Productivity and fishermen's perception of lamp attractors in Sebesi Island, Indonesia

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Abstract. Sebesi Island is one of the islands located southwest of Sumatera Island. This island is located west of the Krakatau Bay. Sebesi Island is inhabited by residents who mostly work as fishers. Fishing line and lift net fishermen on Sebesi Island need innovations in lamp-aggregating devices for operating fishing gear. Lamp attractor technology is expected to create fishing areas and anticipate their degradation of fishing areas. This study aimed to calculate the production and production value of fish catch and to determine fishermen's perceptions of the innovative use of light attractors in the waters of Sebesi Island, Lampung. This study used interviews and purposive sampling methods. Fishermen's perception data were collected through interviews using a questionnaire with 30 fishermen, with respondents determined by accidental sampling. Perception is used to measure the level of understanding of fishermen in catching fish, which is influenced by various aspects such as technological adaptation, social factors, and economic conditions. Lamp attractors have high catch productivity and a large composition of catchable fish. Catch productivity management is carried out to determine the amount of fishery production to help assess the sustainability of fish stocks and prevent over-exploitation.

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1 Introduction

Sebesi Island is located at coordinates 05055'37.43" - 05058'44.48" LS and 105027'30.50" - 105030'47.54" E, and is located at the southwestern tip of Sumatra Island, Sunda Strait, Indonesia. This island is included in the South Lampung Regency, Lampung Province, and the western part of the island is Krakatau Bay. This island has an abundant diversity of coastal ecosystems and can be used well, such as in the capture fisheries business.

Sebesi Island is inhabited by residents who mainly work as fishermen. There are 100 fishermen spread across the Sebesi Island hamlets. Fishermen catch fish using the fishing gear kotrek, rawe fishing rods, payang, boat charts, and bubu. Fishermen on Sebesi Island generally catch many types of fish such as Mackerel (*Scombero-morus* sp.), Selar (*Caranx* sp.), Tengkurungan (*Clupea* sp.), Kurisi (*Holocentrum* sp.), Tambak (*Lutjanus* sp.), Red Snapper (*Lutjanus* sp.), Banyar (*Rastrelliger* sp.), Squid, and reef fish. There are 28 families or as many as 168 species of reef fish found in the waters surrounding Sebesi Island [1].

One of the issues in the fisheries sector faced by the community on Sebesi Island is that fishermen are very dependent on nature, while the catch tends to decrease due to illegal activities outside the island. Local fishermen on Sebesi Island are suspected to need innovations to increase their catch and income. One of these innovations is a light attractor used to operate fishing gear, seine net, and lift net. Light attractor technology is expected to create fishing areas and anticipate their degradation of fishing areas. This activity aims to calculate the catch's productivity and determine fishermen's perception of the use of innovative light attractors in the waters of Sebesi Island, Lampung.

2 Research methods

The research was located on Sebesi Island, South Lampung. This study used interviews and purposive sampling methods. Fishermen's perception data were collected by interviewing 30 fishermen using questionnaires. The fishermen who will be interviewed will consist of the owner fishermen and crew members. In this study, the respondents were selected by accidental sampling, namely by visiting fishing fishermen and then asking questions that had been prepared in the questionnaire (Table 1).

Table 1. List of Fisherman's Perception Questions

No.	Questions about fishermen's perception of light attractors	Answer		
		1	2	3
1	The productivity of the catch is influenced by the availability of fishery resources in the water.			
2	If fish that are not suitable for fishing are caught continuously, it will cause a decrease in fish populations in a water.			
3	Using non-selective fishing gear will affect the number (volume) of the catch.			
4	Government regulations on the size of nets and types of net fishing gear help in achieving sustainable fisheries management.			
5	The size of fish that are not suitable for fishing should be released because it causes the fish population to decline.			
6	The use of fishing aids has the potential to cause habitat degradation.			
7	Differences in catchability between fishermen will cause social conflict among fishermen.			

Note: (*): the respondent's answer choice can be circled or crossed between the three answers
1 : Disagree
2 : Neutral
3 : Agree

The interviews about fishermen's perception of using light attractors consisted of questions related to productivity, sustainability of fishery resources, and conflicts between fishermen. The questionnaire was optional, with indicators of 3 for agree (S), 2 for neutral (N), and 1 for disagree.

This data was collected to determine the views of fishermen regarding the use of light attractors as an innovation in sustainable fishing operations. Every fisherman is asked to organize and interpret their sensory impressions to give meaning to their surrounding environment. In addition to the fisherman perception questionnaire data, data related to fishery production based on the type of fish caught by fishermen and the value of fishery production in South Lampung Regency in the last 4 years (2020-2023) were also obtained.

2.1 Data analysis

This perception can be used to determine a policy or action through observation, experience, and knowledge. This is useful for approaching fishermen and obtaining information on fish resource management issues, especially on Sebesi Island, South Lampung. The fishermen's perception of using light attractors was calculated using a Likert scale. Likert scale has a scale value on each and is used to measure the level of agreement with the question or statement given. The responses in this study were assessed using three answers: agree, neutral, and disagree. Respondents or fishermen face several questions or statements and then answer one of the Likert score criteria.

All data collected were then sorted into a table according to the respondents' answers and assessment scores. The average score was obtained from the total score and divided by the number of respondents. The percentage of fishermen's perception based on each criterion was calculated using the following formula:

$$Percentage\ of\ score = \frac{Number\ of\ respondents - i}{Total\ Responden} x100\% \quad (1)$$

The scores obtained from respondents are grouped into three categories [13]:

Low : $X < Mean_{ideal} - 1\ SD_{ideal}$ (2)

Moderate : $Mean_{ideal} - 1\ SD_{ideal} \leq X \leq Mean_{ideal} + 1\ SD_{ideal}$ (3)

High : $X > Mean_{ideal} + 1\ SD_{ideal}$ (4)

Note:

$Mean_{ideal}$: $\frac{1}{2}$ (maximum score + minimum score)

SD_{ideal} : $\frac{1}{6}$ (maximum score − minimum score)

3. Results and discussion

The fishermen on Sebesi Island tend to have a good perception of the use of light attractors. As many as 80% (20 people) had a high level of perception. The use of light attractors can help fishermen obtain a decent catch. Meanwhile, in the medium level of perception, there were 20% or nine people. This means that some fishermen who use light attractors do not

have a significant enough influence on fishermen, so there is no difference between using lights and not using them when carrying out fishing activities. The difference is that at a low level, as many as 2% or as many as three people are obtained, meaning that only a few fishermen do not benefit from the light tractor aids.

The use of attractors, in general, has an impact if adjusted to the habits of light-loving fish and the selection of fishing time when using light attractors. The use of lamps placed on the water reflects light by 70% of the water's surface, so the results received by fishermen tend to be unsatisfactory [2]. Using lamps in water can help increase the potential of fish to gather. Light attractors have advantages, including the productivity of many catches, various types of catches, and the composition of many fish-worthy categories [3].

3.1 Fishermen's perception of the productivity of catches is based on the availability of fishery resources

Figure1 presents fishermen's perceptions of catch productivity based on the availability of fishery resources. 25 fishermen voted to agree, and five fishermen voted against the idea that the productivity of their catch was influenced by the availability of fishery resources. Fishing productivity can be affected by the number of trips and the availability of fish resources. It can be calculated as an indicator of the value of Catch per Unit Effort (CPUE) [4]. Indications of overfishing can cause the productivity value of catches to fluctuate and decrease [5]. This means that fish resources in these waters have not been able to regenerate, but they continue to be caught, which impacts fishery stocks, which tend to decline.

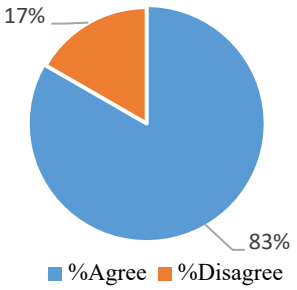

Fig. 1. Fishermen's perception of catch productivity is based on the availability of fishery resources

3.2 Fishermen's perception of fishing for this species as not worth the effort, and if caught regularly, it can cause a decline in fish populations

Fishermen's perception of fishing is unsuitable for catching if caught regularly can cause a decline in fish populations (Fig.2). 24 fishermen voted in favor. Six fishermen voted against it, saying that if fish that are not suitable for fishing are caught continuously, it will decrease the fish population in the water. Changes in the length of fish caught yearly indicate that fish stocks have been disturbed [6]. An effort to maintain sustainable fish stocks is to determine the size of fish suitable for catching or the size of fish that have reproduced or matured gonads. Fish caught after maturing have had the opportunity to spawn and reproduce to increase the population in the waters before they are caught [7].

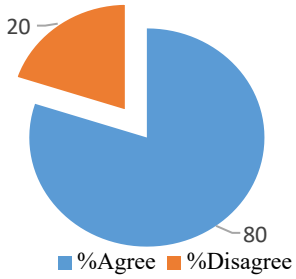

Fig. 2. Fishermen's perception of fishing as not suitable for continuous fishing has an impact on the reduction of fish populations

3.3 Fishermen's perception of non-selective use of fishing gear affects the number (volume) of the catch

The perception that fishermen using non-selective fishing gear will affect the number (volume) of their catch is presented in Figure 3. The 26 fishermen voted in favor, and four who voted against using non-selective fishing gear were concerned that it would affect the number (volume) of the catch. Non-selective fishing gear tends to catch fish of various sizes and types. Non-selective fishing gear negatively influences the sustainability of fish resources in these waters. It has been recorded that non-target fish tend to be sold at low prices or discarded by fishermen (discard) [8].

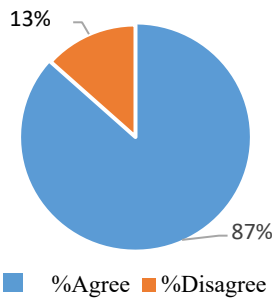

Fig. 3. Fishermen's perception of non-selective use of fishing gear will affect the number (volume) of the catch

3.4 Fishermen's perception of government regulations regarding the size of nets and types of net fishing gear helps achieve sustainable fisheries management

Figure 4 shows fishermen's perception of government regulations regarding the size of nets and types of net fishing gear to help achieve sustainable fisheries management. 26 fishermen voted in favor, and four fishermen voted against the government regulation regarding the size of nets in the type of net fishing gear to help achieve sustainable fisheries management. In general, the size of the net is adjusted to the size of the fish body, which is the target catch. This means that the smaller the net size, the smaller the net size, the more small fish are caught. Fishing activities consider sustainability principles to minimize their impact [9].

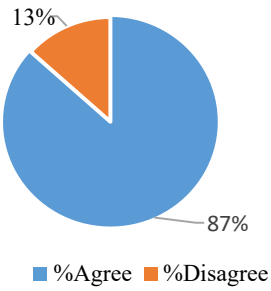

Fig. 4. Fishermen's perception of government regulations regarding the size of nets and types of net fishing gear helps achieve sustainable fisheries management

3.5 Fishermen's perception of fish sizes unsuitable for catching should be released because they cause a decline in fish populations

Fish that are unsuitable for catching should be released because they cause fish populations to decline, as presented in Figure 5. 24 fishermen voted in favor. Six fishermen voted against the size of unsuitable fish for fishing, which should be released because they cause the fish population to decline. Approximately 61.67% of fishermen did not return unsuitable catches, and the location became an active fishing area for fishermen. If this continues, it will have a long-term impact on capture fisheries, namely a decrease in population or species extinction. Many fish are unsuitable for fishing, and protected fish can still survive about 80-90% if released [10].

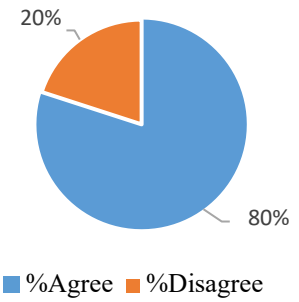

Fig. 5. Fishermen's perception of fish sizes that are not suitable for catching should be released because they cause fish populations to decline

3.6 Fishermen's perception of the use of fishing aids has the potential to cause habitat degradation in the long term

Figure 6 shows the fishermen’s perception that the use of fishing aids has the potential to cause habitat degradation in the river. the 27 fishermen voted in favor, while three who voted against it expressed concerns that the use of fishing aids could lead to habitat degradation. The use of fishing aids provides many benefits for fishermen, one of which is making it easier to collect fish. The application of fishing aid technology/innovation has a positive impact on fish catches [8, 12].

Innovative fishing technology includes fish aggregating device (in bahasa: rumpon), attractors/lures, lights, and other aids. If used continuously and uncontrollably, it can impact the fish population. The government's efforts to maintain the sustainability of capture fisheries by regulating regulations, as stated in the Regulation of the Minister of Marine

Affairs and Fisheries Number 18 of 2021 concerning the Placement of Fishing Gear and Fishing Aids in the State Fisheries Management Area of the Republic of Indonesia and the High Seas as well as the Arrangement of Fishing Andon. Improving fishers' resilience contributes to poverty prevention and alleviation [13].

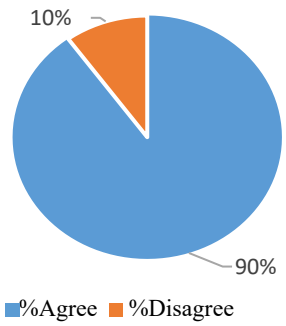

Fig. 6. Fishermen's perception of the use of fishing aids has the potential to cause habitat degradation in the long term

3.7 Fishermen's perception to the difference in *catchability* between fishermen will cause social conflicts between them

Fishermen's supplications to differences in catchability between fishermen will cause social conflicts among fishermen, as presented in Figure 7. 27 fishermen voted to agree, and 3 fishermen who voted against it said that the difference in catchability between fishermen would cause social conflicts between them. The difference in catching ability is generally influenced by the type of fishing gear, auxiliary tools, and fleets used by fishermen: the larger the fishing fleet, the more potential to obtain more catches. One of the efforts to regulate fishermen in the use of fishery resources and minimize conflicts is the implementation of restrictions on the number of permissible catches (JTB). JTB restrictions can be used as a conservation process to ensure that the fisheries' ecosystem remains sustainable.

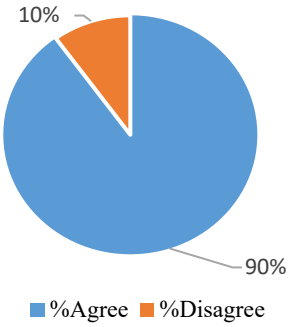

Fig. 7. Fishermen's Presbyterian to the difference in catchability between fishermen will cause social conflicts among fishermen

3.8 Fisheries production, productivity, and value

Based on the results of fishery production, the fish species caught in South Lampung Regency in 2020-2023 have increased. Fishery production in 2020 reached 122,136 tons; in 2021, it reached 125,377 tons; in 2022, it reached 128,276 tons in 2023 it reached 131,264 tons. The

amount of fishery production in South Lampung Regency is shown in Figure 8. The fish caught as a product of fisheries production include vannamei shrimp, catfish, squid, kites and catfish. The value of the catch fluctuates and is influenced by field conditions. Naturalization and the fishing season can also affect the fishermen's catch [11].

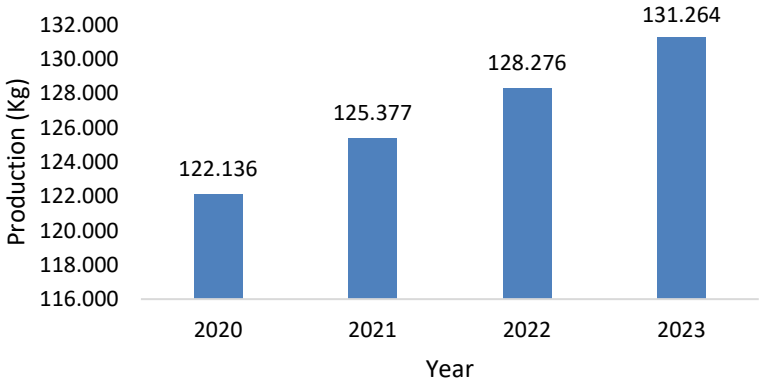

Fig.8. Production of fishery products based on fish species in the South Lampung district

The value of fishery production in South Lampung Regency from 2020-2023 has increased following the increase in catch production. The Production Value in 2020 reached Rp. 310,668,555, in 2021, it reached Rp. 688,514,793, in 2022, it reached Rp. 913,263,530, and in 2023 it reached Rp. 918,814,500. The highest rate of increase in production value was obtained in 2021, which reached approximately 2x from 2020, in contrast to the increase in value in 2023 of approximately 1% from 2022. Production and productivity values can increase during the fish season and under supportive sea conditions.

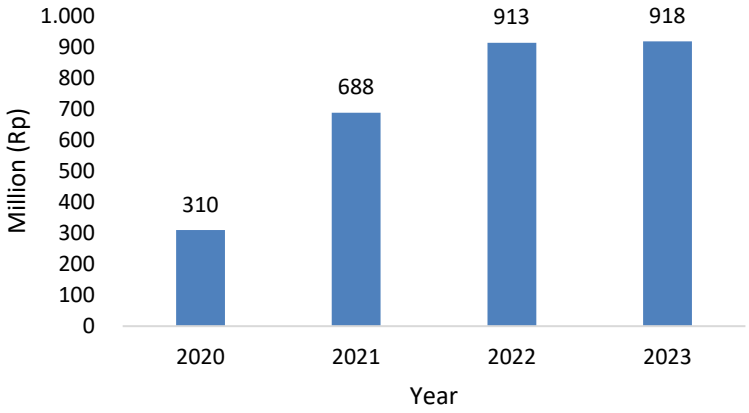

Fig. 9. Fishery Production Value in South Lampung Regency

4. Conclusion and suggestion

4.1 Conclusion

The value of fishermen's perception of light attractors on Sebesi Island is grouped into three categories: most fishermen have a high-level perception, with 18 people (76%), a medium-level perception, with nine people (22%), and a low-level perception, with only three people (2%). Light attractors have advantages, including high catch productivity, diverse types of catches, and the composition of many fish-worthy categories. The production and value of catch production on Sebesi Island in 2020-2023 have increased.

4.2 Suggestion

It is necessary to conduct the experimental fishing design to obtain data on the catch of fishing gear and charts using light attractors.

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