

## Fishing Gears Assessment Based on Code of Conduct for Responsible Fisheries (CCRF) at Probolinggo

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### Abstract

The exploitation level of capture fisheries along the north of Java has reached the recommended MSY. The increasing number and size of fishing gear and ships, as well as the expansion of operations to new fishing areas have resulted in over-exploitation. Research purposes to analyze fishing gear that applies eco-friendly criteria in accordance with the code of conduct responsible fisheries in the Probolinggo City . The research method uses descriptive method, with quota sampling technique. Analysis based on environmentally friendly dental weighing criteria issued by the marine and fisheries department in 2006. Where each of criterion has 4 sub-criteria assessed by scoring from weighting, while the eco-friendly gear category is divided into 4 categories with a range of values as follows: 1-9 i.e. very unfriendly gear, 10-18 i.e. unfriendly gear, 19-27 i.e. Eco-friendly gear, 28-36 i.e. gear is very eco-friendly. The study results fishing gears which are categorized as very eco-friendly, purse seine (31,77), hand line (33,61), pot fish (34,70), lift net (31,10), and gillnet (32,53), just only cantrang (23.28) is included in the eco-friendly. Fishing gear that is very eco-friendly is recommended in the City of Probolinggo, pot fish, hand line, gill net, purse seine, and lift net.

**Keywords:** CCRF, Eco-friendly, Fishing gear, Fishing

### INTRODUCTION

Fishermen are increasingly good at catching fish thanks to their experience, effort, and technological advancement because they catch fish for living [1,2]. Fishing is an activity to obtain fish in waters using any tool and method, including using vessels [3].

The exploitation level of capture fisheries along the north and south coast of Java has reached the recommended MSY (Maximum Sustainable Yield) [4,5,6]. Fisheries resources in Java and their methods of exploitation have undergone significant changes, driven by the increasing population pressures on fragile resource bases combined with increasingly effective exploitation technologies [7]. According to Lutuconsina [8], fishing in Indonesia has reached a critical condition caused by target pressure and competition among fishing gears. This makes fishermen modify their gear to get maximum results, and sometimes they use technologies that are not eco-friendly (destructive fishing) [9,10,11].

The state's interest in managing marine and fisheries resources underlies the progress of marine regulation [12]. The Code of Conduct for Responsible Fisheries (CCRF) is the principle and standard for internationally responsible practices [13]. To realize sustainable capture fisheries that conform the provisions of responsible fishing, exploitation of fish and marine biological resources must be carried out responsibly [14]. These guidelines complement the efforts of the world to ensure a sustainable management of marine resources [15].

The use of fishing gear must pay attention to sustainability and damage prevention to other biota because the damage has a broad influence on the existing ecosystem. Mistakes in anticipating the development of gears also cause the extinction of fisheries resources [16]. Eco-friendly fishing is the use of gear that does not have any negative impact on the environment, for example causing damage to the water base and pollution. The next factor is the impact on biodiversity and resource targets, i.e. production composition, bycatch, and accidentally caught juvenile fish [17].

According to Monintja [18], an important criterion in technology fishing is selectivity; ease of operation; security to fishermen; quality of

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production; safety catches; minimum bycatch and discard; protected and vulnerable species friendliness; minimum impact on biodiversity; and social acceptance. CCRF is an effort to manage marine and fisheries resources wisely for sustainable development.

According to the 2016 Agency of Research and Development of Marine and Fisheries (BALITBANG KP) performance report [19], Probolinggo city is mapped as an area with marine and fisheries resource potential for the development of a sustainable marine economy. The mapping is based on the quality and diversity of the quantity of catches and the value of catches between seasons in Fisheries Management Areas (WPP) 712. Fisheries Port (PP) of Mayangan is a port for fishing boats and a fish auction (TPI) in Probolinggo city. Fishing boats anchored on PP Mayangan use varied fishing gear. The fishing gear can be classified into two: passive gear and active fishing gear. Active gear is mobile, and passive gear is temporarily placed [20]. Passive gears in PP Mayangan are gill net (*jaring insang*), pot fish (*bubu*), lift net (*bagan*), and hand line (*pancing*), while active gears are cantrang and purse seine. The suitability of fishing gear and the development of CCRF-based capture fisheries need to be considered to see the status of gear in each region because the concept of responsible fishing is the use of eco-friendly fishing gear.

According to Roberts and Smellie in Rouxela [21], the government and fisheries stakeholders have prepared fisheries policies that convert past fisheries practices, which emphasize quality over quantity, through alternative fishing methods. Capture fisheries management actions are procedures to regulate and maintain the conditions of fisheries resources at a certain level [22]. The difference in fishing gear can provide very different environmental and socio-economic impacts [21]. Capture fisheries development does not make anything new in the field of fisheries, but it develops something that already exists so that profits can be maximized [23]. Based on the explanation above, research on CCRF based eco-friendly gear in Probolinggo city needs to be done so that fisheries resources in this area can be utilized optimally and sustainably. This effort is a massive involvement in responsible fisheries for marine preservation and the availability of fish for future generations. This study aims to analyze the eco-friendly fishing gear in accordance with the CCRF in the

Probolinggo city and determine the recommended fishing gear. The expected output is prevention of overfishing and environmental damage on fishing ground.

## METHOD

This research was conducted in Probolinggo city from November 2018 to January 2019 using a descriptive method with quota sampling technique. The primary data was obtained from the main respondents, fishermen who have fishing gear and use ships under 30 GT. Fishing gears used for this data collection were thirty purse seines, ten lift nets, ten pot fish, 32 cantrangs, 30 hand lines, and fifteen gill net. The criteria of gear in terms of environmental friendliness refer to FAO, which was later developed by the Ministry of Maritime Affairs and Fisheries [24]. The data was collected through literature review and discussion with related parties and was used to obtain information about the condition of capture fisheries in the research location. At this stage, the criteria of the capture unit are determined based on CCRF. Furthermore, using survey method, questionnaires for field data collection were prepared.

The data analysis was carried out according to the weighting criteria of eco-friendly gear issued by the Ministry of Maritime Affairs and Fisheries in 2006 [24]. Each criterion has four sub-criteria. The weighting on the four sub-criteria was done by scoring, from the lowest score to the highest score, as follows: 1 for the first sub-criteria, 2 for the second sub-criteria, 3 for the third sub-criteria, 4 for the fourth sub-criteria. The weighting was based on nine criteria of eco-friendly fishing gear according to the FAO CCRF of 1995. In CCRF, FAO has established a set of criteria for eco-friendly fishing technology. After the score was obtained, the reference score referenced in the ranking was determined. The maximum score was 36. The category of eco-friendly fishing gear was divided into four categories with certain scores such as the following: 1-9 is very unfriendly, 10-18 is unfriendly, 19-27 is eco-friendly, 28-36 is very eco-friendly. To determine the final result, the total score is divided by the number of respondents according to the type of the fishing gear, or the following formula [25].

$$\begin{aligned} \Sigma X &= \frac{\Sigma X_1 - X_2, \dots, X_n}{n} & X_n &= \text{total score} \\ &= \frac{\Sigma X_n}{n} & n &= \text{total respondents based} \\ & & & \text{on fishing gear type} \end{aligned}$$

**Table 1.** Eco-friendly weighting criteria issued by the Ministry of Maritime Affairs and Fisheries

No.	Criteria	Explanation	Weight
1	<i>gear</i> have high selectivity	Catch more than three species of different sizes	1
		Catch at most three species of different sizes	2
		Catch fewer than three species of approximately the same size	3
		Catch only one species with approximately the same size.	4
2	Does not damage habitat, habitat, spawning ground and other organisms	Causes damage to habitat in a large area	1
		Causes damage to habitat in a narrow area	2
		Causing part of habitat to a narrow area	3
		Safe for habitat (not damaging habitat)	4
3	Produce good quality fish	Dead and rotten fish	1
		Fish dead, fresh, and physically disabled	2
		Dead and fresh fish	3
		Live fish	4
4	No harm to fishermen	How to operate the gear can result in death for fishermen	1
		How to operate the gear can result in permanent defects in the fishermen	2
		How to operate the gear can result in temporary health problems	3
		gear safe for fishermen	4
5	Products do not endanger the health of consumers	Big chance of causing the death of consumers	1
		Opportunity to cause health problems for consumers	2
		Very little chance for consumer health problems	3
		Safe for consumers	4
6	The minimum by-product is wasted	( by catch ) consists of several types (species) that are not sold in the market	1
		( by catch ) consists of several types and some are sold in the market	2
		( by catch ) less than three types and sold on the market	3
		( by catch ) less than three types and high value on the market	4
7	<i>the gear</i> used must have a minimum impact on biodiversity diversity	gear causing the death of all living things and destroying habitat	1
		gear cause the death of several species and damage habitat	2
		gear causing the death of several species of tet gear not destroying habitat	3
		Safe for diversity of biological resources	4
8	Never catch fish and organisms that are protected by law or endangered	Protected fish are often caught	1
		The protected fish is caught several times	2
		The protected fish is 'ever' caught	3
		The protected fish has never been caught	4
9	Socially accepted	Public acceptance of a fishing gear will depend on social, economic and cultural conditions in a place. A tool is socially accepted by the community if: (1) low investment costs, (2) economically profitable, (3) does not conflict with local culture, (4) does not conflict with existing regulations. Weighting criteria is determined by assessing the reality on the ground.	
		gear fulfill one of the four points above	1
		gear fulfills two of the four points above	2
		gear fulfills three of the four points above	3
		gear fulfill all the requirements above	4

## RESULT AND DISCUSSION

The results of the questionnaire assessment were conducted on 130 fishermen in the Probolinggo City based on the type of fishing gear used, gill net, pot fish, lift net, hand line, cantrang and purse seine. The criteria in the questionnaire about weighting an eco-friendly gear in accordance with the guidelines issued by the Ministry of Maritime Affairs and Fisheries in 2006 [24] of 9 criteria which have high selectivity, habitat friendly, good productivity, fisherman friendly, safe product, low bycatch, biodiversity friendly, protected fish friendly, and social acceptance. The results of the assessment of fishermen which consist of weighting on 6 groups of fishermen based on fishing gear can be seen in Figure 1.

### A. The Scoring for the Eco-friendly Fishing Gear 1. High Selectivity

The results of the assessment on 6 gear on gear selectivity level found that cantrang has the lowest selectivity level with a weight value of 1, which means that cantrang cantrang is a fishing gear with a very low level of selectivity because it catches all types and all sizes of fish. This is consistent with [26,27,28] that cantrang has low selectivity. Similar to the above, Habibi and Rusmilansari [27, 29] explained that the low selectivity of cantrang is due to the fact that it catches all sizes and all types of fish, including shrimp, crabs, and other biota.

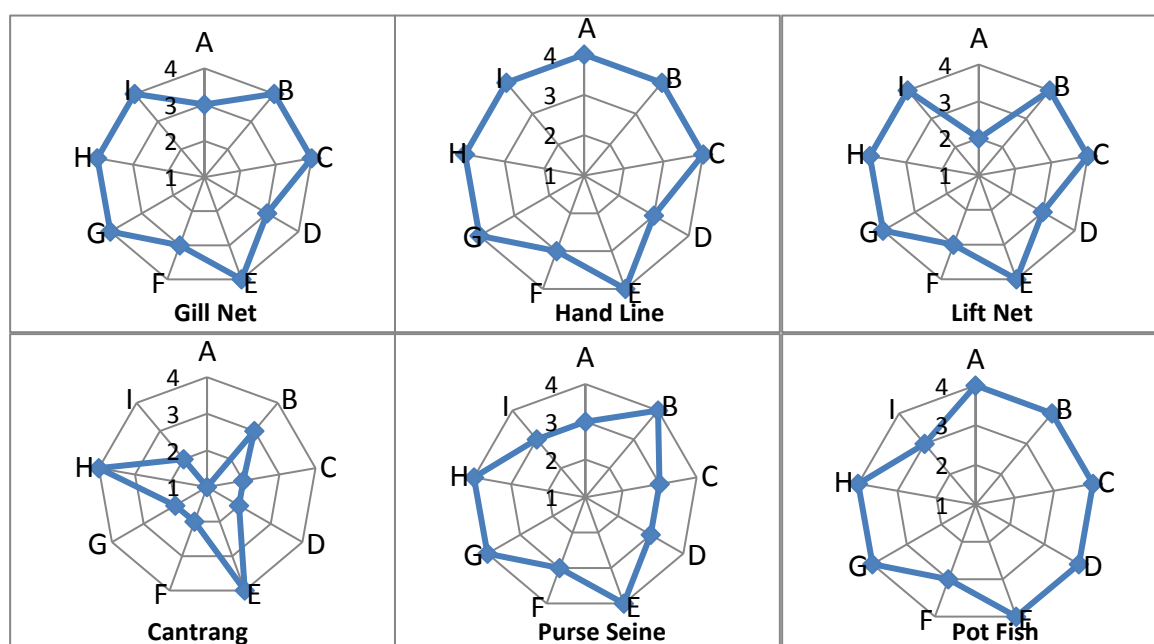


Figure 1. The weighing of the criteria for Eco-friendly fishing gear (mean score per criterion)

A. High selectivity, B. Does not harm habitat and other organisms, C. Does not endanger fishermen, D. High-quality production, E. Does not endanger consumers, F. Low by catch, G. Minimum impact on biodiversity, H. Does not catch protected or vulnerable species, I. Socially accepted

The respondents gave the score of 4 for the selectivity of hand line and pot fish. This means that both fishing gears have a very high selectivity [29,30]. They only catch one species with approximately the same size because they are passive fishing gear, which are installed statically and not moved for a long time. The selectivity of hand line is determined by its hook, whose size is determined by its target [14]. The respondents gave the score of 3 for purse seine and gill net. This means that both fishing gears catch less than three types of fish with approximately the same size. The selectivity of purse seine is quite high because it targets clustered fish that come with the same type and size. According to Chanafi and Firdaus [31,32], gill net is a passive fishing gear because it only waits for the migration of fish or shrimp and the size of the catch is parallel with its mesh size. The respondent gave the score of 2 for lift net. This means that this fishing gear catches three types of fish of very different sizes. According to [33], the selectivity of fishing gear is based on its construction and operation.

## 2. Habitat Friendly

According to this criterion, a good fishing gear does not damage the habitat of fish and other organisms. Its score depends on the area and the level of damage. According to Figure 1, all

fishing gears, except cantrang, have the score of 4, so they are safe for habitat. The score for cantrang is 3; its operation causes damage to some degree in a narrow area. In addition, cantrang creates a conflict between its users and other fishing gear users. This disrupts productivity and damages the habitat of deep aquatic biota. According to Nurhasanah [28], cantrang damages fisheries resources because it sweeps the seafloor when hauled. Cantrang is used to catch demersal fish. It is likely that coral reefs at the bottom of the waters are dredged. Damage to coral reefs disrupts ecosystems, especially underwater ecosystems, because this place is the fish's feeding ground, spawning ground, nursery ground, and protection from predators [26].

## 3. Good Productivity

On the criteria of fish quality it was found that cantrang had the lowest value compared to the other 5 gears with a value of weight 2 with fish caught in a dead, fresh, and sometimes damaged or defective condition. According to the CTF [35], cantrang is not quite eco-friendly, that is not quite selective, and the quality of the catches is relatively low, generally dead and damaged. In addition, because the operation involves hauling, there are flaws in the catches. Physical damage to the fish occurs when the

cantrang is hauled. The caught fish are gathered in a pocket. If the catch is many, it is likely that they are damaged due to friction. The respondents scored 3 for purse seine, hand line, lift net, and gill net, which means that the catches are fresh. According to Firdaus [32], the catches from those fishing gears are fresh since they are put into containers with ice immediately after hauling. According to the annual report of the P2SKP UPT Mayangan Probolinggo of 2017 [34], officers have inspected fish catches landed at the Coastal Fisheries Port (PPP) of Mayangan. The result is that the catches are safe for consumption because the additional ingredients used are only ice and salt.

#### **4. Fisherman Friendly**

Fishing is one of the riskiest jobs in the world; it can cause injury or even death [21]. Human safety is a priority in fishing because humans are the most important part of the sustainable productive fisheries. Its risk assessment is based on the level of danger and the potential impact on fishermen. The respondents gave the score of 4 for hand line, pot fish, lift net, and gill net. This means that those fishing gears are safe for fishermen. Purse seine gets the score of 3, meaning that its operation can cause temporary health problems because, in Probolinggo city, the gear is operated by active hauling using axles. Some respondents explained that careless hauling using an axle can injure limbs. Cantrang has the score of 2; the operation can cause permanent injuries. Because its operation uses an axle when the ship is pulled, the risk of being stuck on the towing rope of the axle is higher.

#### **5. Safe Product**

Catches that do not endanger the health of consumers are those that are caught without bombs or chemical-based fertilizers or cyanide, so there is no possibility that the catch is contaminated with poisons. According to the annual report of the P2SKP UPT Mayangan 2017, the results of the inspections of fish catches that are landed at the Coastal Fisheries Port (PPP) in Mayangan indicate that the catches are safe for consumption. The additional ingredients found in catches are ice and salt. Figure 1 shows that all fishing gears get the score of 4, meaning that the fish catches are safe for consumption.

#### **6. Low Bycatch**

This criterion means that wasted bycatch must be minimal. Fishing gear with low selectivity catches non-target fish or organisms, so that bycatch is high. The bycatch is actually food for larger fish. If they are caught, the ecosystem in the aquatic environment will be disrupted, and fish growth will also be disrupted [28]. According to Figure 1, all fishing gears except cantrang have the score of 3, meaning that the bycatch is less than three types of fish and can still be sold. The score of cantrang is 2, meaning that the bycatch consists of several types of fish and some of which can be sold. Because of its low selectivity, many non-target fish are caught. In PP Mayangan, no fish cannot be sold. Damaged fish is still bought by factories to produce fish meal.

#### **7. Biodiversity Friendly**

According to this criterion, the impact of fishing gear on biodiversity must be low. According to Figure 1, all fishing gears except cantrang have the score of 4, which means that they are safe for biodiversity. Cantrang got the score of 2, which means that the operation caused the death of several species and habitat damage. According to [26], cantrang sweeps the bottom of the waters, no exception to coral reefs, and damages the spawning ground of marine biota. Fisheries resources in Indonesian waters will experience degradation due to the high fishing activities in various regions and the use of cantrang. Biota that have not reached gonadal maturity and that are spawning are caught and fail to reproduce. This condition causes fish stock and resource depletion, reducing fish catches [27,28].

#### **8. Protected Fish Friendly**

This criterion means that fishing gear does not catch protected or endangered species. All fishing gears get the score of 4, which means that they never catch protected fish. According to Hikmah [36], currently the perception of fishermen on Madura Strait regarding responsible fishing policy has begun to increase after legal socialization in the fisheries sector. Although regulations in the field of fishing about fishing gear have been socialized, violations in the field of fishing still occur.

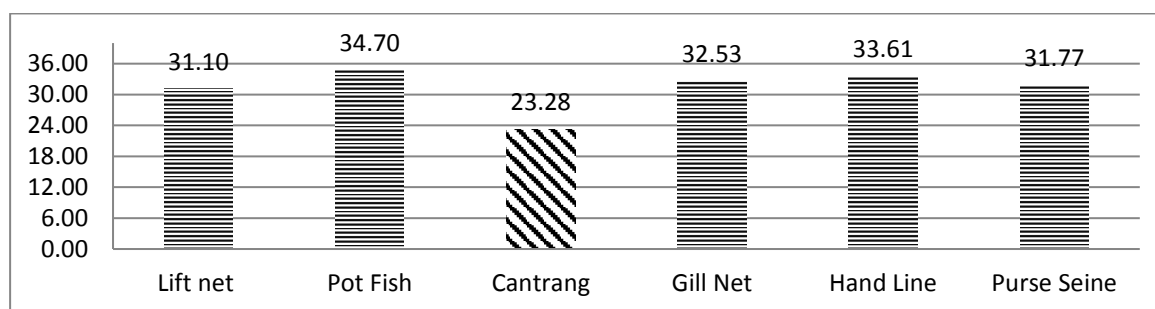


Figure 2. Environmental Friendliness Status Of Fishing Gears

## 9. Social Acceptance

People's acceptance to a fishing gear depends heavily on the social, economic, and cultural conditions of a region. A fishing gear is socially accepted by the community if: (1) its investment costs are low, (2) it is economically profitable, (3) it does not conflict with local culture, and (4) it does not conflict with regulations. According to Figure 1, hand line, lift net, and gill net get the score of 4, which means that the fishing gears are accepted by the community, based on the four conditions above. Purse seine and pot fish get the score of 3, which means that they meet three conditions: economically profitable, does not conflict with local culture, and does not conflict with existing regulations. Cantrang gets the score of 2, which means that it only meets two conditions: low investment costs and economically profitable.

### B. Analysis on the Status of Eco-friendly Gear

Analysis on the status of eco-friendly gear based on the range of scores with 4 categories are as follows: 1-9 is very environmentally unfriendly, 10-18 is environmentally unfriendly, 19-27 is eco-friendly, 28-36 is very eco-friendly. To determine the final result, the total weight is divided with the total of respondents. The results of the analysis of environmental friendliness of the gears can be seen in Figure 2.

Based on Figure 2, it can be seen that the very eco-friendly fishing gears in Probolinggo city are purse seine (31.77), hand line (33.61), pot fish (34.70), lift net (31.10), and gill net (32.53); only cantrang (23.28) is included in the category of eco-friendly.

In the Regulation of Ministry of Marine and Fisheries No. 71/2016 and some references such as Rawaeni, Habibi, and Nurhasanah [26,27,28] argue that cantrang is included in gear that is not

environmentally friendly. Sahrana in Sitepu [38] said that technically the Research Center had discovered or not that it was prohibited or not? The fishermen's version says they are environmentally friendly, not along with trawling. However, the assessment of the criteria for environmentally friendly gear on cantrang is based on the perceptions of fishermen in the city of Probolinggo, as well as the caution of fishermen to provide answers. Because fishermen still argue that cantrang does not damage the environment, so giving assessment is not in accordance with the reality in the field.

Fishing gear that is very eco-friendly and is recommended to maintain the sustainability of fish resources is pot fish. According to Cahyani, Sima, and Latuconsina [8,25,37], pot fish, hand line and gill net is more selective and eco-friendly. In the Regulation of Ministry of Marine and Fisheries No. 71/2016, pot fish, hand line and gill net, which is installed permanently, or not moved for a long time, is categorized as allowed fishing gear. It has other advantages such as easy to carry in large quantities, easy to operate (sink and haul), easy to arrange on board (simple construction and easy to fold), stable in the bottom of the water, long lasting, good in maintaining the quality of the catches, selective and less likely damaging resources, and low production costs [32,35]. According to Latuconsina [8], this fishing gear is permanent, so it does not extensively damage the coral, but it is dangerous in large quantities. Pot fish usually use dead coral or living coral taken from the surrounding waters for its ballast, thus damaging the existing coral community.

## CONCLUSION

The conclusion of the assessment on fishing gears according to the Code of Conduct for Responsible Fisheries (CCRF) in Probolinggo is that purse seine (31.77), hand line (33.61), pot

fish (34.70), lift net (31.10), and gill net (32.53) are very eco-friendly. Cantrang with the score of 23.28 is considered as eco-friendly. Fishing gear that is very eco-friendly is recommended in the City of Probolinggo, pot fish, hand line, gill net, purse seine, and lift net

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