining is among the oldest forms of fishing and is commonly practiced throughout the world today especially by traditional fishers. Handline is very simple fishing gear which only consists of line, hook and reel. This fishing gear can be operated from a stationary or moving boat.

Besides its simplicity, the handline fishery is considered as a sustainable fishing practice (Sainsbury 1996), since Indonesia hold considerable amount of coral reefs (Allen & Adrim 2003) were anthropogenic activities are predicted to have serious impact on coral reefs which can change the composition of reef associated fish communities (Wilson et al 2006). Not at least sustainable fishing practice/ethics should consider climate change issues in order to maintain biodiversity and satisfy fisherman demands (Rudi et al 2012; Ateweberhan & McClanahan 2010).

Even though the catches are vary, the main target of handline fishers in Ambon Island are demersal commercially significant fishes such as groupers and snappers. Large groupers and snappers have high economic values. In local market, the price of grouper is 25 to 30 US$/kg^{-1}, while in international market such as in Hong Kong, Taiwan and China it is sold alive up to 55 US$ /kg^{-1} (Akbar & Sudaryanto 2001).

Some recent studies were conducted regarding traditional fishing techniques, considering day and night fishing, were the night fishing proved to be the most efficient (Rizwan et al 2014).

In the recent years, catches of handline fishers in Ambon Island tend to decrease due to limited distance covered and inefficient fishing operations. Therefore, they try to

improve their fishing boats as well as their fishing gears. This research was conducted in the waters of Ambon Island to compare catches between traditional and mechanized handliners.

Material and Method. This research was carried out in surrounding waters of Ambon Island, Maluku Province, eastern Indonesia (Figure 1). A total of 22 fishing operation consist of 10 sampling for traditional and 12 sampling for mechanized handline were conducted during the research. Data was processed with Microsoft Excel 2010 software. The t test assuming unequal variance was used to analyze difference between traditional and mechanized handline catches in term of weight, length and duration of hauling. Weight and length of the fish caught in relation to hauling duration for each handline were analyzed using one way ANOVA test. Subsequent analysis using Duncan test was conducted when there are significant differences. The level of significance is $P<0.05$.

Figure 1. Map showing research site surrounding Ambon Island.

Results and Discussion. Data in this research was collected from catches of traditional and mechanized handlines. During the research, 88 individuals with total weight of 98.61 kg belong to 18 species were caught (Table 1).

It can be seen in table 1 that mechanized hand liner catch more species compare to traditional one. The numbers of fish caught were dominated by *Caranx* sp and *Lutjanus* spp which comprised 40% of the catch.

Summary of hauling duration and the fish sizes caught by traditional and mechanized handline is presented in table 2. The results of t test showed that length and weight of fishes caught as well as hauling duration of mechanized handline were significantly different compare to those of traditional handline. The total hauling duration of traditional during the research is more than four times comparing to mechanized handline. These results indicated that mechanized handline is more efficient because it caught larger and heavier fish and it is less in duration of hauling than traditional handline.

Analysis of fish weight and fish length caught by mechanized handline in relation to duration of hauling are presented in table 3 and table 4. In this analysis, weight and length of fishes were grouped according to hauling duration of 2-2.9, 3-3.9 and ≥4 minutes. The results showed that the size of fish caught significantly affected duration of hauling. Subsequent analysis using Duncan test is presented in table 5.

Table 1

Species composition, number of individuals and duration of hauling based on traditional and mechanized handline

No.	Species	Traditional			Mechanized		
		Number (ind.)	Weight (kg)	Time (minute)	Number (ind.)	Weight (kg)	Time (minute)
1.	*Caranx* sp	7	7.92	84.5	8	10.33	26
2.	*Plectorhinchus* sp	2	1.67	24	2	2.81	5
3.	*Carcharhinus* sp	2	3.90	39	4	9.79	15
4.	*Parupeneus* sp	2	1.35	16	1	0.72	2.5
5.	*Sphyraena* sp	6	5.25	61	2	1.41	6
6.	*Carcharhinus* sp1	1	0.80	11	1	0.83	3
7.	*Cephalopholis* sp	5	3.55	2	3	3.30	7
8.	*Lethrinus* sp	3	2.35	41	4	4.09	12
9.	*Etelis* sp	4	6.57	58	2	4.13	6
10.	*Sargocentron* sp	1	0.90	6	0	0	0
11.	*Lutjanus* sp1	3	2.59	20	3	2.95	6
12.	*Lutjanus* sp2	1	1.60	12	2	2.51	5.5
13.	*Cheilinus* sp	0	0	0	1	1.30	3.5
14.	*Epinephelus* sp	2	1.36	24	1	0.88	3
15.	*Lethrinus* sp1	0	0	0	1	1.01	3.5
16.	*Cetoscarus bicolor*	0	0	0	2	2.02	5
17.	*Pristipomoides* sp	0	0	0	1	1.24	3
18.	*Lutjanus* sp3	7	5.78	80.5	4	3.71	12
	Total	46	45.59	531	42	53.02	124

Table 2

Comparison of hauling duration and fish sizes caught by traditional and mechanized handline

Statistics	Weight (kg)		Length (cm)		Haul. duration (minute)	
	Traditional	Mechanized	Traditional	Mechanized	Traditional	Mechanized
Total	45.59	53.02	-	-	531	124
Minimum	0.375	0.700	36.0	48.0	6	2
Maximum	2.875	3.035	122.0	119.0	20	<5
Mean	0.991	1.262	59.81	70.33	11.53	2.94
SE	0.071	0.094	2.42	2.72	0.50	0.09

Table 3

ANOVA for duration of hauling and fish weight caught by mechanized handline

Source of variation	df	Sum of square	Mean square	F calc	F crit	P-value
Between	2	3.634	1.812	6.047	3.238	0.005
Within	39	11.718	0.300	-	-	-
Total	41	15.352	-	-	-	-

Table 4

ANOVA for duration of hauling and fish length caught by mechanized handline

Source of variation	df	Sum of square	Mean square	F calc	F crit	P-value
Between	2	3485.492	1742.746	7.316	3.238	0.002
Within	39	9289.842	238.201	-	-	-
Total	41	12775.334	-	-	-	-

Table 5

Duncan test on weight and length based on hauling duration for mechanized handline

No.	*Hauling duration (minute)*	*Weight (kg)*	*Length (cm)*
1	2.0–2.9	1.009[a]	56.36[a]
2	3.0–3.9	1.239[a]	73.63[ab]
3	≥4.0	2.115[b]	86.50[b]

Means with different superscripts within the same column are significantly different.

Data in table 5 showed that duration of hauling of mechanized hand line is significantly affected by the size of fish. The larger size of the fishes caught, the more time needed to haul those fish. Duration of hauling to catch fish weight 2.1 kg in average with length of 86.5 cm for example is almost twice compare to the time needed to catch fish weight 1 kg with mean length 56.4 cm.

The results of analysis for fish weight and fish length caught by traditional handline in relation to duration of hauling are shown in table 6 and table 7, while subsequent analysis using Duncan test is presented in table 8.

Table 6

ANOVA for duration of hauling and fish weight caught by traditional handline

Source of variation	*df*	*Sum of square*	*Mean square*	*F calc*	*F crit*	*P-value*
Between	2	3.280134	1.640	9.907	3.214	0.000
Within	43	7.11863	0.166	-	-	-
Total	45	-	-	-	-	-

Table 7

Anova for duration of hauling and fish length caught by traditional handline

Source of variation	*df*	*Sum of square*	*Mean square*	*F calc*	*F crit*	*P-value*
Between	2	3842.871	1921.435	9.923	3.214	0.000
Within	43	8326.117	193.6306	-	-	-
Total	45	-	-	-	-	-

Table 8

Duncan test on weight and length based on hauling duration for traditional hand line. Mean with different superscripts within the same column are significantly different

No.	*Hauling duration (minute)*	*Weight (kg)*	*Length (cm)*
1	< 10	0.641[a]	39.77[a]
2	10-15	0.933[a]	58.75[b]
3	> 15	1.761[b]	82.33[c]

It can be seen in table 6 and table 7 that size of fish in term of weight and length significantly affected hauling duration of traditional handline. Subsequent analysis using Duncan test in table 8 showed that length of fish caught significantly affected all categories of hauling duration of traditional handline.

Conclusions. The present study shows that mechanized handline caught more species and more weight and it is less in duration of hauling compare to traditional one. Mean weight and mean length of the fishes caught were significantly different in relation to duration of hauling for both types of handlines.

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