Electro shield system applications on set gill net as efforts to preserve shark resources

IOP Conf. Series: Journal of Physics: Conf. Series **1025** (2018) 012022 doi:10.1088/1742-6596/1025/1/012022

Electro shield system applications on set gill net as efforts to preserve shark resources

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Abstract. Sharks are kind of ETP biota (Endangered, Threatened, and Protected), and are generally caught as by catch during fishing operations. In addition, sharks are one of the biota that plays a role in the life cycle in coastal waters. The Electro Shield System (ESS) was a device with an electromagnetic wave source that the shark can detect and make it afraid. ESS can be applied to set gill net operation to prevent the shark from getting caught. The objective of the study was to analyze the ESS on shark catches during set gill net operations. The research method was experimental fishing, conducted in March-May 2017 in Bangka Belitung Islands, Indonesia. Design the study by comparing shark catches during set gill net operation between those without using ESS (control) and using ESS with frequency 55 Hz. The shark catch by using Electro Shield System was 5.26% lower than control (7.80%). *T-student* analysis (sign 0.05) indicates that there was a significant difference between the set gill net without ESS and using the ESS against shark biota as bycatch. This indicates that the application of ESS in set gill net can reduce the capture of shark as by catch.

1. Introduction

Shark was a group of predators of cartilaginous predators (Elasmobranch) that are commonly found in Indonesian waters [1]. The biota lived around the coral reefs and move around the bottom of the water at depths between 70 meters and 600 meters. These predatory animals are at the top of the food chain that plays a role in maintaining the balance of complex food webs[2]. On the other hand, sharks have a slow growth rate and long life, with the time required to enter adult stadia is 18 years [3][4]. It is estimated that more than 75 species of sharks are almost all of their body potential to be utilized as a commodity. The high economic value of all parts of the shark's body provides the opportunity for fishermen to exploit as the main targets of catches, which have been by-catch. If the condition persists continuously it can make the shark and ray population and take a long time to recover and will disrupt the ecosystem's balance on coral reefs[5][1]. Such conditions make the experts to include some species of sharks and rays in the Appendix II Convention on International Trade in Endangered Species (CITES).

Indonesia sea waters, especially the TanjungPandansea waters (Bangka Belitung Islands), sharks are still widely caught as a bycatch biota in gill net set equipment. This is because the TanjungPandansea waters was the largest shark habitat compared to other waters in Indonesia such as the Brondongsea waters (East Java), Karimunjawasea waters (Central Java) [6]

The used of fishing tools that are not selective by fishermen have a negative impact on aquatic ecosystems, especially marine ecosystems. Regulation of the Minister of Marine Fisheries of Indonesia No.2 Year 2015 requires the use of fishing gear which is more environmentally friendly by reducing the impact of catch by shark (Shark and Ray) among others on gill net. Electro Shield System (ESS) is an innovative fishing tool that is considered capable of reducing bycatch. Electric waves generated at the Electro Shield System can be responded to the group of Elasmobranch biota (sharks). Elasmobranch was a biota that has ampullae of lorenzini organ capable of detecting electrical waves, and an ability to detect electrical waves causes a negative response on the shark [7] [8]. ESS mounted on the gill net set during a capture operation is expected as a shark repellent device to avoid being captured as bycatch. Purpose of this research is to analyse the influence of application of Electro Shield System (ESS) on set gill net to shark catch.Purpose of this research is to analyse the influence of application of Electro Shield System (ESS) on set gill net to shark catch.

2. Method

The research was conducted in April - May 2017 in the waters of Tanjung Pandan, Bangka Belitung Islands, Indonesia. The method used in this research is experimental fishing method. The treatment used was the operation variable of set gill net capture with Electro Shield System (ESS) application at 55 Hz and the set gill net operation variable without ESS (control) application. Figure 1 shows the research locations of gill net and ESS sets in the waters of Tanjung Pandan, Bangka Belitung archipelago, Indonesia.

The ESS circuit specifications consist of a series of electronic components, power, system algorithms (flowchart), antenna, and waterproof chase. The ESS tool design and gill net set used during the study can be seen in Figure 2. The working mechanism of ESS is exposure to electric field in pulse, meaning that every 2 minutes work 1 minute (on) and 1 minute (off) during immersing time 6-12 hours.Specification of set gill net design used during the researched can be seen in Figure 3.

ESS is placed on the top of the gill net buoy strap on 3 parts, which is close to the sign buoy, the middle and the part close to the boat. The purpose of laying the ESS on the gill net set at 3 sections is to know the ability of ESS to issue electrononic waves to scare the shark during the arrest operation. Gill net capture operation is also performed without using ESS as a control treatment. Position of the ESS application on the set gill net can be seen in Figure 3 and simulated fishing operations during the research can be seen with the flochat in Figure 4.

Figure 1. The Tanjung Pandan sea waters, Bangka Belitung Islands, Indonesia

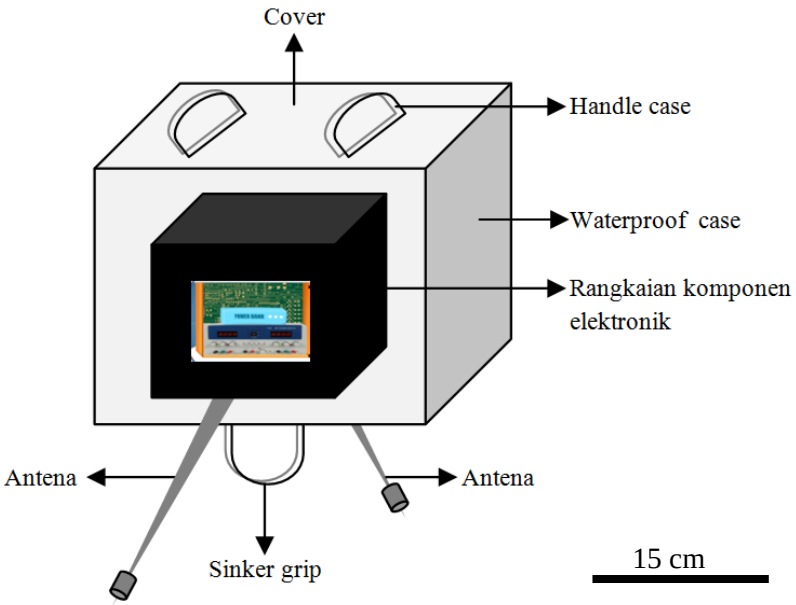


Figure 2. Construction of *Electro Shield System*(ESS)

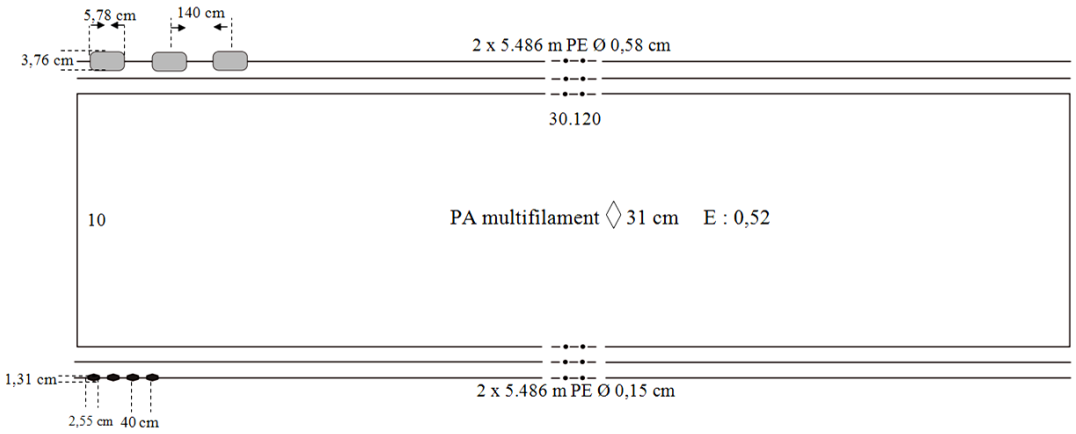


Figure3. Design*set gill net*

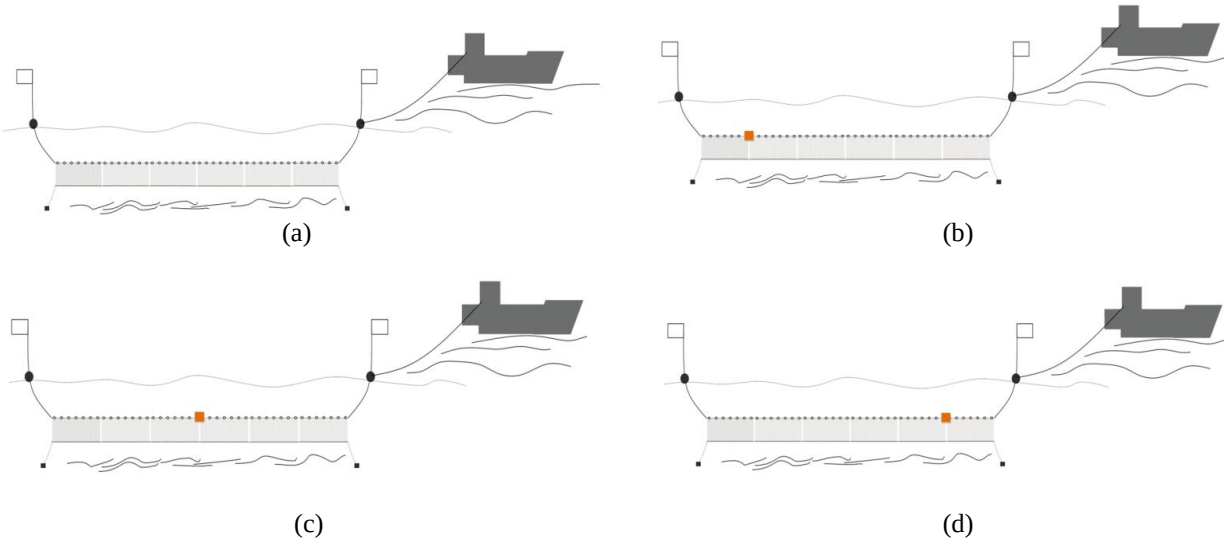


Figure 4. Position of ESS application placement on gill net set during capture operation

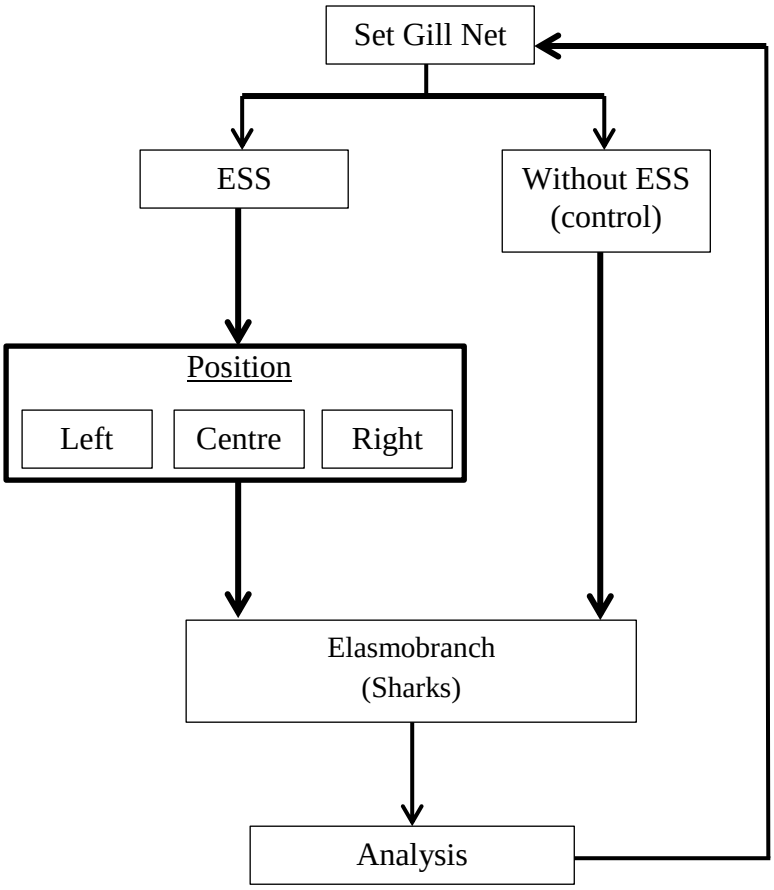


Figure 5. The simulation study of ESS

3. Results and Discussion

The total catch obtained from all trips of set gill net fishing operation in Bangka Belitung waters is 332 tail, with the composition of the catch consist of ray, shark and Teleoste group respectively 297 (87%), 23 (7%) and 21 (6%). The total weight obtained from the catch is 2,038.06 kg with the composition of consecutive 1.571.09 kg (77.09%), 414.80 kg (20.35%) and 52.17 kg (2.65%). The types of ray, shark and teleostei caught during are Jenkins whipray, Bleeker's whipray, Butterfly ray, Eagle ray, *White-spotted Shovelnose Ray*, *Rhincodon sp*, *Formioniger*, *Arius thalassinus* and *Lutjanus*sp of both treatments, while the composition of the catch of each species of fish in units of the amount between treatments without using the Electro Shield System / ESS (control) and treatment using ESS (individual and biomass) can be seen in Fig 5 and 6.

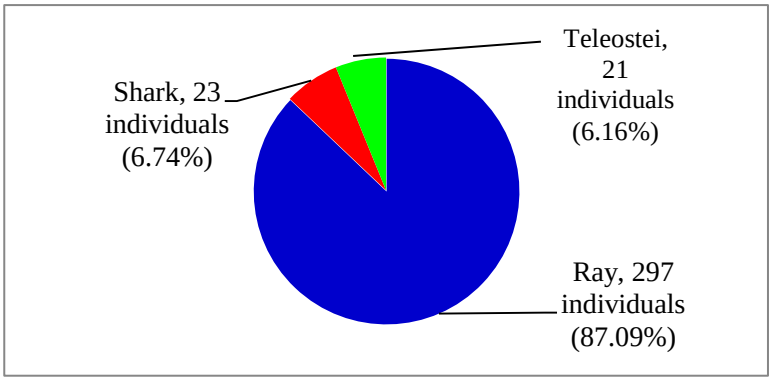


Figure 6. Composition of the catch during the research (in individual)

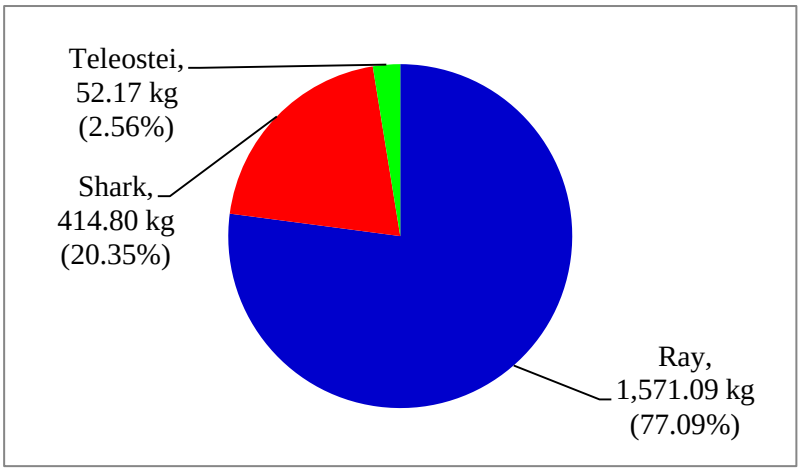
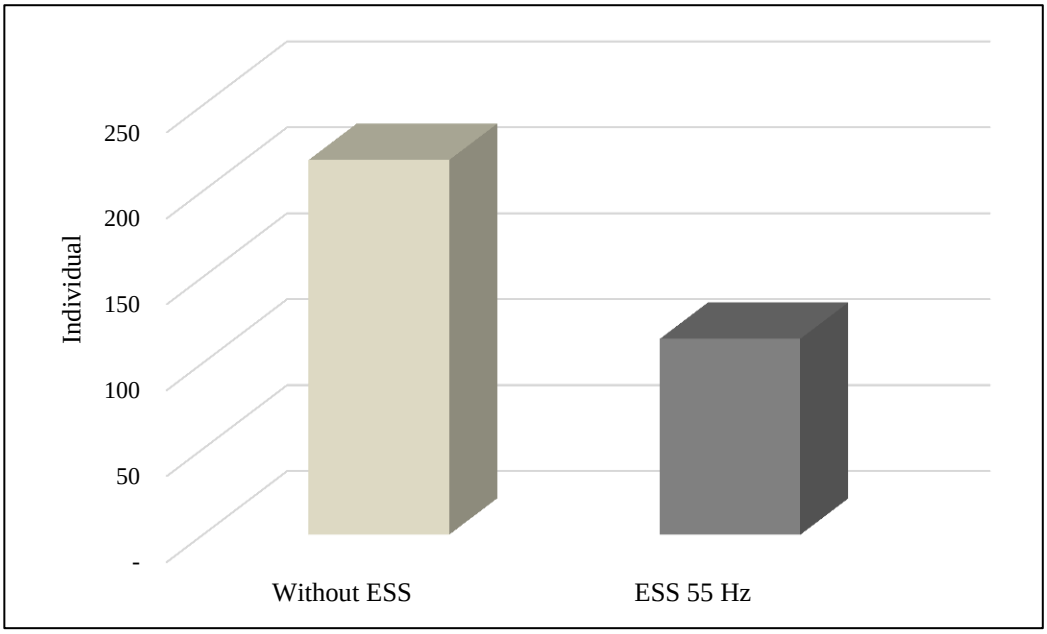
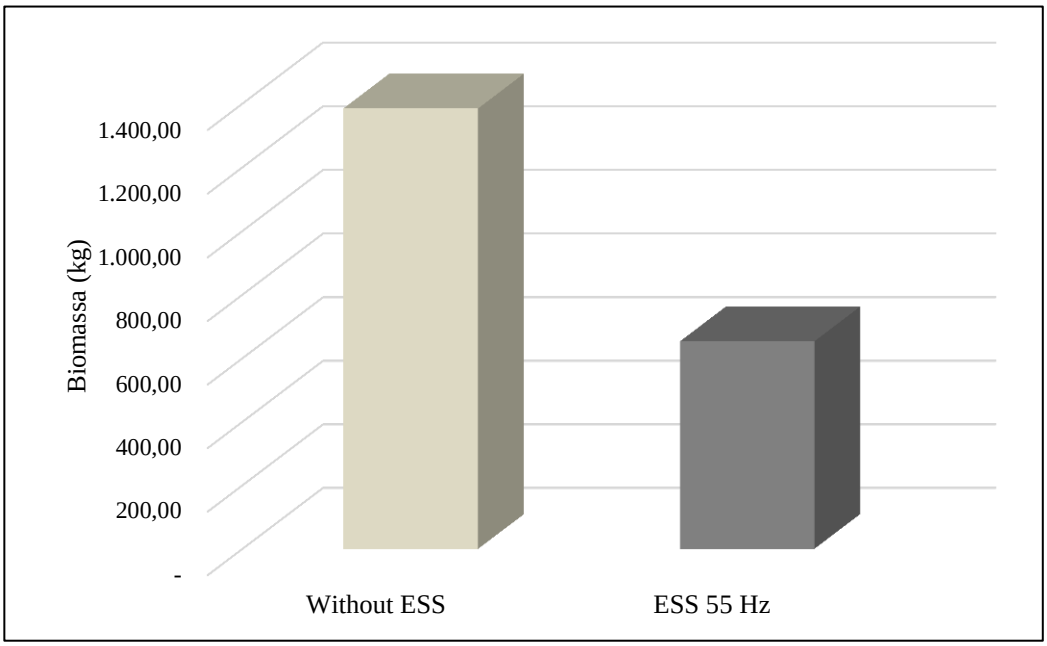


Figure 7. Composition of the catch during the research (in biomass)

Comparison of shark and ray catch between without using ESS (control) and by using ESS 55 Hz there is a tendency of decreasing number and biomass, 18.4% and 22.36% (Fig 7). As for shark and ray species caught between control treatment and using ESS 55 Hz, both shark and ray have sensitivity to different electromagnetic waves [9][10]. There is a chance that sharks are still caught with ESS 55 Hz because the biota for 55 Hz power wave does not detect it (not sensitive).



(a)



(b)

Figure 8. Shark catch without ESS (control) and with ESS 55 Hz, in individuals (a) and in biomass (b)

It indicates ESS 55 Hz tool capable of giving electromagnetic impact on shark, that is preventing approaching Lion Bun. As explained[11] [12]and group of elasmobranch biota have sensitivity to electromagnetic waves, considering the ampullae of lorenzini organ around the mouth is an electromagnetic wave detection sensor. Furthermore, it is explained that the magnitude of electromagnetic vibrations that can be received from the animal group is still unknown. *T-student* analysis (sign 0.05) indicates that there was a significant difference between the gill net set without using the ESS and by using the ESS against shark biota as by catch

The use of ESS as a tool for avoiding caught sharks in set gill net provides an evidence of the workings of electromagnetic wave sensitivity on sharks. ESS 55 Hz frequency. This indicates that the sensitivity of electromagnetic waves of the most optimum shark in the range of 55 HZ, but it also affects other elasmobranch (rays).The use of ESS as a tool to avoid sharks caught in set gill nets provides evidence of how electromagnetic wave activity sensitivity in sharks. This indicates that the sensitivity of electromagnetic waves of sharks is 55 Hz. Information about the range of shark sensitivity values when detecting electromagnetic waves has not been widely known, existing information that the ability of sharks to detect electromagnetic waves is as low as 5 nV cm^{-1} [13] [14].

4. Conclusion

The shark catch by using Electro Shield System was 5.26% lower than control (7.80%). T-student analysis (sign 0.05) indicates that there was a significant difference between the gill net set without using the ESS and by using the ESS against shark biota as by catch. This indicates that the application of ESS in Set Gill Net tool can reduce the capture of shark as by catch.

Acknowledgments

The authors would like to thank the World Wide Fund for Nature Foundation (WWF) Indonesian which has provided research grants to the Purse Seine POKJA KKP Working Group. The authors would like to thank RomiDwi Nanda, GalihDandung and AlifDhofir for the electrical design of The Electro Shield System (ESS) and AgusRosadi for helping to collect data.

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