Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology
Available at http://ejournal.undip.ac.id/index.php/saintek
Vol. 17 No. 3 : 175-179, October 2021

THE EFFECT OF DIFFERENCES IN ARTIFICIAL BAIT COLOR AND SOAKING TIME IN HAND-LINE FISHING GEAR ON TUNAS (*E. afinnis*) IN SENDANG BIRU WATERS, MALANG, INDONESIA

Nadia Elis Febrita, Aristi Dian Purnama Fitri*, Kukuh Eko Prihantoko
Capture Fisheries Department, Faculty of Fisheries and Marine Sciences, Universitas Diponegoro
Email : aristidian.undip@gmail.com

Received : 11 July 2021, Accepted : 15 September 2021

ABSTRACT

Hand-line fishing gear is traditionally used by fishermen in Sendang Biru, Malang, Indonesia to catch *Euthynnus affinis*. Therefore, this study aims to analyze the color differences of the artificial bait and soak time of *E. afinnis's* catch. The study was conducted in the waters of Sendang Biru, Malang, Indonesia from July to August 2019, with the experimental fishing method by comparing the artificial bait color variables (white, red, blue, and gray) and soaking time (2 and 20 minutes). The results showed that the artificial red bait color gave the most catches and was affected by the soaking time (with a significant level of 0.05).

Keywords: artificial bait color; soaking; *E. afinnis*; Sendang Biru.

INTRODUCTION

Sendang Biru in Malang Regency is one of the largest pelagic producing areas with high economic value in East Java (DMF 2014). As an area in the south of Malang Regency, it is directly adjacent to the Indian Ocean and allows the surrounding waters to have a variety of pelagic fish species. Furthermore, tuna fish is one of the leading commodities, and it is mostly caught by fishermen in Sendangbiru. Its number in Coastal Fishing Port Pondok Dadap is 6,569 tons/year, and when compared with the existing potential, Sendang Biru fishermen can only utilize these fish resources by 29%. (Hermawan 2006).

Sendang Biru is a coastal area that is the biggest priority for fisheries activities in Malang Regency. The location has a natural port and the potential for large pelagic fish, especially tuna (*E. afinnis*). Hand-line fishing gear is efficiently and effectively used with artificial bait as a vital part of fishing gear (Nugroho 2002). The method that has been used so far is using white artificial bait.

Research on bait color as an artificial bait has been carried out, including research by Paransa et al (2014) on red and green color artificial bait to capture Selaroides sp and E. afinnis. The catch of red silk threads is superior to pink (Imbir et al 2015), and the use of red and blue artificial bait is better than yellow when catching Tuna fish (*E. affinis*), and Skipjack Tuna (*Katsuwonus pelamis*) with troll line (Jaya et al 2017). Furthermore, silver artificial bait for Skipjack tuna (*Katsuwonus pelamis*) provides high catch (Puspito 2010). Although, red artificial bait on troll line fishing gear obtains the most catch of tuna fish (*E. afinnis)* compared to green, blue, and whitebait as controls in the Karimunjawa waters (Niam et al., 201 3).

Soaking time is one of the important factors in the successful use of fishing rods. However, fishermen do not have a standard soaking time, and based on the observation period, it takes an average of 2 minutes to obtain the catch (Rouxel 2017). Handline with a short soaking time resulted in the target fish being brought to the surface in a better physical condition even though the amount of catch was low (William et al 2013). The average Sendang Biru fishermen have a soaking time of 20 minutes because they think that the more hooks, the longer the time taken. However, as at the time of this study, the optimal soaking time for hand lines has not been found.

A study related to artificial bait color and soaking time to obtain optimal results in Sendang Biru has never been conducted. It aims to become a reference (information) that can support the development of knowledge, especially in the field of capture fisheries or as an evaluation material for the development of hand-line fishing fleets.

RESEARCH METHODS

This study was conducted in Sendang Biru waters, Malang, Indonesia from July to August 2019 (Figure 1), and the specifications of the handline is evident in Figure 2. The fishing base of hand-line fishing gear is at the "Pondokdadap" port of Sendang Biru, Malang, Indonesia (Figure 1). Meanwhile, the fishing ground is located around Sendang Biru waters around Sempu Island and every fisherman that operates a handline has the same ability.

The research method used is experimental fishing. The treatments tested were several colors on the artificial bait and the soaking time of the bait. The treatments for the different artificial bait colors consisted of red, blue, green, and white (control), while the soaking time consisted of 2 and 20 minutes (control). Experiments were conducted by observation under artificial conditions, where these conditions are created and regulated. Furthermore, it was conducted by manipulating the object of the study and the presence of control (Natsir 2003). This study compared several colors of artificial bait (Figure 3) to the catch of tuna (*E. afinnis*), using handline fishing gear (Figure 2). There are 4 units of hand line used in this study with different colors. The design of the hand line fishing gear is shown in Figure 4.

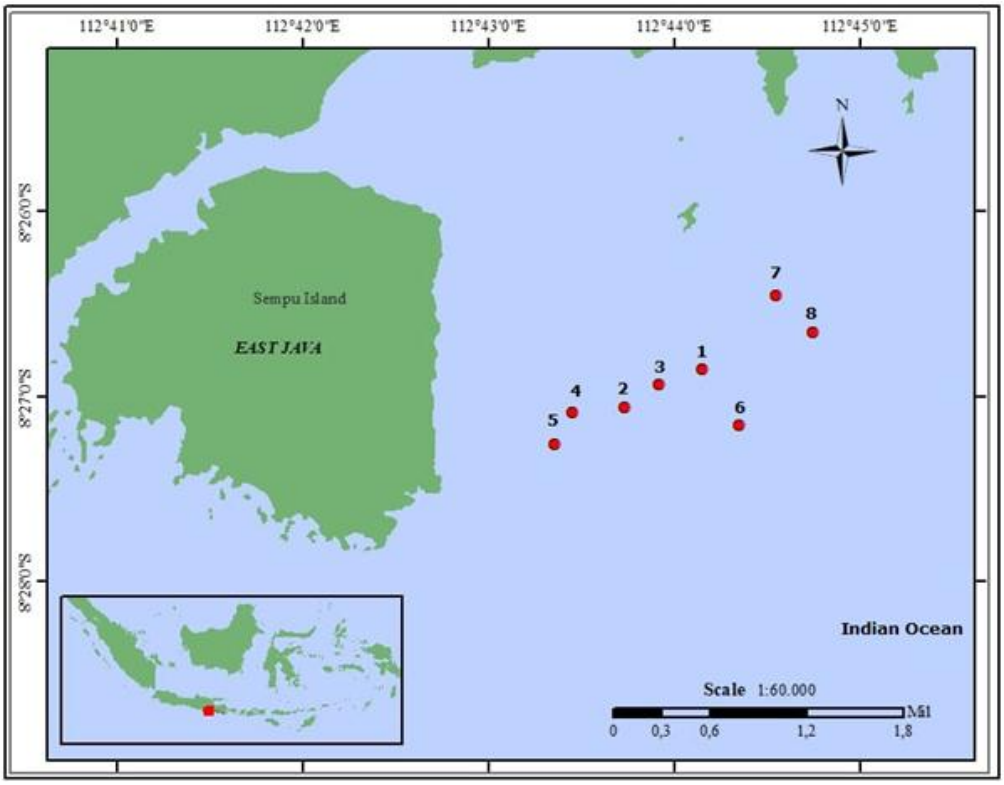

Figure 1. Location Map of Sendang Biru

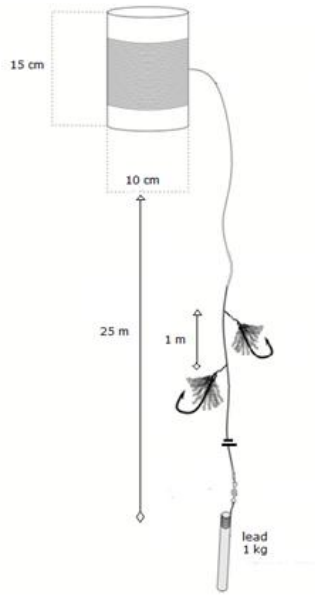

Figure 2. Handline Specifications

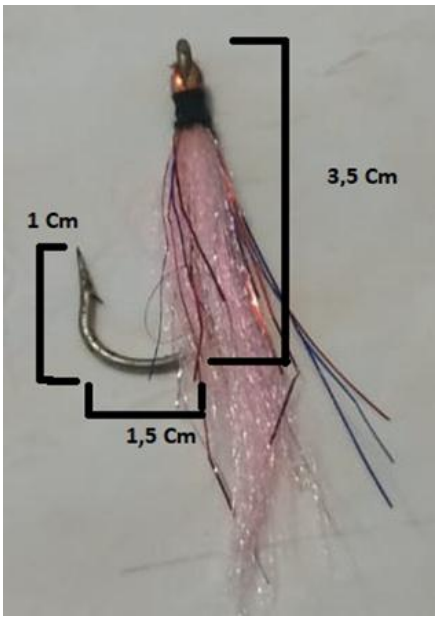

Figure 3. Artificial Bait Design

Table 1. Combination of Repetition Treatments

Trip	Setting 1	Setting 2	Setting 3	Setting 4	Setting 5	Setting 6	Setting 7	Setting 8
1	W (2')	W (20')	R (2')	R (20')	B (2')	B (20')	G(2')	G (20')
2	G (2')	G (20')	W (2')	W (20')	R (2')	R (20')	B (2')	B (20')
3	B (2')	B (20')	G (2')	G (20')	W (2')	W (20')	R (2')	R (20')
4	R (2')	R (20')	B (2')	B (20')	G (2')	G (20')	W (2')	W (20')
5	W (2')	W (20')	R (2')	R (20')	B (2')	B (20')	G (2')	G (20')
6	G (2')	G (20')	W (2')	W (20')	R (2')	R (20')	B (2')	B (20')
7	B (2')	B (20')	G (2')	G (20')	W (2')	W (20')	R (2')	R (20')
8	R (2')	R (20')	B (2')	B (20')	G (2')	G (20')	W (2')	W (20')

Description : W = White Artificial Bait; R = Red Artificial Bait; B = Blue Artificial Bait; G = Green Artificial Bait

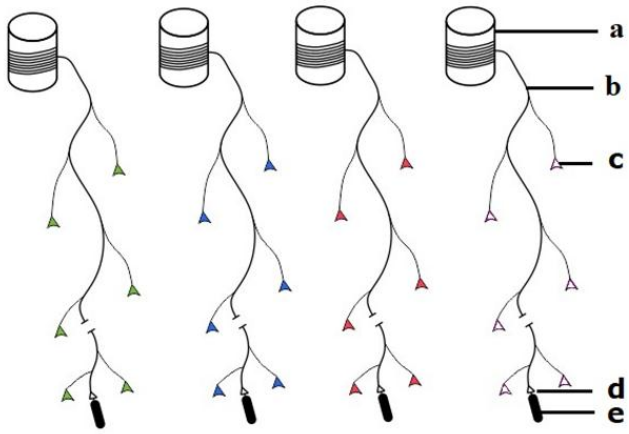

Figure 4. Handline Design
Description: A = Rollers (Bamboo Θ 10 cm); B = Main Rope (PA Monofilament 25 meters); C = Artificial Bait (Silk Thread, 20 Hooks in one handline unit); D = Swivel (*stainless steel* Θ 7 mm); E = Weight (1 kg of tin).

The handline fishing gear used in Sendang Biru waters is divided into several parts, including fishing line rollers, fishing line, branch line, 20 hooks, and 1 swivel. The hook was used with rod number 9 with stainless steel material. The fishing line is made by nylon monofilament (string) with a line number of 100 - 120 and a total length of 25 m. The fishing line rollers are made of bamboo with a diameter of 10 cm and a length of 15 cm. Meanwhile, the swivels are made of stainless steel with a length of 0.7 cm. The artificial bait used is specially modified from strands of silk and is given several strands of the lightning thread in silver or gold to attract the attention of Tuna (*E. afinnis*). The artificial bait consists of several colors, including white, red, green, and blue. The artificial bait is made from silk thread using smooth and shiny materials. When the bait is used in moving water, it attracts the attention of Tuna fish (*E. afinnis*).
The hypothesis is :
H_0 : There is no influence of artificial bait and soaking time variables on the tuna catch in hand-line fishing gear.
H_1 : There is an influence of artificial bait and soaking time variables on results.

RESULTS AND DISCUSSION

Result

The results conducted for approximately 1 month show that 100% of the catch composition is tuna fish (*E. afinnis*). The catch in Sendang Biru waters uses four different colored artificial baits, including white, red, green, blue, and soaking time for 20 and 2 minutes. The treatment obtained up to 8 repetition trips between 06.00-07.30 Malang time. The number of tuna catches (*E. afinnis*) on the Handline is different for each color and soaking time. The catch of tuna (*E. afinnis*) obtained during the study is represented in Figure 4.

The catch from the handline fishing gear on 8 trips in each artificial bait color treatment is as many as 31 heads on white artificial bait. Furthermore, 50 heads were obtained for red, 22 for green, and 13 for blue. The red color obtained the most tuna catches, and this is because it has a clear contrast. Tuna is a dichromatic animal that cannot distinguish colors (color blind), therefore when dark colors like black, dark blue, dark green provide contrast, it is colorless for the tuna. Striking profiles such as dark reflective colors, red/yellow/green are appropriate for dichromatic fish. These colors will be striking due to the difference in contrast caused by the light (Gath 2015).

The biggest catch is in the red artificial bait treatment, as many as 38 heads of tuna (*E. afinnis*), at 20 minutes soaking time. Meanwhile, the lowest catch is in blue with a soaking time of 2 minutes. There is a significant difference in the number of tuna catches (*E. afinnis*) between 2 and 20 minutes of soaking time. Therefore, the tested variable (2 minutes) does not affect the catch since the difference on soaking time is influenced by several factors such as the number of hooks and the stocking density of tuna. Furthermore, the relationship between soaking time for line fishing efficiency is influenced by the number of hooks, bait, and fish density (Løkkeborg, 1994). Red artificial bait is the most effective bait to catch tuna (*E. afinnis*) in Sendang Biru waters using handline fishing gears.

Soaking time of 20 minutes obtained more results than 2 minutes because the soaking time was related to the tool used. Therefore, the more the number of hooks on fishing gear, the longer the immersion time needed (Rahmat 2008). The relationship between artificial bait color and soaking time is shown table 2.

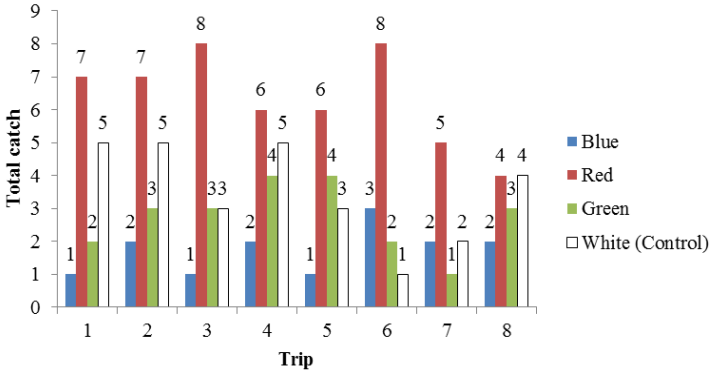

Figure 4. Tuna Catch Results Against Time.

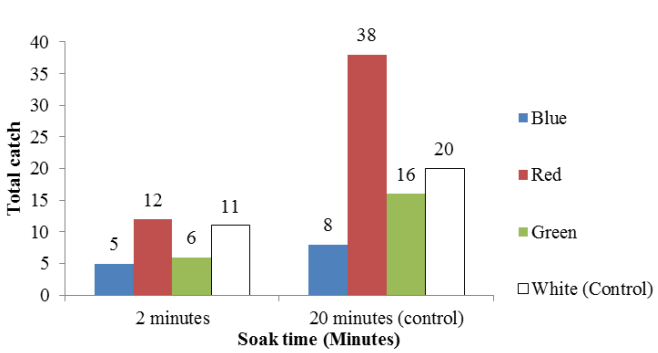

Figure 6.Catch Based On Color Differences

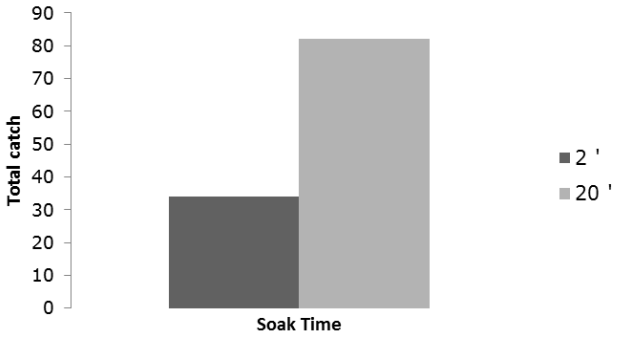

Figure 7. Catch based on soaking time

Table 2. Tests of Between-Subjects Effects

Dependent Variable: Total catch

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	153.984[a]	7	21.998	30.138	.000
Intercept	244.141	1	244.141	334.480	.000
Artificial bait colors	70.922	3	23.641	32.388	.000
Soak time	47.266	1	47.266	64.755	.000
Artificial bait * soak time	35.797	3	11.932	16.348	.000
Error	40.875	56	.730		
Total	439.000	64			
Corrected Total	194.859	63			

a. R Squared = .790 (Adjusted R Squared = .764)

There is a relationship between the artificial bait color and soaking time, and the catch data are analyzed by performing several statistical tests. The results were obtained to conclude the proposed hypothesis. This was conducted by comparing the Fcount from each source of diversity with the Ftable in the test level (α) 0.05 at the free degree of each diversity source and the free error degree.

Hypothesis testing in this studyd ecision making from variance (ANOVA), including:

a. Significance> 0.05, then accept H_0 or reject H_1

b. Significance ≤ 0.05, then reject H_0 or accept H_1

Based on the results tested using the two-way ANOVA on handline using artificial bait, the effect of artificial bait on tuna obtained a significance value of 0.000. Therefore, when the significance is <0.05, there is a difference in the catch against the length of soaking.

Discussion

Red artificial bait obtained the most catch (50 heads) compared to other colors such as green (22 heads), blue (13 heads), and white (31 heads). This is because red artificial bait is the best visual attractor compared to other colors. It has better contrast than other colors and can be detected by *E. afinnis*. Contrast color in water is indicated as a good attractant to be detected by biota (fish) through the visual organs. The red color has a short wavelength spectrum but a high frequency, meaning that the red color will be absorbed more quickly in the water than the mid-spectrum light such as blue, green, and white (Husni, 2002).

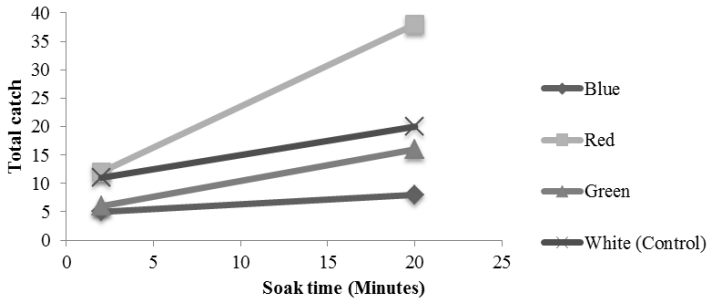

Figure 8. Interaction of Tuna Catch Amounts (head).

E. Afinnis is a Teleostei fish group that uses the eye organ as its life activity and is a positive phototaxis fish in conducting activities. It relies on the presence of light detected through the visual organ. The ability of Tuna (*E. afinnis*) to see objects in the water depends on the retina activity of its eyes (Syam & Hendra 2009). Therefore, it can be stated that pelagic fish are attracted to objects that are bright and shiny. The sensitivity of the fish's eye in response to visuals can be identified based on the contraction of the con cells by looking

at the movement of the con ellipsoid in the visual cell layer (Hajar 2008).

Handline is a passive fishing tool and its success lies in the soaking time. One of the factors of soaking time is the sensitivity level of the target fish's eye. At soaking, Tuna (*E. Afinnis*) that are in the fishing ground needs time to obtain the artificial bait. Soaking for 2 minutes is considered too fast and the total catch of Tuna (*E. Afinnis*) is less than 20 minutes soaking. The response shown is Tuna (*E. afinnis*) likes the striking color of the bait since fish will look sharper in good contrast (Lythgoe 2006).

The results show that there is an influence of artificial bait and soaking time variables on the tuna catch (*E. Affinis*). However, the catch of tuna (*E. afinnis*) was mostly obtained at 20 minutes of soaking with red artificial bait. Therefore, when the red color is given various soaking time, it will work, and the length of soaking for 20 minutes using any color will work as well. Another factor that affects the number of tunas catches on soaking time is stock density. Soaking time depends on the number of fish in these waters (Sudrajat 2014). Ogura and Arimoto (1980) stated that the time for line fishing to soak is better to follow the fish feeding period. Therefore, when the fish feeding period arrives, there is no need to do a long soaking time because the tuna will swim fast when in a condition of looking for prey.

CONCLUSION

The most effective artificial bait is red compared to the other three colors (green, blue, white) and the optimal soaking time is 20 minutes.

REFERENCES

Gath W. L., 2015 Colour Perception Across the Species. 117 pp.

Gunarso W., 1985 [Fish behavior in its relationship with fishing tools, methods and tactics]. Department of Fisheries Resource Utilization. Faculty of Fisheries. Bogor Agricultural Institute. Bogor. 149 pp.[in Indonesian]

Hajar M.A.I., 2008 [Visual acuity of pasifis saury cololabis saira for understanding capture process]. Tokyo University of Marine Science and Technology. Tokyo. Marine Fisheries Research Journal 69: 789-791. [in Indonesian]

Husni M., 2002 Effect of container color differences on the growth and survival of galah shrimp (*Macrobrachium rosenbergiide* Man). Faculty of Fisheries and Marine Sciences. Department of Aquaculture. Bogor Agricultural Institute. Bogor.

Imbir F. F., Patty W., Wenno J., 2015 [The effect of the color of the bait on the catch of tonda fishing rods in the waters of Manado Bay North Sulawesi]. Jurnal Ilmu dan Teknologi Perikanan Tangkap 2(1) : 9-13. [in Indonesian]

Jaya M. M., Budy W., Domu S., 2017 [Sustainability of tuna fisheries in Sendang biru waters of Malang Regency]. Jurnal Albacore. 1(1): 111 – 125. [in Indonesian]

Løkkeborg S., 1994 Fish behaviour and longlining. In: Ferno, A. and Olsen, S. (Editors). Marine Fish Behaviour in Capture and Abundance Estimation. Fishing News Books Ltd. Oxford. 216 pp.

Lythgoe J. N., 2006 The ecology, function and phylogeny of iridescent multi layers in fish corneas. Blackwell, Oxford, 211-247 pp.

Magnuson J. J., 1996 Swimming activities of the scombrid fish *E. Affinis* as related to search for food. FAO Fish. Rep. 62:439-451.

Nasution, A.H dan Barizi., 1986 Statistical Methods. PT Gramedia. Jakarta. 159 pp.[in Indonesian]

Niam A., Fitri A. D. P., Yulianto T., 2013 The difference in color of artificial bait against the catch of cob Fish (E. *afinnis*) in tonda fishing rod fishing equipment in Karimunjawa Jepara Waters. Journal of Fisheries Resources Utilization Management and Technology, 2(3) : 202-212. .[in Indonesian]

Natsir M., 2003 Research methods. Ghali Indonesia. Jakarta. 179 pp. [in Indonesian]

Nugroho P., 2002 Effect of difference in fishing eye size on tonda fishing catch in Palabuhanratu Sukabumi Waters of West Java. Faculty of Fisheries and Marine Sciences Bogor Agricultural Institute.

Ogura M., Arimoto T., Inoue Y., 1980 Influence of the immersion time on the hooking rate of a small bottom long-line in coastal waters. Bulletin of the Japanese Society of Scientific Fisheries, 46(8):963-966.

Paransa I. J., Tipinbu W. R., Kumajas H. J., 2014 [The effect of artificial bait color on the catch of noru fishing rods in the waters of Manado Bay]. Jurnal Ilmu Dan Teknologi Perikanan Tangkap, 1 :78-84. [in Indonesian]

Puspito G., 2010 [Huhate's mock bait color]. Jurnal Saintek Perikanan, 6(1), 1-7. [in Indonesian]

Rahmat E., 2008 Use of fishing rod (hand line) to catch large pelagic fish in Bacan Waters, South Halmahera. BTL 6(1):29-33.

Rouxel, Y. 2017. Best practices for fishing sustainability fishing gear assessment in the new found land inshore nourthern cod fishery. 119 pp.

Subagyo J., 2004 Research methods in theory and practice. Rineka Cipta. Jakarta. 158 pp. [in Indonesian]

Subani W., Barus H.R., 1989 Fishing equipment and sea shrimp in Indonesia. Agricultural Research and Development Center. Department of Agriculture. Jakarta. 248 pp.

Sudrajat S. M. N., Rosyid A., Bambang A.N., 2014 [Technical and financial analysis of Layur Fishing Business (*Trichiurus sp*) at Pelabuhanratu Sukabumi Indonesian Port]. Journal of Fisheries Resources Utilization Management and Technology (JFRUMT) 3(3) : 141 – 149. [in Indonesian]

William A., Green M., Graham K., Upston J., Barker B., Althaus F., 2013 Determining the Distribution of Gulper Sharks on Australia's Eastern Seamount Chain and the Selectivity of Power Handline Fishing in Regard to Seamount Populations of Blue-Eye Trevalla and Harrisson's Dogfish. CSIRO. 1 – 30