Analysis of the Difference in Frequency Sound Waves to the Catch of Gulamah Fish (*Johnius trachycephalus*) Using a Trammel Net in the Coastal Area of Surabaya

Nurul Rosana[1,2,*], Nuddin Harahab[3], Gatot Ciptadi[3], Andi Kurniawan[3], Supartono[1],Viv Djanat Prasita[1], Suryadhi[1], Safriudin Rifandi[1], Amirul Muminin[1]

[1] *Faculty of Engineering an Marine Science, Hang Tuah University, Surabaya, Indonesia*
[2] *Student of Postgraduate Environmental Science Doctoral Program, Universitas Brawijaya, Malang, Indonesia*
[3] *Postgraduate Environmental Science Doctoral Program, Universitas Brawijaya,, Malang, Indonesia*
*Corresponding Author. Email: nurul.rosana@hangtuah.ac.id

ABSTRACT

The attractor is a fishing aid in form of light or sound waves that attracts fish attention, thereby getting them closer to the fishing gear. This research aims to analyze the difference in the frequency of sound wave attractors to the catch of gulamah fish (*Johnius trachycephalus*) using a trammel net on the east coast of Surabaya. This research used the experimental fishing method to determine the effect of sound wave attractor on fish. The result showed that the distribution of the catch of gulamah fish using trammel net fishing gear with sound wave-based attractors, produced the highest value of 7.4 kg (33.63%) at a frequency range of 800 Hz, followed by 5.1 kg (23.18%) at 700 Hz and 3.3 kg (15.00%) at 900 Hz.

Keywords: Attractor, Frequency, Sound-wave

1. INTRODUCTION

Indonesia as an archipelagic country has enormous fishery potential, so information about the presence of fish is very important for capture fisheries actors, where currently fishing is more dominant based on fishing experience [1]. One method that can be used to increase efficiency in fishing operations is the use of underwater acoustic technology, which converts electrical signals into sound signals [2-4].

Sound plays an important role in the life of organisms under the sea [5]. Marine organisms obtain information from biotic and abiotic sound sources through their hearing system and then react to these sources [6]. The challenge in the world of fisheries, especially in the field of fishing, is the touch of environmentally friendly technology which is expected to be used to increase the catch of fishermen, especially traditional fishermen [7]. Traditional fishermen who use simple fishing gear in carrying out fishing operations are still the dominant number in Indonesia. Appropriate technology that is easy

to use and is applied when fishing operations are a necessity that can be used as a solution to increasing the amount of catch.

Three-layer gill net (*trammel net*) is a simple fishing gear that is widely used by fishermen on the coast of Bulak District, Surabaya. This type of fishing gear can be used by fishermen throughout the year with various types of catches according to the fishing season. The types of fish caught from the trammel net are small pelagic and large pelagic fish, as well as demersal fish, one of which is gulamah fish (*Johnius trachycephalus*).

The attractor is a fishing aid that can attract fish attention getting closer to the fishing gear. The attractor as a catching aid that is used can come from light or sound waves [8]. Sound wave-based attractors with a frequency range of 500-1000 Hz [9] are a fishing aid that can be used in three-layer gill nets (trammel net) to increase the catch. In the results of previous research, it was found that the fish's interest in the sound produced by the attractor produced a pattern, where the fish that had approached,

turned away due to a change in the frequency of the sound produced by the tool, so it is necessary to research changes in the frequency range aimed at optimizing the catch.

This research focuses on gulamah fish (*Johnius trachycephalus*) as catch fish because this fishing can be done all year round. According to Saputra et al. [10], the peak fishing season is in January. Gulamah fish (*Johnius trachycephalus*) is one of the dominant types of demersal fish caught by fishermen using a three-layer net (trammel net) [11]. Gulamah fish (*Johnius trachycephalus*) is included in the order Percoformes, the Scinidae family with various local names or names, including: tigawaja, tengkerong, siliman, purslane and gelomo with an average length of 150 mm males and 154 mm females at the time of the study [11]. And according to Saputra et al. [10], female fish have a dominant length ranging from 152-161 mm while dominant male fish has a length of 150 - 156 mm.

The focus of this research was to analyze the difference in the frequency of sound wave-based attractors to the catch of gulamah fish (*Johnius trachycephalus*) using a trammel net on the coast of Bulak District, Surabaya. The use of sound wave-based attractors with a frequency range between 500-1000 Hz aims to make the fish that are attracted to the sound source are fish that are the target of fishing in these waters. In addition, the use of attractors is also used to find out at what frequency the fish gives the highest response.

2. MATERIALS AND METHODS

The method used in this research was experimental fishing, where the research was carried out by giving treatment to the object and looking for the effect of the treatment on the object under study. The instrument used in this study was a sound wave-based attractor that had been tested in the laboratory and in the water [9]. In this study, the frequency ranges used as treatment were the range of 500-1000 Hz by using 6 tools, each of which had a different frequency ranges, namely 500 Hz, 600 Hz, 700 Hz, 800 Hz, 900 Hz and 1000 Hz. The data analysis used to determine the effect of different attractor frequencies on the catch of gulamah fish (*Johnius trachycephalus*) was a statistical analysis with a completely randomized design test and to determine the best treatment using a different frequency range, the Duncan test was used. The expected hypothesis (H_1) used was sound wave-based attractors with different frequency ranges affect the catch of gulamah fish (*Johnius trachycephalus*) using a three-layer net (trammel net) on the coast of Bulak District, Surabaya.

The fishing gear used was a trammel net with an outer mesh size of 4 inches and an inner mesh of 1 inch, the net was operated at a water depth of about 5 meters above sea

level and the number of nets used was 30 pieces. The fishing operations were carried out 9 times in March-April 2021 in the waters of Bulak District, Surabaya.

The sound wave-based attractor was hung on the top rope on the trammel net fishing gear randomly, with the distance between the tools being every 5 pieces of net. Data on catch weight and total length of gulamah fish (*Johnius trachycephalus*) were data taken for analysis. The sound wave-based attractor used was as follows (Figure 1).
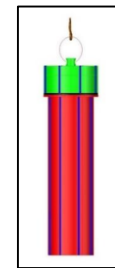

Figure 1 Fish attractor

3. RESULTS AND DISCUSSION

Gulamah fish (*Johnius trachycephalus*) is one of the economically important fish belonging to the demersal fish group that lives on the bottom of the waters and does not form groups. The distribution of the catch of gulamah fish (*Johnius trachycephalus*) using trammel net fishing gear and the frequency difference treatment of sound wave-based attractors with a range of 500-1000 Hz can be seen in Table 1. The total catch using 9 replications was 22 kg with average weight fish per fish was 0.4 kg (400 g).

Table 1. Distribution of gulamah (*Johnius trachycephalus*) catch using trammel net with sound wave-based attractors at different frequencies in Bulak district, Surabaya

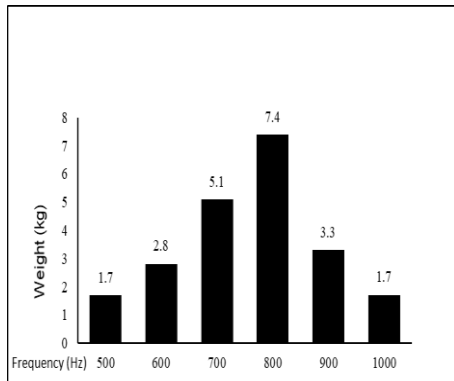| Frequency (Hz)	Catches Results of Gulamah fish (*Johnius trachycephalus*) (kg)/ Repetition									Total (kg)	Percentages (%)
	1	2	3	4	5	6	7	8	9		
500	0	0.3	0.1	0	0.2	0.4	0.4	0	0.3	1.7	7.73
600	0.2	0.3	0.6	0.3	0.3	0.2	0.2	0.2	0.5	2.8	12.73
700	0.6	0.6	0.2	0.8	0.2	0.6	0.8	0.4	0.9	5.1	23.18
800	0.8	0.5	0.5	0.8	0.6	1.3	1.2	0.3	1.4	7.4	33.63
900	0.5	0.2	0.4	0.2	0.2	0.1	0.6	0.4	0.7	3.3	15.00
1000	0.3	0.3	0.2	0.2	0.0	0.3	0.0	0.0	0.4	1.7	7.73
Total										22	
Mean of weight per tail										0.4	

Figure 2 Distribution of gulamah (*Johnius trachycephalus*) catches using trammel net with sound wave-based attractors at different frequencies in the coastal district of Bulak, Surabaya

From Table 1 and Figure 2, it can be seen that the distribution of the catch of gulamah fish (*Johnius trachycephalus*) using trammel net fishing gear with the use of sound wave-based attractors obtained the highest value in the 800 Hz frequency range of 7.4 kg (33.63%) . This was followed by a frequency of 700 Hz. amounted to 5.1 kg (23.18%) and a frequency of 900 Hz was 3.3 kg (15.00%). The number of catch tended to decrease at a frequency of 500 Hz, 600 Hz and 1000 Hz. In Figure 2, it can be seen that the response of gulamah fish on each replication is the highest at a frequency of 800 Hz. It can be explained that fish can respond the sound and getting closer to the source, adjusting to the similarity of the sound emitted with a fish activity. Thus, frequency range where fish interest decreases, it can be caused by sounds that are not in accordance with activities which are usually responded to as a positive thing.

The significance value obtained from the analysis of gulamah fish (*Johnius trachycephalus*) using a completely randomized design test is 0.00 below 0.05 (Table 2). So H_1 can be accepted, which means that sound wave-based attractors with different frequency ranges have an effect on catches. Gulamah fish (*Johnius trachycephalus*) using a three-layer net (trammel net) on the coast of Bulak District, Surabaya. To find out the best treatment using different frequency ranges, the Duncan test was used. The best value was obtained at a frequency of 800 Hz with an average catch per fish value of 0.82 kg (Table 3).

Temperature, pressure and salinity parameters had a significant effect on sound propagation when moving through sea water [12]. In this study, the parameter values of sea surface temperature ranged from 25.9 °C, current velocity 0.1 m/s, salinity 28 ppm and brightness 80 cm.

Changes in behavior due to incoming sounds can occur in marine organisms, which can result in these animals leaving their feeding or reproductive areas to move to another place or vice versa. Intense sound in the

water may also have no effect, especially if the level of sound received is not large [13]. The fish's response to the 800 Hz frequency was probably caused by the attraction to the sound coming from the attractor, which changed the behavior of the fish approaching for food or reproduction. According to Rosana et al. [14] fish responds to sounds emitted by sound wave-based attractors with a frequency range of 500-1000 Hz. Respectively, the 800 Hz, 900 Hz and 700 Hz frequencies get a higher response than the frequencies of 500 Hz, 600 Hz and 1000 Hz. This proves that the difference in the frequency range can be used to determine the level of interest in the fish to approach the sound source as a positive response. Various studies have reported that several species of cartilaginous fish, detect sounds of no more than 600 or 800 Hz [15-18].

According to Rosana et al. [19], the effect of the frequency used on sound wave-based attractors with the aim of catching kacang-kacang fish (*Oxyporhamphus micropterus*) which was operated using a trammel net obtains the best results for fish response at a frequency of 800 Hz, seen from the number of results. Research from Sugiyanto et al. [20] stated that fish responses tend to approach fish callers at a frequency of 142 Hz and 650 Hz which had been tested on red snapper (*Lutjanus sp*). Their study also reported that the fish catcher hearloss had been measured in the air and put into water, where the largest gearloss was at a depth of 2 m, which is 9,286 db /Hz.

Table 2. ANOVA test completely randomized design

ANOVA					
Number of Gulamah Fish (*Johnius trachycephalus*)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.735	5	0.547	9.788	0.000
Within Groups	2.682	48	0.056		
Total	5.417	53			

Table 3. Results of Duncan's test analysis

Number of Gulamah Fish (*Johnius trachycephalus*)				
Duncan^a				
Frequency	N	Subset for alpha = 0.05		
		1	2	3
500	9	0.1889		
1000	9	0.1889		
600	9	0.3111		
900	9	0.3667	0.3667	
700	9		0.5667	
800	9			0.8222
Sig.		0.152	0.079	1.000
Means for groups in homogeneous subsets are displayed.				
a. Uses Harmonic Mean Sample Size = 9.000.				

4. CONCLUSION

The distribution of the catch of gulamah fish (*Johnius trachycephalus*) using trammel net fishing gear with the use of sound wave-based attractors obtained the highest value in the 800 Hz frequency range of 7.4 kg (33.63%) followed by a 700 Hz frequency of 5.1 kg (23.18%) and frequency 900 Hz equal to 3.3 kg (15.00%). The response of gulamah fish to attractors in each replication showed the highest value at a frequency of 800 Hz. Frequency modification that is able to attract fish attention needs to be done by making improvements to the sound wave-based attractor. Thus, it can be said to be an environmentally friendly attractor and it is hoped that it can be done with a larger number of samples.

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