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The effectiveness of crab apartment to shelter egg berried female of blue swimming crab (*Portunus pelagicus*) in Rembang, Central Java, Indonesia

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Abstract. Blue swimming crab is an Indonesian fishery commodity with high economic value for export to America, Asia, and Europe. The increase in crab fishing activities every year results in diminishing stocks in nature, in addition to predator attacks around spawning areas. The purpose of this study was to determine the growth of blue swimming crabs and identify types of fish in the crab apartment shelters in Rembang Regency, Central Java Province, from March to May 2023. The egg berried female crabs were put in a floating apartment for three months and monitored every 2 weeks to determine the growth of the hatched crab eggs. Our observations showed as many as 50 egg berried female crab with with an average size of 8–10 cm and a weight of 40–65 g. There were other marine organisms found in the shelter, including rabbit fish, shrimp, small crabs, and therapon-perch. Rabbit fish and therapon-perch often result in reduced juveniles. Therefore, add and installing shelter is highly recommended to the entry of these fish. This study found crab apartment brings positive impacts on the survival of hacthing crabs and protected them from the threat of predatory fish.

Keywords: blue swimming crab; crab shelter; fish; floating apartment

1. Introduction

Blue swimming crab is one of Indonesia's main export fishery products to many countries, especially the United States, which ranks fourth after squid, shrimp, and tuna [1]. One of the biggest regions in Central Java for crab production is Rembang Regency. Every day, commercial fishing operations are conducted, which causes a decline in natural population levels. Because people are unaware of the sustainability of the crabs, it is still common practice to catch egg-berried female crabs. It is necessary to keep approaching fishermen as the primary players in capturing blue swimming crabs and consider the long-term viability of small crab populations.

To release egg-berried female crabs so their eggs can hatchback into the wild, it is necessary to construct floating crab apartments in the sea. Predatory fish are one of the reasons for the decrease in

blue swimming crabs. To protect developing crab eggs from predators, crab shelters must also be made. It has been demonstrated that the application of fish aggregating devices (FADs) can raise fish productivity in specific waters [2]. Furthermore, using shelters in floating blue swimming crab apartments allows one to keep an eye on the development of hatching crab eggs. It serves as a detector for fish and crustacean breeding sites, among other biota [3].

Based on the information above, shelter must be added to the crab apartments to safeguard hatchlings from predators, large sea waves, and powerful currents. Observations regarding the growing period of blue swimming crabs in the wild can also be made. Fish sustainability is impacted by excessive and unregulated usage of FADs, although they have numerous positive effects on fishing productivity [4]. Determining the growth of blue swimming crabs and the kinds of fish surrounding the shelter in floating blue swimming crab apartments was the aim of this study.

2. Methods

2.1. Study Area

The research was conducted in Dukuh Layur, Gedongmulyo Village, Lasem District, and Rembang Regency from March to May 2023. Dukuh Layur is one of the villages in Rembang Regency whose livelihood relies on produce from the sea, one of its main catches is blue swimming crab. This village is located east of the city in Rembang district.

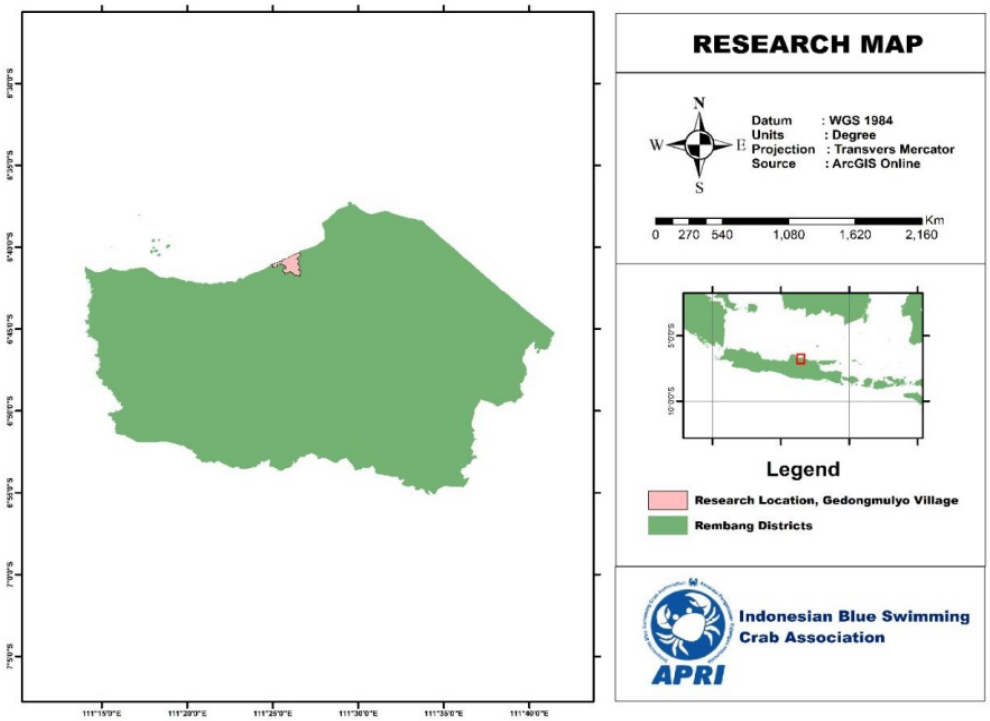

Figure 1. Map of research locations in Rembang, Central Java.

2.2. Data collection

Data was collected by field observation method with purposive sampling. Observation and data collection were carried out once a week every Friday at the floating blue swimming crab apartment in Gedungmulyo Village, Rembang (Figure 2). The step for sampling was taken by observing the movements of the blue swimming crabs and non-target species around the shelter and catching all visible biota using nets. Then identifying their names also characteristics. Data on catches of crab and non-target species from crab apartments is used as material for making tables and figures so that their growth is known.

Figure 2. Floating blue swimming crab apartment in Gedungmulyo Village, Rembang.

2.3. Data analysis

To find out the effectiveness of the shelter in the floating blue swimming crab apartments, it can be seen from the growth of the crabs during the study time and the number of non target species around the shelter for analysis of the types and habitats of the most. Descriptive analysis is used in this study to make a systematic, factual, and accurate description of the facts and characteristics of a particular population or area [5].

3. Results and discussion

The sampling data was taken on May 19, 2023 (2 months) after the egg-berried female crab was placed in the crab apartment on March 12, 2023 (Table 1). The egg-berried female crab that brings black eggs only needs 1 day of hatch time. In contrast to orange eggs, it takes a longer time, namely 7 days [6]. Observing weekly, showed that the growth of crabs for 2 months in nature varies from the smallest size of 83 millimeters with a weight of 39.2 grams to the largest size of 102 millimeters with a weight of 70 grams. Most of the crabs caught samples were dominated by the female crabs. The size variability of the crabs was influenced by several factors such as sex, age, disease, parasites, food availability, water quality, and loss of limbs [7]. Blue swimming crabs have a growth trend that depends on environmental change or food availability [8].

Tabel 1. Sample data of blue swimming crab.

No.	Carapace widht (milimeter)	Weight (gram)	(F/M)	Maturity
1	87	40,8	Female	1
2	92	52,3	Male	-
3	88	42,3	Female	1
4	99	70	Female	1
5	102	70	Female	2
6	83	39,2	Male	-

While the non target species data that entered the apartment area included therapon-perch, rabbits fish (Table 2 and Figure 3), Rabbit Fish is non target species, which dominates the floating blue swimming crab apartment area. Microalgae, macroalgae, protozoa, detritus, and crustaceans were the

variant of Rabbit fish food [9]. From the non target species, it is suspected that they are predators were eat the eggs of the crab in nature. Only some of the million eggs of the crab can escape to live. The fecundity value of fish could be the parameters of fish potential reproductive, whose gonadal eyes depend on the spawning season [10]. According to Widiana, the spawning season of Rabbits fish occurs from April to May [11].

Tabel 2. Non-target species data caught in shelters around the blue swimming crab apartment.

No	Local name	Species name	Total
1	Shrimps	*Panaeus monodon*	1
2	Terapon-perch	*Therapon theraps*	9
3	Rabbits fish	*Siganus javus*	6
4	Small crabs	*Charybdis affinis*	1
5	Rabbits fish	*Siganus canaliculatus*	17

Figure 3. The type of non target species that enters the floating blue swimming crab apartment area.

The apartment as a shelter for the blue swimming crab brooders, was very influential in survival as well as protecting the crabs that were starting to hatch from predators. As Wahyudin states, shelters are very useful as a tool to lure and as a place for spawning [12]. The crab seeds live by sticking and not floating in the water at the megalopa stage, so they need shelter using a net from polyethylene plastics (called waring in Bahasa) [13]. Floating apartments make shelters easier to build and see the growth trend of the crabs.

Figure 4. Shelter in blue swimming crab apartment.

The blue swimming crab apartment with a floating system has a length of 10 meters and a width of 6 meters and is placed in the sea at a distance of 1 mile from the shoreline. Ihsan claims that it is not a good idea to sink net cages more than 100 meters from the coast because the high concentration of dissolved sediment particles causes the water's turbidity to fluctuate constantly[14]. On the edge of the blue swimming crab apartment, there is a crab box made of fruit baskets that serve as a place to release brood crabs that lay eggs. In the middle, a shelter is installed, which forms a cage-like structure with a length of 4 meters, a width of 4 meters, and a height of 3 meters. The function of providing waring as a means of research when using the shelter is that the waring used has an eye diameter of 1 millimeter. The closer the mesh, the less biota it is hoped will be able to enter. The non target species that entered the apartment area were indicated by the damage to the sides of the net and during high waves, which caused small fish to be carried by the waves into the apartment area. The main benefit of the blue swimming crab apartments is to release the egg-bearing female (EBF), either intentionally or unintentionally caught by fishermen.

In the Rembang area, mini trawl fishing is still practiced, which contributes to the demise of young crabs, megalopa, and zoea. In order to protect the recently hatched crabs from predators and fishing gear, nets have been added to the crab apartments. One method for achieving management of crab cultivation is integrated manag.ement of crab cultivation with a sinking net cage system [15]. It is necessary to provide refuge in waring so that zoea, megalopa, and juvenile crabs are safe. Young crab survival rates can be raised and cannibalism levels lowered by using shelters [16]. To prevent the zoea and megalopa from attacking one another, the shelter is dispersed throughout the center and along the inner edge of the waring.

4. Conclusion

The size of the crab varies due to sex, age, disease, parasites, availability of feed, loss of limbs during molting, and changes in the environment. There are five types of NTS around the blue swimming crab apartment, dominated by rabbits fish, which are predatory fish for small blue swimming crab. The diet of rabbit’s fish includes microalgae, macroalgae, protozoa, detitrus, and crustaceans. Spawning time is based on the season, namely; April–May. The role of non target species is very influential on the survival and growth of the crab. The shelter in the floating apartment is very influential in the survival of the crabs that start to hatch.

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