Original Research Article

Analysis of the Effect of Immersing Duration and Bait Type on the Catch of Banana Prawn (*Penaeus merguiensis*) using Dragon Traps in Semarang Waters

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ABSTRACT

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| **Aims:** Toanalyze the effect of immersing duration and bait type on the catch of Banana Prawn (Penaeus merguiensis) in the waters of Semarang**Study design:** Experimental fishing**Place and Duration of Study:** This research was conducted in November 2024 at Tambak Lorok, Semarang City, Central Java, Indonesia **Methodology:** The method used in this study was experimental fishing, involving two variables: immersing duration and bait type, with seven repetitions. The immersing durations were set at 12 hours and 24 hours, and the bait type used were discarded catch, chicken intestines, and green mussel shells.**Results:** The catch composition of the dragon trap includes banana prawn (*Penaeus merguiensis*), tiger shrimp (*Penaeus monodon*), dory snapper (*Lutjanus fulviflamma*), green mud crab (*Scylla paramamosain*), mangrove stone crab (*Myomenippe hardwickii*), barracuda (*Sphyraena barracuda*), and orange-spotted grouper (*Epinephelus coioides*). The Mann-Whitney test results showed an Asymp. Sig value of 0,018 (<0,05) for immersing duration, indicating a significant difference. Meanwhile, the Kruskal-Wallis test fir bait type resulted in a Asymp. Sig value of 0,173 (>0,05), indicating No. significant effect. The interaction between immersing duration and bait type using the Friedman test showed a significant effect with a value of ,0,000 (<0,05).**Conclusion:** The study demonstrates that a 12-hour immersion period using discarded catch as bait is the most effective combination for maximizing banana prawn catch in dragon trap fishing operations, with immersion duration having a significant impact on catch efficiency. |

*Keywords: Bait Type, Banana Prawn, Catch Composition, Dragon Traps, Immersing Duration*

1. INTRODUCTION

Dragon traps are a type of fishing gear increasingly utilized by coastal fishermen in Semarang to capture banana prawns (*Penaeus merguiensis*). This fishing gear is preferred because of its straightforward design, ease of operation, and cost-effectiveness. The Dragon traps employed in this study were rectangular, approximately 10 m in length, and were equipped with a pocket filled with gravel or seashells to serve as a weight. The primary target of dragon traps is the banana prawn, which inhabits river estuaries characterized by sandy and muddy substrates. According to Septiani et al. (2024), banana prawns constitute the highest average crustacean catch in this region.

Dragon traps, as passive fishing gear, require bait to enhance their effectiveness. Fishermen in Semarang frequently utilize discarded catches as bait because of their strong odor, which is particularly attractive to banana prawns. This study evaluated the use of various alternative bait types, including discarded catches, chicken intestines, and green mussels. The selection of these baits was based on their availability and strong scent, which effectively attracted banana prawn. According to Bakhtiar et al. (2014), fishing gear that incorporates bait generally achieves higher catch rates than gear without bait, particularly when the bait contains protein, fat, and a strong odor that stimulates the olfactory and visual senses of aquatic animals.

This study was conducted in the waters of Semarang to assess the effectiveness of alternative bait types in dragon trap operations and determine the optimal immersion time for maximizing catch yield. The bait prices at the study site varied, with discarded catches priced at approximately IDR 20,000/kg, chicken intestines at IDR 15,000/kg, and green mussels available at no cost, as they are commonly found in fish markets. According to Yuda et al. (2014), chicken intestines contain proteins and amino acids comparable to those in discarded catch and are widely available in large quantities. Therefore, this study aimed to provide alternative bait options for fishermen, offering cost-effective and efficient solutions to enhance banana prawn catch rates.

2. methodology

**2.1 Location and Time of Research**

This study was conducted in November 2024 in Tambak Lorok, Semarang City, Central Java, Indonesia. The researcher employed observations, literature reviews, and documentation to gather data.



Figure 1. Research Location

**2.2 Research Materials and Method**

The data used in this study consists of two types are primary data and secondary data. Primary data is obtained directly during the research process, including information on the construction and design of the fishing gear, operational methods, fishing area, and catch results of the dragon trap. Secondary data is collected from the Central Java Marine Affairs and Fisheries Office and the Semarang City Marine Affairs and Fisheries Office to support the primary data. This study employs an experimental fishing method to examine the effect of bait type and immersing duration on the catch efficiency of the dragon trap. The tested baits include chicken intestines and green mussels, with discarded catches serving as the control. Immersing durations of 12 hours (control) and 24 hours are compared to evaluate the effectiveness of each bait. The experimental design follows a factorial design with two main factors: bait type and immersing duration, resulting in six treatment combinations. Each treatment is repeated at least five times, based on Federer’s formula (1963) as cited in Indratama and Yenita (2017). In this study, the treatments were repeated seven times to enhance data accuracy.

* 1. **Analysis Method**

The data analysis methods used in this study consist of the following:

1. Mann-Whitney Test

 The Mann-Whitney test was conducted to achieve the second objective, which is to determine the effect of different immersing durations on the catch of *Penaeus merguiensis*.

• If the probability (Asymp. Sig) > 0.05, then H0 is accepted.

• If the probability (Asymp. Sig) < 0.05, then H0 is rejected.

1. Kruskal-Wallis Test

The Kruskal-Wallis test was conducted to achieve the third objective, which is to determine the effect of different bait types on the catch of *Penaeus merguiensis*.

a. Estimation of the effect of different bait types on the catch weight:

• H0 = Differences in bait types do not affect the catch weight.

• H1 = Differences in bait types affect the catch weight.

b. Estimation of the effect of different immersing durations on the catch weight:

• H0 = Differences in immersing duration do not affect the catch weight.

• H1 = Differences in immersing duration affect the catch weight.

c. Based on the Asymp. Sig or P-value:

• If the Asymp. Sig or P-value > 0.05, then H0 is accepted.

• If the Asymp. Sig or P-value < 0.05, then H0 is rejected.

3. Friedman Test

This test was conducted to determine the interaction between immersing duration and bait type on the catch of Penaeus merguiensis.

a. Estimation of the interaction between immersing duration and bait type on the catch weight:

• H0 = The interaction between immersing duration and bait type does not affect the catch weight.

• H1 = The interaction between immersing duration and bait type affects the catch weight.

b. Based on the P-value:

• If the probability (P-value) > 0.05, then H0 is accepted.

• If the probability (P-value) < 0.05, then H0 is rejected.

3. results and discussion

**Table 1. Total Main Catch and Bycatch**

|  |  |  |
| --- | --- | --- |
| **Catch Spesies** | **Amount (tail)** | **Weight (grams)** |
| Banana Prawn (*Penaeus merguiensis*) | 1,180 | 3,135 |
| Giant Tiger Shrimp (*Penaeus monodon*) | 1 | 60 |
| Dory Snapper (*Lutjanus fulviflamma*) | 3 | 153 |
| Green Crab (*Scylla paramamosain*) | 131 | 21,97 |
| Stone Crab (*Myomenippe hardwickii*) | 8 | 210 |

Table 1 shows the total primary catch and bycatch associated with the use of dragon trap fishing gear. The predominant primary catch was banana prawns (*Penaeus merguiensis*). This study was conducted along the shores of Tambak Lorok, where the seabed substrate consists of sandy mud, providing an optimal habitat for crustaceans and demersal fish. The primary catch was mainly banana prawn (*Penaeus merguiensis*), while the most prevalent bycatch was green crabs (*Scylla paramamosain*), which were found in relatively high numbers in the study area. Fishermen typically release green crabs back into water because of their low economic value, although some are used as bait. Small quantities of fish caught are generally consumed by the fishermen themselves, whereas live banana prawns are immediately sold, and deceased ones are sorted by size before being sold to collectors. According to Atmajaya et al. (2021), the sustainability of fishing gear can be assessed based on the ratio of target to non-target catches and their impact on the aquatic ecosystem.

Based on Tables 2 and 3, the total catch obtained varied according to the three different bait types and immersion durations of 12 h and 24 h. The choice of bait significantly influenced the quantity of main catch, as each bait exhibited varying levels of attractiveness to the target species. Discarded catch bait tends to disintegrate quickly, chicken intestines are more durable yet still fragile, and green mussels demonstrate high durability owing to their hard shells. According to Zalzati et al. (2019), bait with a high fat content and strong fishy odor is more durable and attractive to fish. The results indicated that a 12-hour immersion period was more effective than a 24 hours, as prolonged immersion allowed target species to escape and caused the trap to become dirty, reducing its attractiveness to aquatic organisms. According to Aldita et al. (2014), shorter immersion durations optimize trap efficiency compared with excessively long periods. Furthermore, the decline in catch rate during the 24-hour immersion period was also attributed to predation by green crabs and cannibalism among banana prawns, which increased under stressful conditions due to space constraints. Supadminingsih et al. (2015) stated that crabs exhibit carnivorous and cannibalistic behavior, while Purnamasari et al. (2017) suggested that cannibalism in shrimp is influenced by genetic factors and habitual behavior.

**Table 2. Main catch of dragon trap based on a 12-hour immersing time and bait type**

|  |  |
| --- | --- |
| **Replication** | **Bait Type** |
| **Discarded Catch** | **Chicken Intestines** | **Green Mussels** |
| **Number** | **Grams** | **Number** | **Grams** | **Number** | **Grams** |
| 1 | 20 | 165 | 26 | 174 | 21 | 46 |
| 2 | 80 | 178 | 13 | 96 | 64 | 187 |
| 3 | 36 | 73 | 22 | 56 | 12 | 26 |
| 4 | 59 | 74 | 10 | 48 | 38 | 50 |
| 5 | 65 | 145 | 36 | 122 | 41 | 102 |
| 6 | 71 | 156 | 29 | 99 | 32 | 97 |
| 7 | 34 | 109 | 27 | 86 | 24 | 89 |
| Total | 331 | 791 | 136 | 595 | 232 | 597 |

**Table 3. Main catch of dragon trap based on a 24-hour immersing time and bait type**

|  |  |
| --- | --- |
| **Replication** | **Bait Type** |
| **Discarded Catch** | **Chicken Intestines** | **Discarded Catch** |
| **Number** | **Grams** | **Number** | **Grams** | **Number** | **Grams** |
| 1 | 2 | 5 | 13 | 114 | 13 | 26 |
| 2 | 10 | 14 | 4 | 4 | 6 | 19 |
| 3 | 8 | 18 | 2 | 4 | 4 | 10 |
| 4 | 47 | 69 | 54 | 77 | 11 | 14 |
| 5 | 31 | 55 | 41 | 127 | 22 | 21 |
| 6 | 22 | 43 | 20 | 89 | 26 | 34 |
| 7 | 29 | 56 | 40 | 121 | 15 | 37 |
| Total | 149 | 260 | 174 | 536 | 97 | 161 |

**Table 4. Total main catch and bycatch (grams) based on immersing duration**

|  |  |
| --- | --- |
| Catch Type | Weight (grams) |
| 12 hours | 24 hours |
| Banana Prawn (*Penaeus merguiensis*) | 2,178 | 904 |
| Giant Tiger Shrimp (*Penaeus monodon*) | 60 | - |
| Dory Snapper (*Lutjanus fulviflamma*) | 92 | 61 |
| Green Crab (*Scylla paramamosain*) | 879 | 1,318 |
| Stone Crab (*Myomenippe hardwickii*) | 90 | 120 |
| Barracuda (*Sphyraena barracuda*) | - | 82 |
| Orange-Spotted Grouper (*Epinephelus coioides*) | 292 | - |

Based on Table 4, the immersing durations of 12 and 24 hours resulted in a significant and diverse bycatch. The 24-hour immersion period resulted in a higher incidence of bycatch compared to the 12-hour period, primarily due to the entrapment of large non-target species, particularly crabs, which encounter difficulty escaping once inside the trap. According to Susanto et al. (2014), mangrove crabs possess rounded dactylus swimming legs adapted for aquatic movement but may become entangled in trap meshes, leading to injuries or stress that impede their movement. If the mesh size of the trap is inappropriate, the swimming legs of the crabs may become ensnared in the net openings, preventing their escape. Based on the study findings, the optimal immersion duration for dragon traps is 12 h rather than 24 h, considering banana prawn behavior and fishing efficiency. Banana prawns actively forage at specific times of the day, particularly when the bait is fresh and scented. A 12-hour immersion period with discarded catch bait maintains bait attractiveness and enhances the likelihood of shrimp entering the trap. In contrast, prolonged immersion increases the risk of bait contamination by debris, algae, or organic residues, thereby reducing its effectiveness. According to Aldita et al. (2014), shorter immersion periods help preserve bait quality, prevent odor degradation, and optimize banana prawn catch rates.

Discarded catch bait proved to be the most effective in attracting banana prawns because of its strong aroma, soft texture, and high nutritional content, which closely resembled the natural diet of the species. In contrast, chicken intestines and green mussels were less effective because their denser texture and limited odor dispersion in water resulted in lower catch rates. As noted by Zalzati et al. (2019), bait, which is rich in fat and possesses a strong fishy odor, is more appealing to fish as it is more durable and emits a potent scent. This underscores the significant impact of bait selection on fishing efficiency, with discarded catch emerging as the optimal choice for attracting banana prawns and other target species.

**Table 5. Mann-Whitney test for immersing duration**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Z Score** | **Assymp. Sig (2-tailed)** | **Indication** |
| 12 hours vs. 24 hours | -2.364 | 0.018 | Significantly different |

The significance value (Asymp. Sig) obtained in Table 5 is 0.018. It demonstrated a significant difference in catch outcomes. The optimal immersion duration for dragon traps was 12 h, as it was more effective than 24 h in maintaining fresh and attractive bait, thereby enhancing shrimp capture rates. The reduced catch volume during the 24-hour immersion period was likely attributable to banana prawn cannibalism, which occurs when shrimp are confined in a limited space for extended periods. Purnamasari et al. (2017) found that cannibalism in shrimp is associated with genetic factors and behavioral tendencies, with size variation within groups due to genetic differences being a major contributing factor.

**Table 6. Kruskal-Wallis test for bait type**

|  |
| --- |
| **Test Statisticsa,b** |
|  | CatchResult |
| Kruskal-Wallis H | 3.507 |
| df | 2 |
| Asymp. Sig. | .173 |
| 1. Kruskal Wallis Test
2. Grouping Variable: Bait
 |

Based on the Kruskal-Wallis test results in Table 6, the significance value (Asymp. Sig) is 0.173 (>0.05) for bait type. This result indicates that there is no significant effect of bait type on catch results. However, the Friedman test (Table 7) showed a significance value (Asymp. Sig) of 0.000 (<0.05), demonstrating a significant interaction between immersing duration and bait type in determining catch efficiency. Thus, while bait type individually did not have a statistically significant impact, the combination of bait type and immersing duration played a crucial role in optimizing dragon trap fishing performance.

**Table 7. Friedman test for interaction between immersing duration and bait type**

|  |
| --- |
| **Test Statisticsa** |
| N | 42 |
| Chi-Square | 66.706 |
| df | 2 |
| Asymp. Sig. | .000 |
| a. Friedman Test |

4. Conclusion

The conclusion of this study is that a immersing time of 12 hours yields better results compared to a immersing time of 24 hours. The type of bait does not have a significant effect on the total catch; however, among the tested bait types discarded catch, chicken intestines, and green mussels, the bait that resulted in the highest catch was discarded catch. The interaction between immersing time and bait type showed a significant effect.

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