Application of foldable cube and cylinder fishing pot in Tuban Regency water

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Abstract. Fishing pot is an environmentally friendly fishing gear that has been used by fishermen in Indonesia with all kinds of shapes and sizes. This study aimed to determine the composition of the catches using a modified cube folding trap and tube folding trap, as well as provide design information material to develop environmentally-friendly fishing gear. The research was conducted in Socorejo Village, Jenu District, Tuban Regency, East Java, in October-December 2018. The method of this research used experimental fishing with 30 units of cube folding trap and 30 units of tube folding trap. Traps were operated long lines at 10 different coordinate points and the results were analyzed further using the T-test with 95% of confidence level. The catch composition of cube and tube folding traps shows the largest catches in percentage are swimmer crab as much 65% and 57%. The value of catches composition cube and tube folding trap is 0.169 and 0.227 which indicate that cube folding trap is more selective. Based on the results of T-test, total and weight of the catches between cube and tube folding trap show no significant difference. The results conclude that the cube folding trap is more effective with more catches.

Keywords: cube, cylindrical, foldable fishing pot, swimmer crab, Tuban

1. Introduction

The sea area of Tuban Regency stretching along 65 km with vast water as much as 22.608 km². The fishing activities in this regency are spread in five districts area, Palang, Tuban, Jenu, Tambakboyo, and Banjar district. By this geographical location, the production of fisheries in Tuban Regency are abundant and even exceed the society’s consumption need of fish (Agency for Regional Development of East Java 2013). In 2017, the fisheries production in Tuban Regency achieved 11,489 ton with the number of fisherman household 3,243 and still dominated by fisheries business in small scale. Fisherman in Tuban mostly use the catching tools with Seine Net as much as 1,916 unit, Drifting Gill Net 811 unit, Danish Seine 792 unit, Fishing pot 524 unit and other tools such as purse seine and fishing equipment (Agency Statistics of East Java 2019).

Pots are a type of trap used to capture much potential fish, crustaceans, or molluscs. They are usually composed of a rigid frame covered in a net and attached by a rope to a buoy at the surface (Murray...
Fishing pot is kind of catching tools which has passive, selective characteristics also had various shape and size. The operation of fishing pot can be located on the bottom of water, floated, and wandered. Various kind of fishing pot has been used by fisherman in Indonesia with different size and shape which is also aimed to catch certain type of catch. Slack-Smith (2001), mentioned that even if there are many shapes, such as rectangle, circle, hexagonal, conical, semi-cylinder, chevron and arch, all those working systems are same, the fish are trapped into one or some funnels and prevented to escape.

Pots, like trap-nets, possess several appealing characteristics compared to many other fishing gears: low energy use, minimal habitat impact, the catch is still of good quality, and live delivery (Slack-Smith 2001, Suuronen et al 2012). Pots can be installed in the water for a long time and the catch is still retained in good condition (O’Brien and Dennis 2008). Some fisheries that specifically target the capture of live fish have developed pots as the principal capture method. Live-capture may bring a substantially higher price to the fisher because the catch is still in good condition and fresh. Where the quality of the catch is critical, pots may be the preferred capture method. While pot fishing vessels, in general, have low fuel use, some other fishing gear exhibit high fuel use (Suuronen et al 2012).

Foldable fishing pot is the most used catching tools nowadays by the fishermen because it is easy to bring in numerous amounts inside the ship and the making price is relatively cheap. The fishing pot being the alternative of catching tools which considered as eco-friendly and easy to be operated. This research is aimed to identify catching result composition using cubic fishing pot and cylinder fishing pot and to test whether there is real difference between the total number and weight of catch result from the two of foldable fishing pot models.

2. Materials and methods

This research is conducted in the sea of Java, Socorejo Village, Jenu District, Tuban Regency, East Java which was done in October to December 2018, started by designing and making fishing pot catching tools, then data gathering was done by installing fishing pots in 10 different coordinate points. The trap that used is the development of fishing pot model according to Rachman (2017). In this research the modification will be done in fishing pot catching tool of cube shape fishing pot with circle funnel and cylinder fishing pot with circle funnel which could not be folded before to become able to be folded, in order to become efficient to bring in numerous amount and easily used when going to the sea.

2.1. Materials

The main tool used in this research is foldable cube fishing pot and foldable cylinder fishing pot with each 30 unit/model. This foldable fishing pots are designed to catch the main catch result that is fish with economic value. The material used in the frame of the fishing pot is iron with 4 mm diameter and using polyethylene net in 1.5 inch mesh size, also have a bait holder inside the room body. The two models of fishing pot have circle funnel with 25 cm diameter which given net inside the room body of fishing pot to guide fish get trapped in. Specification and frame of foldable fishing pot are shown in figure 1 and the shape of foldable fishing pot is shown in figure 2.

The other additional materials were fish baits, permanent weight measuring scale, a ruler, fisherman’s motorboat, GPS to determine position of each fishing pot operation, and camera to document each process of the research.
**Figure 1.** Specification and frame unit trial in a foldable fishing pot.

**Figure 2.** Foldable cube and cylinder fishing pot.
2.2. Methods
The method used in this research was experimental fishing. The operation of foldable fishing pots was divided into three steps, including setting, immersing or fishing period, and hauling. Fishing pots were paralleled using a rope with 10 m interval for each fishing pot. The installation of foldable cylinder and foldable cube fishing pot were done alternately as described in figure 3, with total number of 60 units. The preparation of fish bait was done in the day before fishing pot installation. Fish baits were cleaned in the stomach part in order to delay the decomposition. The operation of fishing pot installation started at 6 AM then the tools were immersed for 24 hours.

2.2.1. Data analysis. The fish of catching result data is measured from its every length and weight. The data gathered then being analyzed for its catch result composition with pattern which formulated by Rachman (2017), as written below:

\[ C = \frac{n}{N} \]

C = Catch result composition, \( n \) = number of catch result species, \( N \) = total number of fishing pot catch result.

![Figure 3. Fishing pot installation condition in the water, a = marker (flag), b = buoy, c = sinker, d = foldable cylindrical fishing pot, e = foldable cube fishing pot.](image)

The score of C is influenced by the total amount of fish types which trapped inside the fishing pot and total catch result by using fishing pot. If the score of C is bigger or close to one, then fishing pot model used is not selective towards the fish target of catch. On the other hand, the score of C is smaller and close to zero then the fishing pot model used is selective towards the fish target.

Comparison test analysis of fish result production based on weight and a total number of catch in foldable cube fishing pot and cylinder cube fishing pot is done by T-test. The hypothesis for this test was \( H_0 \) = No significant difference of the total catches between foldable cube fishing pot and cylinder cube fishing pot, meanwhile \( H_1 \) = There is significant difference of the total catches between foldable cube fishing pot and cylinder cube fishing pot. The rule of decision making if significance score \( t < 0.025 \) then \( H_0 \) rejected, then if significance score \( t > 0.025 \) then \( H_0 \) accepted.

3. Result and discussion
The sea of Tuban, East Java has good potential resources of fisheries. With various catch result resources, there are many fishermen who depend their life on the fishing result. Capture fisheries production in East Java Province generally consists of pelagic fish groups, demersal fish groups, and
non-fish groups (Crustaceans and Molluscs). Economically important fish production in the pelagic fish group is dominated by 6 types of fish, namely: layang fish, lemuru, mackerel, tuna, skipjack, and cob. Meanwhile, for demersal fish groups, fish production with important economic value is dominated by manyung, grouper, kurisi, and layur fish. Furthermore, for non-fish groups that have important economic value, their production is dominated by species: swimming crabs, crabs, and white shrimp (Crustaceans), mussels, blood clams, and squid (Molluscs).

The foldable fishing pot installation location was done 10 times of trip with different coordinate points and recorded using GPS. The installation locations were around fish apartment which has been developed by Fisheries Department of Universitas Gadjah Mada, Yogyakarta in 2014. The depth average of fishing pot installation is 27m-30m. Maps location of installation tools can be seen in figure 4.

3.1. Catch result composition

The total of catch result composition of 10 times trip operation using foldable cube fishing pot as much as 71 individual with total of 12 types of catch result species. The composition and amount of each type consist of 2 individuals crab (*Charybdis anisodon*, 3%), 3 individuals Vermiculated spine foot (*Siganus vermiculatus*, 4%), 3 individuals Grouper (*Epinephelus sp.*, 4%), 3 individuals Pig faced leather jacket (*Paramonacanthus choirocephalus*, 4%), 7 individuals Snapper (*Lutjanus fulviflamma, Lutjanus rufolineatus*, 10%), 4 individuals Target fish (*Terapon jarbua*, 6%), 2 individuals Vachelli’s glass perchlet (*Ambassis vachelli*, 3%), 1 individual Russell’s snapper (*Lutjanus russeli*, 1%), and 46 individuals swimming crab (*Podopthalmus vigil, Charybdis feriatus, Portunus pelagicus*) with the highest percentage 65%. The proportion of catching result composition is provided in figure 5.

![Figure 4](image_url)  
*Figure 4. Maps coordinate of foldable fishing pot installation.*

The total catch using foldable cylinder fishing pot 4 individuals with total of 10 types of species. Composition and amount of each type constantly consist of crab (*C. anisodon*) 1 individual (2%), Vermiculated spinefoot (*Siganus vermiculatus*) 4 individuals (9%), Grouper (*Epinephelus sp.*) 6 individuals (14%), Pig faced leather jacket (*Paramonacanthus choirocephalus*) 3 individuals (7%), Snapper (*Lutjanus fulviflamma, Lutjanus rufolineatus*) 3 individuals (7%), Three-spined frogfish (*Batrachomoeus trispinosus*) 1 individual (2%), and swimming crab (*Podopthalmus vigil, Charybdis feriatus, Portunus Pelagicus*) 25 individuals with the highest percentage 57%. The proportion of catching result composition are provided in figure 6.
Figure 5. Percentage of catch result composition foldable cube fishing pot, ■ = swimming crab 65%, ■ = snapper 10%, ■ = target fish 6%, ■ = Vachelli’s glass perchlet 3%, ■ = Russell’s snapper 1%, ■ = crabs 3%, ■ = Vermiculated spinefoot 4%, ■ = grouper 4%, ■ = pig faced leather jacket 4%.

Mostly pot and trap used in the tropical area have arranged to fish in coral, stones area, and the rough bottom. Fish, cephalopod, and crustaceans caught were snappers, spineless cuttlefish, emperor fish, grouper fish, parrot fish, angelfish, squirrel fish, and others. Various type of squid and octopus also trapped in the most topical water area (Slack-Smith 2001). This research was conducted around fish apartment which the location close to corals. This is why the catch results obtained were varied.

Figure 6. Percentage of catch result composition foldable cylinder fishing pot, ■ = swimming crab 57%, ■ = Vermiculated spinefoot 9%, ■ = Pig faced leather jacket 7%, ■ = grouper 14%, ■ = Three-spined frogfish 2%, ■ = spineless cuttlefish 2%, ■ = crabs 2%, ■ = snapper 7%.

According to catchment composition score, foldable cube fishing pot has C score 0.169 and foldable cylinder fishing pot 0.227. If the score of C is bigger or close to one, then fishing pot model used is not selective towards the fish target of catch. On the other hand, of the score of C is smaller and close to zero then the fishing pot model used is selective towards the fish target (Rachman 2017). Hence, foldable cube fishing pot is more selective towards catch target compare to foldable cylinder fishing pot.

Table 1. Comparison of catch result composition.

| Group                 | Cube fishing pot | Cylindrical fishing pot |
|-----------------------|------------------|-------------------------|
| Total of catch (n)    | 71               | 44                      |
| Total type of catch (N)| 12               | 10                      |
| Catch composition (C) | 0.169            | 0.227                   |
3.2. Target and non-target total catch result
The catch total from fishing pot included two groups, target of catch and by catch. The total target species catch result of two foldable cube fishing pot models have a proportion which provided in figure 7.

![Figure 7](image-url)

**Figure 7.** The proportion of species target and non-target, ■ = species target, □ = by-catch.

Catch result in foldable cube fishing pot has main catch proportion 32% which consist of Vermiculated spinefoot (*Siganus vermiculatus*), Grouper (*Epinephelus* sp.), Pig faced leather jacket (*Paramonacanthus choirocephalus*), Snapper (*Lutjanus fulviflamma, Lutjanus rufolineatus*), Target fish, (*Terapon jarbua*), Vachelli’s glass perchlet (*Ambassis Vachelli*), Russell’s snapper (*Lutjanus russeli*). Moreover, for alternative catch results are crabs (*Podopthalmus vigil, Charybdis feriatus, Portunus Pelagicus*) and swimmer crabs (*C. antisodon*). The catch result of foldable cylinder fishing pot has main catch proportion as much as 39% which consist of Vermiculated spinefoot (*Siganus vermiculatus*), Grouper (*Epinephelus* sp.), Pig faced leather jacket (*Paramonacanthus choirocephalus*), Snapper (*Lutjanus fulviflamma, Lutjanus rufolineatus*), Three-spined frogfish, (*Batrachomoeus trispinosus*), and for the alternative catch are crabs (*Podopthalmus vigil, Charybdis feriatus, Portunus Pelagicus*) and swimmer crabs (*C. antisodon*).

The result shows that foldable cube and cylinder fishing pots was not efficient enough to catch fish, as seen that crabs and swimming crabs number trapped in the fishing pots are bigger than fish itself. This can be influenced in terms of fishing pot models, the shape, the model and size of entrance, trap size, also the location of the tool placement has a high potential for swimmer crabs. Trap size can affect catch rates by influencing the density of animals in the trap (Montgomery 2005). Bycatch from pots can be minimized by using appropriate baits, mesh sizes, materials and choosing the correct size, shape, location, and design of the entrance and escape openings. In line with statement by Lundin (2014), the alternative result, although the size of fish target or other unwanted sizes are threat by sustainable fisheries in the world. Two main actions used to reduce by-catch in the world of fishery are input and output control and management technique. The input control means that limitation applied in number of ship and fishing gear used, amount of time of fishing, number of fishermen allowed to catch fish, etc. the output control means the use limitation of catch, such as number of fish which allowed to catch and minimum size. The management technique including net eye size policy and selective panel installation in the fishing gear.

3.3. T-test result
According to T-test result to compare catch result the total amount of foldable cube and cylinder cube fishing pot shows that T-calculation < T-table which was 1.40 < 2.101, for the test result T to comparison weight catch result by two models of fishing pot show the same result that was 1.43 < 2.101 (T-calculation < T-table). From the two tests we can conclude that according to the total number of catch
result and comparison of weighing catch result foldable cube and foldable cylinder are not significantly different.

From the total results can be concluded that catch result composition in foldable cube and cylinder cube fishing pot have the most catch result in the form of crabs compare to catch target or fish with economic value. Additionally, the score of C shows that foldable cube fishing pot is more selective to catch targeted fish compare to foldable cylinder fishing pot. And based on test result T shows that it is valued by the total amount of catch and the total weight of catch result are not significantly different each other.

Foldable cube and foldable cylinder fishing pot need to be improved and modified in order to become more effective and selective to target such as fish with economics value. The modification made to design fishing gears has a bigger impact on the level of catch and composition of catch. The modification can be used to promote transition to sustainable fishing gears (Bergshoeff et al 2019), reduce bycatch non-target species (Bergshoeff et al 2019), and increase the level of catch from all fishing gears (Bergshoeff et al 2019). If compare to fishing gears such as basic trawl and long line, trap and pot are more beneficial because it is more selective for species and the size of target, and support the release of bycatch which still alive after getting caught (Suuronen et al 2012).

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