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THE ANALYSIS OF ENVIRONMENTALLY FRIENDLINESS LEVEL OF COLLAPSIBLE TRAPS IN TAMBAKOSO, SIDOARJO REGENCY

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ABSTRACT

Sustainable fisheries are an essential agenda in Indonesia's capture fisheries sector to ensure future fish availability, preserve ecosystems, and maintain fishermen's livelihoods. One approach to achieving sustainable fisheries is through the application of the Code of Conduct for Responsible Fisheries (CCRF), which serves as a framework for assessing whether capture fisheries activities are environmentally friendly and capable of supporting sustainability. This study aims to evaluate the environmental friendliness of fishing gear used by fishermen in Tambakoso Village, Sidoarjo Regency. Data were collected through direct observation and interviews with 11 fishermen operating collapsible traps (bubu lipat) targeting tiger snail (Babylonia spirata). Using a mixed-methods approach and nine principles of the CCRF, the results indicate that the collapsible trap fishing gear used by fishermen in Tambakoso Village is classified as highly environmentally friendly, achieving a total score of 30.8 points.

Keywords: Collapsible traps, Code of Conduct for Responsible Fisheries, Environmental friendliness level, Sustainable fisheries

INTRODUCTION

Tambakoso Village, Sidoarjo Regency, is home to fishermen who drive the economy of Sidoarjo Regency in the capture fisheries sector using collapsible traps and catching tiger snails (Babylonia Spirata). The fishermen in Tambakoso carry out their fishing activities in the Madura Strait, about 18 miles from the coast of Tambakoso Village. The Madura Strait is a relatively small area, but it is crucial because it is the location of capture fisheries for several cities in East Java, indicating overfishing (Akmal, Fadlian, Prismayanti, & Rahayu, 2019). Therefore, action is needed to ensure sustainable fisheries in the Madura Strait area.

Sustainable fishing is a common term in capture fisheries. Sustainable fishing is an important agenda for building a fishing environment for future generations (Menon, Sowman, & Bavinck, 2018; Adrianto, 2005). Sustainable fisheries can be described as a condition in which fishing activities leave a sufficient number of fish in their habitat, are able to maintain the ecosystem, and ensure

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that those involved in capture fisheries can maintain their livelihoods (Huertos, 2020).

Recognizing that sustainable fisheries are a major and vital agenda for the capture fisheries sector, the Food and Agriculture Organization (FAO) initiated the Code of Conduct for Responsible Fisheries (CCRF) in 1995 as a guideline for capture fisheries actors to carry out their activities using methods and fishing gear that are safe for the environment in three dimensions, namely economic, ecological, and social dimensions (Devina & Panggabean, 2024; Pramesthy, Mardiah, & Arkhan, 2020). In addition, the main function of the Code of Conduct for Responsible Fisheries (CCRF) is to improve the welfare of fishing communities (Apriliani, 2025). Given that the CCRF is a very important guideline, all capture fisheries operators are required to implement it.

One form of implementation of the Code of Conduct for Responsible Fisheries (CCRF) is the use of environmentally friendly fishing gear, which is reviewed through three aspects, namely economic, ecological, and social. To determine whether a fishing gear is environmentally friendly, it must be reviewed through the 9 principles of the CCRF, which include:

1. High selectivity.
2. Does not damage the habitat.
3. Does not endanger fishermen or operators.
4. Produces fish of good quality.
5. The products produced do not endanger consumer health.
6. Minimizes by-catch and discards.
7. The fishing gear used must have a minimal impact on biodiversity.
8. Does not catch fish that are protected by law and threatened with extinction.
9. Socially acceptable (Apriliani, 2025).

Given the importance of realizing sustainable fisheries and implementing the Code of Conduct for Responsible Fisheries (CCRF), the researchers' main objective was to analyze the environmental friendliness of Bubu Lipat fishing gear in the Sidoarjo area, specifically in Tambakoso Village.

DATA AND METHODS

This research was conducted from April 2025 to July 2025 and was located in Tambakoso Village, Sidoarjo Regency. The residents of Tambakoso Village have long been known to work in the fisheries sector, both in fishing and aquaculture. The main catch of fishermen from Tambakoso Village is tiger conch (Babylonia Spirata), which is caught using collapsible traps.

The researchers used observation and interviews with fishermen to collect data. Observations were made by following the fishermen's activities from the preparation

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process until they finished fishing. Interviews were used to gain a deeper understanding of the environmental friendliness of collapsible traps.

The sample size for this study was 11 people. The data recorded consisted of catch data for 15 days by 5 fishermen and interview data based on the 9 principles of the Code of Conduct for Responsible Fisheries (CCRF).

In processing the data, the researchers used a mixed-method approach, which is a combination of qualitative and quantitative methods. According to Creswell and Creswell (2018), by combining these two methods, the results of the study will provide a stronger understanding or answer to a problem or question. The quantitative method will be used to process numerical data, namely catch data and environmental friendliness scores, while the qualitative method will be used to process interview data.

To ensure that a fishing gear is environmentally friendly, not only will each point be explained, but the overall score will also be calculated using the following formula:

$$X = \frac{\sum Xn}{N}$$

This formula is used to show the final score of the environmental friendliness assessment so that conclusions can be drawn about how environmentally friendly collapsible fishing gear is based on the rules of the Code of Conduct for Responsible Fisheries (CCRF).

RESULT AND DISCUSSION

Selectivity of Catch

During a 15-day trip and interviews with 11 fishermen, the catch of fishermen in Tambakoso village consisted of four species. Their main catch was tiger conch, accounting for 45.6% of the total catch. Other catches included rajungan (5.3%), lilit (28.7%), and reke-reke (20.4%). The following table shows the scores for the catch selectivity indicator (Table 1):

Table 1. Table of catch selectivity criteria

Explanation	Weight	Total
Gear that catches more than 3 species	1	11
Gear that catches 3 species of significantly different sizes	2	
Gear that catches less than 3 species of roughly the same size	3	
Gear that catches 1 species of roughly the same size	4	
Total		11

Based on the above points, collapsible nets are categorized as non-selective fishing gear. However, it should be noted that the species caught are similar in shape and type, and not vastly different, such as fish or other aquatic animals.

Does Not Damage Habitats

This section is one of the important principles in creating sustainable fisheries related to marine ecosystems. The fishermen agreed 100% that collapsible traps are very safe and do not damage the environment. The total score obtained on this point was 44. All fishermen explained that collapsible traps are very safe for the environment because they are passive fishing gear that simply wait for the target to come and get caught in the trap. In addition, the structure of collapsible traps does not cause damage to the seabed and does not produce waste or water pollution (Nisak, Noor, & Saraswati, 2025). The results of this principle are as follows (Table 2):

Table 2. Table of criteria for not damaging the habitat and dwelling places of organisms

Explanation	Weight	Total
Fishing gear causes habitat damage over a wide area	1	
Fishing gear causes habitat damage over a small area	2	
Fishing gear causes partial habitat damage over a small area	3	
Fishing gear is safe for the habitat	4	44
Total		44

Not harmful to fishermen

One of the articles in the CCRF states, "States should ensure that health and safety standards are adopted for everyone employed in fishing operations (FAO, 1995), which indicates that the health and safety of users is one of the concerns in developing sustainable fisheries. The data obtained by researchers on this point shows that all fishermen agree that collapsible traps are a very safe tool for fishermen to use. The score obtained was 44 points, as shown in the table below (Table 3):

Table 3. Table of criteria that do not endanger fishermen

Explanation	Weight	Total
Fishing gear and its use can result in the death of fishermen.	1	
Fishing gear and its use can result in permanent disability for fishermen.	2	
Fishing gear and its use can result in temporary health problems.	3	
Fishing gear and its use are safe for fishermen.	4	44
Total		44

Thus, collapsible traps meet the criteria of being safe for users. This study differs slightly from previous studies, which showed that collapsible traps can cause temporary health problems, provided that there are contributing factors (Nisak, Noor, & Saraswati, 2025).

Quality of Catch

The fourth principle that must be present in environmentally friendly fishing gear is good catch quality. A good catch is indicated by the fresh condition of the fish (Apriliani, 2025). The following is a table showing the catch points (Table 4).

Table 4. Table of quality criteria for catches

Explanation	Weight	Total
Fishing gear produces dead and rotten fish	1	
Fishing gear produces dead fresh fish with physical defects	2	
Fishing gear produces dead fresh fish	3	
Fishing gear produces live fish	4	44
Total		44

Similar to the previous criteria, where the score obtained was 44. All fishermen interviewed agreed that their catch targets were always alive. The fundamental reason for the catch remaining alive was the construction of the collapsible trap made of polyethylene material that did not injure the catch (Marliana et al., 2015). It can be concluded that collapsible traps are a very efficient fishing gear for maintaining the quality of the catch and meeting the criteria for fresh catch quality.

Level of Security for Consumers

One of the clauses in the CCRF states, "States should establish and maintain effective national safety and quality assurance systems to protect consumer health and prevent commercial fraud (FAO, 1995)," which can be interpreted to mean that consumers of fish catches are also protected by FAO regulations. By using collapsible traps, the safety of fish catches for consumption is highly guaranteed. Susanto (2023) explains that collapsible traps are free from explosives and toxins, as both of these substances are chemicals that can pollute the environment and catch. In addition, the method of storing the catch also affects its condition; if stored properly, its freshness can be maintained. The following table shows the consumer safety scores (Table 5):

Table 5. Consumer safety level criteria table

Explanation	Weight	Total
High risk of causing death	1	
Risk of causing health problems for consumers	2	
Very low risk of causing health problems for consumers	3	
Safe for consumers	4	44
Total		44

The conclusion from this data is that collapsible nets are able to provide catches that are very safe for consumers.

Bycatch

This section relates to the selectivity of fishing gear, for which the FAO has also established rules stipulating that fishing gear must minimize bycatch and discards (FAO, 1995). With these rules in place, we can assess whether a particular type of fishing gear is causing overfishing, which damages marine ecosystems. Based on observations and interviews, fishermen using collapsible traps in Tambakoso caught two species of bycatch, all of which were sold at the market, but at low prices. The details are as follows: reke-reke at Rp. 5000/kg and lilit at Rp. 4000/kg. Therefore, the points obtained for this criterion are 33. The following table provides an explanation (Table 6):

Table 6. Table of bycatch criteria

Explanation	Weight	Total
Bycatch consists of several types of fish and is not sold in the market.	1	
Bycatch consists of several types, some of which are sold in the market.	2	
Bycatch consists of less than three types and is sold in the market.	3	33
Bycatch consists of less than three types and is highly valued in the market.	4	
Total		33

From the table above, it can be concluded that the collapsible traps owned by fishermen in Tambakoso, Sidoarjo are still environmentally friendly even though the selling price of bycatch is not high.

Level of Security for Biodiversity

Collapsible traps are passive and non-invasive fishing gear. Furthermore, fishermen do not need to use chemicals or explosives that can destroy the marine ecosystem and threaten fish populations when using collapsible traps. Collapsible traps are known for their popularity among fishermen. Collapsible traps are also known as fishing gear that is suitable for long-term use and very suitable for a sustainable environment (Ismail et al., 2024; Nisak et al., 2025; Susanto et al., 2023). This study also proves that collapsible traps preserve marine biodiversity. The score obtained in this criterion is 44, meaning that 100% of fishermen agree that collapsible traps are very environmentally friendly (Table 7).

Table 7. Table of safety level criteria for biodiversity

Explanation	Weight	Total
Fishing gear and its operation cause the death of all living creatures and destroy habitats.	1	
Fishing gear and its operation cause the death of species and destroy habitats.	2	
Fishing gear and its operation cause the death of species and destroy habitats.	3	
Safe for biodiversity.	4	44
Total		44

Endangering Species Protected by Law

Regulations in Indonesia regarding the protection of fish in the sea are stipulated in Law No. 45 of 2009 and Decree of the Ministry of Maritime Affairs and Fisheries No. 1 of 2021. Some of the fish species protected in Indonesia are arowana (Kalimantan and Irian), balida, sea turtles, dugongs, several species of sharks, and manta rays. While using collapsible traps, fishermen in the village of Tambakoso have never found any protected fish in their traps. For fishermen, collapsible traps have been specifically designed to catch fish such as tiger snails, rajungan, and mangrove crabs. Therefore, fish protected by law do not easily enter the traps. The following are the details of the scores obtained (Table 8):

Table 8. Table of criteria for endangered species protected by law

Explanation	Weight	Total
Fish/biota protected by law are often caught	1	
Fish/biota protected by law are caught several times	2	
Protected fish/biota have been caught	3	
Protected fish/biota have never been caught	4	44
Total		44

By obtaining the maximum score, it can be concluded that the collapsible trap meets these criteria.

Socially accepted indicators

This indicator is quite different from the previous indicator, as it covers two aspects, namely economic and social dimensions. There are four requirements that a fishing gear must meet, namely:

1. Low investment cost.
2. Economically profitable.
3. Does not conflict with existing culture.
4. Does not conflict with existing regulations.

Collapsible traps are assessed to determine whether they meet all of the above criteria or only some of them. The following table shows the scores for collapsible traps (Table 9).

Table 9. Table of socially accepted criteria

Explanation	Weight	Total
The fishing gear meets one of the four criteria above.	1	
The fishing gear meets two of the criteria above.	2	4
The fishing gear meets three of the four criteria above.	3	27
The fishing gear meets all four criteria above.	4	
Total		31

On this criterion, the responses from Tambakoso fishermen were divided into two camps: 18% of the fishermen group responded that only two of the statements were relevant to collapsible traps, while 82% stated that three statements were still very relevant to collapsible traps. All fishermen agreed that collapsible traps were not a cheap investment. This was because all fishing activities involving collapsible traps required a significant amount of capital.

The second statement that became an issue was statement number 2.18% of fishermen chose not to select number 2 as a statement that was suitable for collapsible traps. The fishermen felt that the demand for tiger conch (the main catch) was not as high as before, and the export

market had also declined drastically after Covid-19. This has caused the price of tiger conch to decline further. Before Covid-19, the price of tiger conch reached IDR 65,000/kg, but now it has dropped to IDR 45,000 - IDR 47,000/kg with demand also declining.

Based on these criteria, it can be concluded that from an economic perspective, the collapsible net requires sufficient capital for its daily operations. Additionally, external factors influence the profitability of fishermen. For this criterion, the collapsible net does not fully meet the requirements.

Based on the total points obtained, to determine whether a fishing gear is environmentally friendly, its environmental friendliness value must be calculated. The following are the results of the calculation:

$$X = \frac{339}{11}$$

$$X = 30.8$$

The calculation results for environmental friendliness are 30.8, indicating that collapsible traps are very environmentally friendly fishing gear, especially for preserving the marine ecosystem and ensuring safety for users and consumers.

In addition to the score that proves that collapsible traps are a very environmentally friendly fishing gear, the researchers did not forget to emphasize that there are three dimensions that are assessed in a fishing gear. Through this study, it is very clear that collapsible traps are very environmentally friendly, especially when viewed from the ecological and social dimensions, but the assessment is not so good when viewed from the economic dimension.

Based on the table on the previous page, it can be seen that all criteria related to ecology, namely criteria 1, 2, 3, 4, 7, and 8, received very high scores, except for the criterion of catch selectivity. The high scores related to the ecological dimension are due to the passive nature of the collapsible trap itself, which does not damage the environment, especially the basic marine ecosystem. This fishing gear does not move but waits for fish to come and get caught in it. This gear also does not use hazardous materials that can pollute the environment and endanger fishermen and consumers.

When viewed through the social dimension, implied in criteria 3, 5, and 9, the results of the study show that the collapsible trap fishing gear owned by fishermen in Tambakoso village is well accepted by the community. This acceptance extends from the users of the product (fishermen) to the consumers of the catch. This acceptance is due to the safety aspect of the fishing gear when used by fishermen, where accidents are minimal, and the construction of the fishing gear does not contain hazardous materials, such as explosives or other chemicals, so that it does not

affect or poison the catch. As a result, the catch consumed does not harm consumers. In addition, another important thing is that collapsible traps are fishing gear whose materials and methods of use do not conflict with local culture. Furthermore, the materials and methods of use of collapsible traps do not violate Indonesian law. Several fishing tools that are now prohibited from use include dragnets and trawl nets (cantrang, dogol, lampara dasar, and pair seine) (Ulya, 2021).

However, there is a slight gap that can be examined from the collapsible trap fishing gear and its level of friendliness, which comes from the economic dimension implied in criterion 9. Looking at the results of the analysis of the 9 criteria of the Code of Conduct for Responsible Fisheries and the results of interviews with fishermen, collapsible traps are not a fishing gear that can fully meet this aspect. However, this aspect cannot be fulfilled due to external factors, namely the economic conditions in Indonesia and the demand for tiger conch.

These economic conditions are related to fuel prices and the high needs of fishermen. As a result, fishermen need a lot of capital for each trip. The demand for tiger conch, especially from abroad, is also a contributing factor. Since Covid-19, the export market, especially to China and Thailand, has declined dramatically. This has resulted in suboptimal absorption of catches and caused the price of tiger conch to fall in the market.

The problems that occur in this economic dimension can be overcome with policies and innovations that can be applied to collapsible trap fishermen, not only in the Tambakoso area, but also throughout Indonesia. Although it is one of the three dimensions studied, the economic dimension is not the main point of the environmental friendliness analysis. However, this does not mean that it is unimportant because through this point, we will know the prospects for capture fisheries in the future, whether they will continue or not.

CONCLUSION

Based on the analysis results, it can be concluded that collapsible traps are a very environmentally friendly tool with a score of 30.8. The main focus of the environmental friendliness of collapsible traps is their level of friendliness to the marine ecology, as this fishing tool does not harm the marine ecosystem and biodiversity. In addition, the use of collapsible traps and the resulting catch are not harmful at all. However, a concern arises when examined from an economic perspective, where collapsible traps and their catch are not as profitable as before due to external factors such as a decline in selling power and the high initial capital required for each trip.

However, to refine the economic analysis of collapsible traps, a more in-depth study is needed, especially on the use of collapsible traps in Tambakoso village, Sidoarjo district, which is related to the socioeconomic situation in Indonesia. Hopefully, in the future, there will be innovations and policies that can improve this dimension so that the environmental friendliness of collapsible traps can be fulfilled in all dimensions.

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