Squid attractor: an appropriate technology for empowering fishing communities

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Abstract. The use of squid attractors is expected to promote optimum sustainable utilization of fisheries resources. The exploitation of squid, the important exportable commodities, has been very intensive. Fisheries management on such resources should also promote business development based on sustainability and enrichment of the stocks. Squid attractors are appropriate technology that can make a fishing area as a gathering place for squid and fish. The study presented here was focused on the effectiveness of squid attractors as an alternative tool for enriching squid stocks in coastal areas. The squid attractors were tested in the field. The squid attractors were made of materials from harmonica wire, bamboo, used car tires, used drums and pipes. Such materials can be easily obtained by fishermen so that they can help themselves to make them promoting livelihood and improving the habitat. The construction of the attractors and presence of squid eggs were directly observed underwater. The fishing efficiency using the squid attractor found to be 60-70%, i.e. the proportion of number of squid attractors occupied by the squid. Deployment of squid attractors is a potential place for spawning habitat for the squids.

Keywords: attractors, stock enrichment, sustainability

1. Introduction

The concept of sustainable fishing must be directed towards business development based on the stock of certain species (in this case, for example squid). The development should be managed rationally to ensure that efforts in business are commensurate with the production capacity of existing resources. This is intended to protect the population, quality of production and aquatic ecosystems. Fishing activities that use explosives, poisons, and fishing practices that can cause environmental damages.

Natural and sustainable fish cultivation activities are meant to make the coastal area as a place of enrichment of certain species resources (e.g squid). This is also an effort to maintain the carrying capacity of the environment, so that the sustainability of resources can be maintained and their utilization sustainable. The utilization of marine biological resources, especially in the field of capture fisheries, aims to obtain maximum results without damaging the sustainability of fish resources with the lowest possible operating costs [1]. For this reason, a technology development that can support the use of existing resources does not damage the environment and can be utilized in the development of integrated coastal areas. Squid attractors is an appropriate technology that can be developed to
improve sustainable use and increase the carrying capacity of squid resources and at the same time be a means of developing integrated coastal areas.

The deployment of squid attractors is intended for optimal utilization of the squids and for habitat enrichment by providing artificial spawning area for the squids. The squids are expected to release and lay their eggs on the hanging materials inside the attractors. Squid attractors was developed in Japan since 1950 with the main goal for enriching squid resources. The function of the attractors is as a place for the squid to release their eggs, then the eggs stick to the attractors until they finally hatch. Squid attractors have been introduced in Indonesia, including in Palabuhanratu Bay, Alor Bay, Batam Island, Barrang Lompo Island and Moyo Island [2].

2. Materials and Methods

The construction of squid attractors was made of harmonica wires, bamboos, used metal drums, PVC pipes. The hanging materials were strings of hemp rope, coconut fibres. The hanging materials were mounted inside the construction. The attractors were deployed underwater at depths range 3-7 m. Five or ten attractors were laid down and connected serially with 5 m ropes (figure 1).

![Squid attractor of harmonica wire, bamboo, used drum, and paralon pipes type.](image)

The effectiveness of squid attractors was analyzed by calculating the success rate of attractors in collecting squid eggs. The indicator of the level of effectiveness is by calculating the percentage of attractors (EA) contained in squid eggs using the formula [2].

Effectiveness of squid attractors were calculated by the following formula:

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EA = \frac{\text{The number of attractor blocks overgrown with squid eggs}}{\text{Total block attractor}} \times 100\%
\]

Note: EA\(\geq 60\) % = very effective; 60%>EA\(\geq 30\) % = effective; and EA<30 % = less effective

3. Results and Discussion

Squid attractors are developed by utilizing the behavior of the squid itself, where they are spawned by attaching their eggs to the substrate with a dimly lit environment. In this condition the attractor is very
effective as a spawning place, and in a certain time the squid population will increase significantly. Attractors will form new ecosystems within a certain period of time, can increase natural productivity in areas that have experienced habitat degradation. Aside from being a place of spawning, attractors also act as parenting and enlargement areas, various types of fish will look for food and play around these attractors. This can make the area a potential fishing area.

The benefits of squid attractors include: (1) its function as artificial habitat, (2) As a tool for collecting squid and as a place for squid to release their eggs, so the installation of these attractors in an area of water will create a unique underwater landscape, namely the view of squid egg stretches, (3) Enriching fishing area with spawning locations, (4) underwater attraction to coastal ecotourism, with diving and fishing activities, (5) transferable to the community in order to empower coastal communities, improve the skills of coastal communities in the development of alternative livelihoods, namely squid cultivation, and (6) Research development.

Research on squid attractors in Indonesia began in 2006 in Palabuhanratu Bay, West Java. Attractor was made from the main ingredients of harmonica wire and used car tires. Observations showed that the harmonica squid wire was more effective compared to the used tires, which respectively were 70% and 50% respectively [3]. At the time of observation, many types of squid were found in the waters of Palabuhanratu Bay, they were from the Sepia pharaonis species, which in marketing was known as Pharaoh cuttlefish. These animals live in the bottom of coastal waters which then use the attractor to associate or attach their eggs. Their eggs were encased in capsules. The squid and eggs are shown in figure 2.

In 2011 a trial activity was carried out to install squid attractors in the waters of Palabuhanratu Bay, Simpenan District, Sukabumi Regency. The activity began by providing training on the manufacture of squid attractors to fishermen with the installation of squid attractors. Squid eggs (Loligo sp.) begin to occur in the attractor in the third week (figure 3). The number of squid eggs found in one attractor amounted to around 600 to 1,000 eggs.

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Research on squid attractors from bamboo's main ingredient was carried out in 2006 at Teluk Mutiara, Alor District, East Nusa Tenggara. From the location of the attractors installed on the surface, mid and bottom of the waters, it shows that squid only attach their eggs to the attractors placed on the bottom of the waters (depth of 4-5m) with an average number of eggs of 100 capsules for each attractor [4]. Some of the squid eggs obtained were hatched in floating net cages, where squid eggs hatched on day 21. More squid eggs (*Loligo* sp.) to cylindrical shape attractors which reached 95% compared to the box shape which only 5%. Of the 100 eggs squid hatched in floating net cages, as many as 90% can survive until the age of three months. Juvenile squid was fed with broken fish after a week to three months of age [5-8]. The bamboo squid attractor and juvenile squid are shown in figure 4.

![Bamboo squid attractor and juvenile squid](image)

**Figure 4. Bamboo squid attractor and juvenile squid.**

Research and trials of squid attractors have been carried out with a long process and journey to date. The effectiveness of squid contractors from materials that are easily obtained by coastal communities and of course also cheap, easy to manufacture and friendly to the environment is still being studied and observed. One of the construction of squid attractors tested in 2013 was the squid attractor from used asphalt drums or oil drums. These used drums were paired with hemp ropes on the inside as a lure so that the squid is attracted and will lay its eggs on the hemp ropes. The research was conducted in Tuing Waters, Riau Silip District, Bangka Regency, Bangka Belitung Islands Province. A total of 3 sets of used drum squid attractors were installed at 3 m, 5 m and 7 m depths.

One month after installation of squid attractors from used drums, as much as 77% have been attached by *Loligo chinensis* squid eggs. Each attractor of used drum squid contains 234 egg capsules on average, where each capsule contains 4-5 individual candidates for squid, meaning that each unit of the used drum squid can produce about 930-1,170 individuals for prospective squid. The attractors that were plastered with squid eggs were attractors installed at 3m and 5m depths, while those installed at 7m depth were slightly attached to squid eggs. This is predicted because of the behavior of squid that live and move in deep waters if they will spawn looking for a comfortable place to attach their eggs to the substrate in shallow coastal waters or waters. Squid eggs in the used drums attractor shown in figure 5.
Figure 5. Squid eggs in the used drums attractor.

The success parameter of the squid attractor as a place for squid nest is the number of squid eggs attached to the attractor. Squid that will release their eggs concentrated in an area are expected to be potential areas for stock enrichment and integrated fisheries development, both fishing, fish farming, fishery processing and marine tourism. Providing assistance to fishermen with more modern fishing gear, machinery and boats, is not sure to give significant results in increasing the catch of fishermen. Because indeed the water area in the location has been overfishing, where the number of catching fleets is large but very minimal in the effort to enrich the fish stock. That is, efforts to increase fishing catches are done by modernizing fishing gear, but the effort to enrich fisheries is hardly done. It can be predicted that the number of catches will decrease because the number of fishery commodities in the sea continues to decrease. Efforts to enrich fish resources need to be done to provide business certainty that is profitable and sustainable. For example, fishermen on Dabi Island, Pangkep Regency, South Sulawesi, after they have installed squid attractors with the aim of enriching squid resource stocks, their fishing results can increase from what they usually get 1-3 kg per day, after the squid are the result of their fishing rods being 5-10 kg per day.

The benefits of installing squid attractors have been felt by fishermen in 30 Indonesian water regencies who have had the opportunity in the application of this technology. They can increase the catch, because with the presence of an attractor in an area of water can be a definite and potential fishing area, then they can also develop alternative livelihoods, which in turn can improve welfare. In the future, engineering of this technology is needed to develop sustainable and responsible environmental carrying capacity.

As with the development of the design and construction of squid attractors carried out this year (2017) made from paralon pipes. The shape of paralon pipe squid attractor was square-shaped (80 cm long, 50 cm wide and 50 cm high). The top is closed waring, equipped with palm fiber straps, in the middle has been in field testing in the waters of Palabuhanratu Bay. In the pipe the paralon at the bottom is cast with cement (concrete) on the inside which is useful as a ballast.

The research to compare the paralon pipe squid attractor with harmonica wire squid attractor has been done in 2017 and 2018. The paralon pipe squid attractor and harmonica wire squid attractor trial in Palabuhanratu Bay dan Lampung Bay. The each attractor contain 10 units. The result of squid egg and effectivity from the paralon pipe squid attractor with harmonica wire squid attractor shown in table 1.
Table 1. The comparison between harmonica wire and paralon pipe squid attractor.

| Squid attractor | Palabuhanratu Bay | Lampung Bay |
|-----------------|------------------|-------------|
|                 | Squid egg | Effectivity | Squid egg | Effectivity |
| Harmonica wire  | 680       | 68%         | 650       | 65%         |
| Paralon pipe    | 650       | 65%         | 600       | 60%         |

The design and construction of squid attractors made from paralon pipes was developed, with the hope that the materials used could be easily obtained by fishermen so that they could develop in order to enrich squid stocks, improve habitat, form a potential fishing grounds and sustainable resource utilization. Squid attractors are one of the most effective technologies that can be developed to increase the carrying capacity of resources and at the same time can support the concept of sustainable fisheries activities and support the development of integrated coastal areas. The paralon pipe squid attractor and squid eggs shown in figure 6.

![Figure 6. Paralon pipes squid attractor and squid eggs on it.](image)

4. Conclusion

The fishing efficiency using the squid attractor found to be 60-70%, i.e. the proportion of number of squid attractors occupied by the squid. Deployment of squid attractors is a potential place for spawning habitat for the squids. The squid attractors are alternative technology in empowering fishing communities, promoting sustainable management and utilization of fish resources.

References

[1] Grofit E 1980 The Fishing Technology Unit (FTU) (Rome: Fisheries Technical Papers)
[2] Baskoro M S and Mustaruddin 2006 Rumpon cumi-cumi: teknologi potensial dan tepat guna untuk pengembangan kawasan pantai terpadu Prosiding Seminar Nasional Perikanan Tangkap Dep PSP FPIK IPB Bogor
[3] Baskoro and Mustaruddin 2006 Rumpon atraktor cumi-cumi: teknologi potensial dan tepat guna untuk pengembangan kawasan pantai terpadu Prosiding Seminar Nasional Perikanan Tangkap Dep PSP FPIK IPB Bogor
[4] Tallo I 2006 Perbedaan jenis dan kedalaman pemasangan atraktor terhadap penempelan telur cumi-cumi [Thesis] (Bogor: Institut Pertanian Bogor)
[5] Oktariza W, Wirayawan B, Baskoro M S, Kurnia R and Wisudo SH 2016 Kepulauan Bangka-Belitung (Bio-economic model of squid fisheries in the waters of Bangka Regency) J. Mar. Fish. Technol. Management 97-107
[6] Syari I A, Kawarie M and Baskoro M S 2016 Perbandingan efektifitas rumpun cumi-cumi menurut musim, kedalaman dan jenis rumpun J. Penelitian Perikanan Indonesia 20 63-72
[7] Baskoro M S, Sondita M F A, Yusfiyandayani R, Syari I A 2017 Efektifitas bentuk atraktor cumi-cumi sebagai media pemanfaatan telur cumi-cumi (Loligo sp.) J. Kelautan Nasional 10(3) 177-184

[8] Baskoro MS, Syari I A, Kawaroe M, Wahyu R I and Yusfiyandayani R 2015 Squid eggs attachment and fish association on the squid attractor aggregating device KnE Life Sci. 1 247-254