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IMPLEMENTATION THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES IN PURSE SEINE OPERATIONS AND CATCH HANDLING

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ABSTRACT

The purse seine is one of the primary fishing gears used to land pelagic species at the Nusantara Fishing Port, Prigi. The adoption of environmentally responsible fishing practices is critical to minimizing bycatch, preventing habitat degradation, and preserving pelagic fish stocks. This study assessed the operational performance of small pelagic purse seines and catch-handling practices in relation to the CCRF. Fieldwork was conducted from February to May 2025 using purposive sampling, supported by observations and interviews with purse seine fishermen, including the stages of onboard and landing-site handling. A scoring system was applied to evaluate each indicator, and gap analysis was used to identify deficiencies in the handling system on KM. Sinar Mutiara. A total of 25 fishermen and 25 community respondents were surveyed, yielding an average score ($\bar{X}$) of 28.78, indicating limited compliance with sustainable fisheries resource management principles. Variation in adherence to CCRF handling standards further reinforces this finding. While post-harvest handling at the auction site showed relatively better alignment with CCRF provisions, notable gaps remain in onboard and landing-site operations. These results underscore the need for targeted improvements to enhance compliance and support the transition toward more sustainable purse seine fisheries in Prigi.

Keywords: *CCRF, handling of ctach, Prigi fishing port, purse seine*

INTRODUCTION

The Nusantara Fishing Port (NFP) Prigi is a fishing port located in Tasikmadu Village, Watulimo District, Trenggalek Regency, East Java,dominated by small-scale fishermen with vessels larger than 10 GT (Sari *et al*., 2015). Some of the fishing gear used by fishing vessels at PPN Prigi include purse seine, beach seines, drift gillnets, trammel nets, longlines, handlines, cast nets, and trammel nets (Adhihapsari *et al*., 2024). The fish catches landed at Prigi Fishing Port include Yellowfin tuna (*Thunnus albacares*), Indian scad (*Decapterus russelli*), Little tuna (*Euthynnus affinis*), Skipjack tuna (*Katsuwonus pelamis*), and Largehead hairtail (*Trichiurus lepturus*).

Purse seines are a type of fishing gear employed to capture pelagic fish that typically swim in schools. In terms of operational appropriateness, purse seines come in third place since they may capture over three different types of fish of different sizes. Purse seine are environmentally friendly fishing gear that comply with (Ministry of Marine Affairs and Fisheries of the Republic of Indonesia, 2016) and the Code of Conduct for Responsible Fisheries (CCRF). The CCRF aims to ensure that fishing practices are conducted sustainably to maintain the balance of marine ecosystems and the sustainability of fish resources. The purse seine is one of the commonly used fishing gear types for catching pelagic fish at the Prigi Fishing Port. The operation of the purse seine involves first

encircling a schooling of fish with the net walls to a certain depth, then pulling the ring line so that the net forms a pool-like shape, and finally gradually reducing the size of the pool by pulling the bottom of the net, after which the fish are lifted onto the vessel (Sutoyo, 2018).

Fish caught using purse seine must be handled properly and correctly because fish is a type of food that spoils easily. Proper handling is carried out to achieve maximum results, not only while on board the vessel but also during handling on board the vessel and at the fish auction site. Efforts to maintain fish quality are highly dependent on how it is handled. Ideally, fish should be handled using methods known as good fish handling practices. The principles of good fish handling include cold conditions, speed, care, and cleanliness (Sari & Nawafil, 2023). The earlier and more thoroughly these four principles are applied, the better the fish quality will be maintained. The decline in fish quality begins as soon as the fish are caught and loaded onto the vessel. The process of quality degradation occurs during the fishing process, handling on board the vessel, storage in the hold, unloading, and transportation of the cargo to the processing unit/consumer (Alimina *et al*., 2022).

The environmental friendliness rating of purse seine fishing gear at Prigi Fishing Port as a form of CCRF implementation aims to assess the extent to which this fishing gear impacts marine ecosystems and the sustainability of fish resources. Although purse seine are known to be effective in catching pelagic fish such as mackerel, improper use can lead to by-catch, catching fish below the minimum size, or disturbing non-target species. Therefore, it is important to observe how the gear is operated. Through this study, it can be determined whether the purse seine used is in line with environmentally friendly principles, and it can serve as a basis for providing technical improvement recommendations to make the gear more selective, efficient, and less damaging to marine habitats.

This research is important because it provides an evidence-based assessment of how the principles of the Code of Conduct for Responsible Fisheries (CCRF) are implemented in small pelagic purse seine operations, linking fishing practices to environmental sustainability. The strength of this study lies in its integration of ecological, technical, and management aspects to evaluate the level of compliance with responsible fishing standards. The CCRF is applied in this context because it serves as a globally recognized framework developed by the FAO, offering comprehensive and holistic guidance that covers conservation, fishing operations, and post-harvest practices. Compared to other regulatory instruments, the CCRF provides broader principles that can be adapted to national policies and local fisheries, making it the most suitable reference for assessing responsible and sustainable fishing activities.

Observations of the environmental friendliness of purse seine nets play a crucial role in assessing their impact on marine ecosystems. The use of environmentally friendly fishing gear can minimise by-catch, avoid habitat damage and maintain fish population balance. This is particularly relevant given the high level of fishing activity using purse seine fishing gear in Prigi Fishing Port. Furthermore, fish handling offers various important benefits, particularly in maintaining the quality of catches and the sustainability of fisheries resources. By applying the CCRF principles, fish handling can be carried out hygienically, efficiently, and in accordance with quality standards, resulting in fresher, safer-to-consume products with higher market value. Therefore, the objective of this study is to examine the application of CCRF in the use of purse seine fishing gear and the handling of catches to ensure that the quality of fish reaching consumers is maintained. This is, of course, to achieve sustainable fisheries while prioritising the quality of fisheries products reaching consumers.

METHODS

Data Collection

The research was conducted from February to May 2025 at the Prigi NFP located on Jl. Raya Pantai Prigi, Gares Kidul, Tasikmadu, Watulimo District, Trenggalek Regency, East Java, Indonesia. (Figure 1).

The research method used was purposive sampling with observation and interview techniques. The respondents in this study consisted of fishers engaged in small pelagic purse-seine operations, including both vessel skippers and crew members, as well as coastal community members residing in the vicinity of the study area. This method was used to answer the research objectives, which focused on fishermen who use purse seine fishing gear and continued to the stage of -

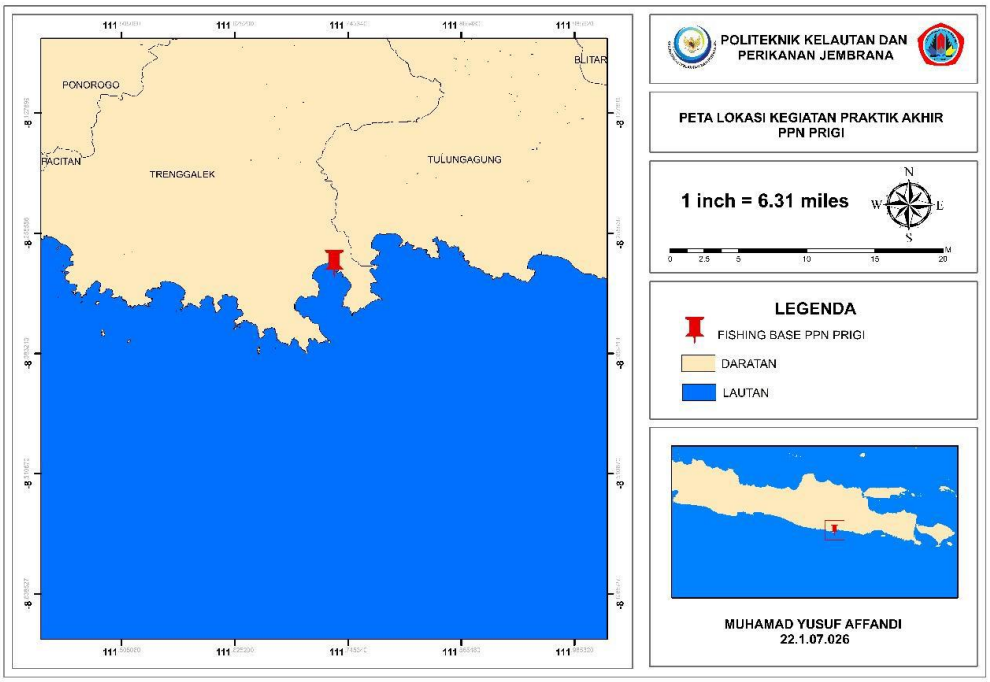

Figure 1 Map of the Research Location

handling their catch. Field observations and interviews are necessary to determine whether the handling of fish catches on board vessels, at ports, and at fish auction sites complies with Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019), and from a sustainability perspective, whether purse seine fishing gear can be considered environmentally friendly for marine ecosystems. Interviews were conducted to obtain opinions or views from 25 fishermen and 25 community members (Total of 50 respondents). Community members were selected as respondents in the implementation of CCRF because they are the main actors in fishing activities, have local knowledge about fishing practices and resource management, and directly feel the impact of applying CCRF principles.

Questions were asked to gather data on the handling of catch on board vessels, at the pier, and at the fish auction site, as well as observations on the environmental friendliness of the purse seine fishing gear. The data was obtained primarily through direct collection in the field and from the KM Sinar Mutiara vessel (length of 19.45 m, a width of 6.08 m, and a draught of 1.57 m) with a gross tonnage of 30 GT. The fishing gear used is a small pelagic purse seine with a mesh size of 1.25-1.50 inches. The data collected is qualitative in nature, consisting of descriptions of fish handling methods and the environmental friendliness of fishing gear, as well as quantitative data such as catch weight.

Data Analysis

Data analysis using a scoring system explains the observation process by assigning scores to each item or indicator, then processing and interpreting those scores to obtain a certain picture or conclusion. Classification and determination of environmental criteria for purse seine fishing gear at Prigi Fishing Port using the following formula:

$$\overline{X} = \sum_{i=1}^{N} \frac{X_i}{N} \; atau \; \overline{X} = \frac{\sum X_n}{N} \quad \text{.....(1)}$$

With:

$\overline{X}$ = Level of environmental friendliness of purse seine fishing gear

X_i = Total weight value

N = Total respondents

The scoring analysis in this study was used to explain the environmental friendliness of purse seine fishing gear using the categorisation, as shown in (Table 1). The classification of purse seine fishing gear into environmentally friendly categories is based on its impact on aquatic ecosystems, selectivity in terms of fish species and size, and potential by-catch, as shown in Table 2.

Table 1 Environmental performance assessment criteria of purse seine fishing gear

No	Criteria	Sub-Criteria	Score
1	High Selectivity	Catches more than three species with wide variation in sizes	1
		Catches up to three species with wide variation in sizes	2
		Catches less than three species with relatively uniform size	3
		Catches one species with relatively uniform size	4
2	Non-Destructive to Habitat	Causes habitat destruction on a wide area	1
		Causes habitat destruction on a limited area	2
		Causes partial damage to habitat in a limited area	3
		Safe for habitat	4
3	Produces High-Quality Fish	Fish dead and decayed	1
		Fish dead, fresh, with physical defects	2
		Fish dead but fresh	3
		Fish caught alive	4
4	Does Not Endanger Fishers	Potentially fatal to fishers	1
		May cause permanent disability to fishers	2
		Causes only temporary health disturbances	3
		Safe for fishers	4
5	Production Safety for Consumers	High risk of causing consumer death	1
		May cause health disturbances to consumers	2
		Relatively safe for consumers	3
		Safe for consumers	4
6	Impact on Biodiversity	Causes death of all living organisms and destroys habitat	1
		Causes death of several species and destroys habitat	2
		Causes death of several species but does not destroy habitat	3
		Safe for biodiversity	4
7	Non-Endangerment of Protected Species	Protected species frequently caught	1
		Protected species occasionally caught	2
		Protected species rarely caught	3
		Protected species never caught	4
8	Social Acceptability	Low investment cost	1
		Economically profitable	2
		Not in conflict with local culture and community	3
		Comply with existing regulations and management measures	4
9	Low By-catch	By-catch consists of several species with no market value	1
		By-catch consists of several species with some having market value	2
		By-catch consists of fewer than three species and can be sold in the market	3
		By-catch consists of fewer than three species and has high market value	4

Source: Aisyaroh & Zainuri (2021)

Table 2 Categories of environmental friendliness of purse seine fishing gear

No	Category	Score Range ($\overline{X}$)
1	Environmentally Friendly	$\overline{X}$ > 3.5
2	Less Environmentally Friendly	2.5 < $\overline{X}$ ≤ 3.5
3	Not Environmentally Friendly	1.5 < $\overline{X}$ ≤ 2.5
4	Environmentally Destructive	$\overline{X}$ ≤ 1.5

Source: Aisyaroh & Zainuri (2021)

Table 3 Handling compliance categories for purse seine catch

No	Score Range (%)	Handling Category
1	0% – ≤ 34%	Handling is highly inconsistent with the standard
2	34% – ≤ 50%	Handling is inconsistent with the standard
3	50% – ≤ 65%	Handling is inconsistent with the standard
4	65% – ≤ 80%	Handling is moderately consistent with the standard
5	80% – ≤ 100%	Handling is consistent with the standard

Source: Thamrin *et al*., (2024)

The proportional contribution of environmentally friendly indicators in purse seine fishing gear was also analysed in this study. The level of implementation of the Code of Conduct for Responsible Fisheries (CCRF) in this study also looked at the indicator assessment approach. Each indicator related to ecological, social, and economic aspects is scored according to the results of data collection in the field. Furthermore, the score of each indicator is compared with the total score to obtain a relative contribution percentage. This percentage is then used as a basis for assessing the extent to which each indicator supports the overall implementation of the CCRF principles, so that the most dominant aspects and those that still need improvement can be identified.

Data analysis to compare fish handling at the Prigi Fishing Port. In addition, descriptive methods were also used to identify factors affecting the implementation of the Code of Conduct for Responsible Fisheries (CCRF) at the Prigi Fishing Port using gap analysis. Gap analysis is a method used to evaluate gaps in the fish handling system on KM. Sinar Mutiara (case study on board). Miriyanti & Rokhman (2019), states that this gap is measured using the following formula:

Gap = CLh – CLr……(2)

With:

Gap = Handling gap

CLh = Standard handling

CLr = Current handling

The assessment of CLh (Standard Handling) was based on how well fish handling procedures, from capture to distribution, adhered to the guidelines established by CCRF Article 11 and the Ministry of Marine Affairs and Fisheries (2019), specifically with regard to cold chain management, hygiene, and product quality. Current Handling, or CLr, on the other hand, reflects the real procedures seen in the field. The study was able to determine the discrepancy between the existing handling circumstances and the specified criteria by comparing CLr and CLh, which made it evident which areas needed modification in order to better apply the CCRF principles.

The evaluation of current handling practices is conducted by calculating the quantitative values from the questionnaire results, while standard handling practices refer to the standards established by the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019) and the Codex Alimentarius & FAO/WHO (2020). The decision-making process in the assessment is based on the criteria outlined in (Table 3).

RESULTS

During three trips, identification of fish catches using purse seine nets resulted in five species of fish, consisting of two main-catch species, namely Indian scad (*Decapterus russelli*) and Skipjack tuna (*Katsuwonus pelamis*) as the primary targets in the operation of purse seine nets in Prigi Bay, and 3 by-catch fish species like Yellowfin tuna (*Tunnus albacares*), Rainbow runner (*Elagatis bipinnulata*), and Dash-and-dot goatfish (*Parupenneus barberinus*). During the study period, it was found that Skipjack tuna was the most dominant catch in trips one to three, as shown in (Table 4).

These results on Table 4 indicate that the selectivity of purse seine fishing gear at Prigi Nusantara Fishing Port is highly dependent on the availability of target fish species, which is related to the season. The percentage of main catch in the total catch was 67%, compared to 33% for by-catch.

The results of the scoring analysis in this study were used to explain the level of friendliness of purse seine fishing gear by interviewing 50 respondents, namely 25 fishermen and 25 community members involved in the utilisation of purse seine catches (Table 5) and proportional contribution of environmental friendliness indicators in purse seine fishing gear (Figure 2).

Based on the results of an analysis of the environmental friendliness of fishing gear (Table 5), involving 25 fisherman and 25 community respondents, an average value ($\bar{X}$) of 28.78 was obtained. This value is categorised as less environmentally friendly ($22.5 < \bar{X} \leq 3.5$), indicating that the fishing gear used does not fully comply with the principles of sustainable fisheries resource management. The analysis highlights the need to enhance fishermen's awareness and understanding of the importance of using more environmentally friendly fishing gear. Additionally, support from relevant parties in the form of socialisation, training, and supervision is needed to enable fishermen to transition to sustainable fishing methods.

The assessment of environmental friendliness criteria for purse seine fishing gear indicates that the highest contributing factors are non-destructive to habitat and safe for consumers, each accounting for 13% of the overall score. This is followed by no harm to fishers and low impact on biodiversity at 12%, as well as social acceptability and high-quality catch at 11%. In contrast, high selectivity and no threat to protected species represent the lowest proportions, each at 9%. Overall, the distribution of scores across the criteria is relatively balanced (ranging from 9% to 13%), suggesting that the environmental sustainability of purse seine operations is shaped by a combination of ecological, social, and economic considerations, with particular strengths in habitat protection and consumer safety, but relatively lower performance in terms of selectivity and protection of endangered species.

Handling of fish caught on board with gap analysis was conducted by identifying the compliance of fish handling practices at the Prigi Fishing Port with the standards. The analysis results indicate a gap in the handling of fish catches at the Prigi Fishing Port compared to the standards set by Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019)and CCRF Article 11. The average standard handling value (CLh) is 4, while the current handling value (CLr) is 2.83, with an average gap of 0.50. The percentage of compliance between current handling and standards is 71%, indicating that fish handling on board is fairly close to the standards set by Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019). However, there is a gap in the handling of caught fish that needs to be improved to achieve optimal handling (Table 6).

Table 4 Catch composition by fishing trip for KM Sinar Mutiara

Category	Common Name	Scientific Name	Trip 1 (kg)	Trip 2 (kg)	Trip 3 (kg)	Total catch (kg)
Main Catch	Indian scad	*Decapterus russelli*	812	1,579	2,420	4,811
	Skipjack tuna	*Katsuwonus pelamis*	5,004	602	4,880	10,486
Sub-total			5,816	2,181	7,300	15,297
Percentage			63%	81%	67%	67%
By-catch	Yellowfin tuna	*Thunnus albacares*	3,395	390	3,630	7,416
	Rainbow runner	*Elagatis bipinnulata*	–	91	–	91
	Dash-and-dot goatfish	*Parupeneus barberinus*	–	34	35	69
Sub-total			3,395	515	3,665	7,576
Percentage			37%	19%	33%	33%

Source: Primary data

Table 5 Environmental friendliness assessment of purse seine fishing gear

No	Criteria	Sub-Criteria	Score	Respondents' score (x) (Number of respondents × weight)	
				Purse Seine Fishermen	Community
1	High Selectivity	Catches more than three species with wide size variation	1	3	4
		Catches up to three species with wide size variation	2	6	14
		Catches less than three species with relatively uniform size	3	24	27
		Catches one species with relatively uniform size	4	24	20
	Subtotal			**67**	**65**
2	Non-Destructive to Habitat	Causes habitat destruction on a wide area	1	2	1
		Causes habitat destruction on a limited area	2	2	0
		Causes partial habitat destruction on a limited area	3	3	0
		Safe for habitat	4	84	96
	Subtotal			**91**	**97**
3	Produces High-Quality Fish	Fish dead and decayed	1	0	2
		Fish dead, fresh, with physical defects	2	4	10
		Fish dead but fresh	3	27	24
		Fish caught alive	4	56	40
	Subtotal			**87**	**76**
4	Does Not Endanger Fishers	Potentially fatal to fishers	1	2	3
		May cause permanent disability	2	6	4
		Temporary health disturbance	3	3	21
		Safe for fishers	4	84	52
	Subtotal			**91**	**80**
5	Production Safety for Consumers	High risk of causing consumer death	1	0	0
		May cause health problems to consumers	2	0	0
		Relatively safe for consumers	3	24	30
		Safe for consumers	4	68	60
	Subtotal			**92**	**90**
6	Impact on Biodiversity	Causes death of all organisms and destroys habitat	1	0	1
		Causes death of several species and destroys habitat	2	8	8

No	Criteria	Sub-Criteria	Score	Respondents' score (x) (Number of respondents × weight)	
				Purse Seine Fishermen	Community
		Causes death of several species but does not destroy habitat	3	12	9
		Safe for biodiversity	4	68	68
	Subtotal			**88**	**86**
7	Non-Endangerment of Protected Species	Protected species frequently caught	1	4	3
		Protected species occasionally caught	2	14	16
		Protected species rarely caught	3	36	39
		Protected species never caught	4	8	4
	Subtotal			**62**	**62**
8	Social Acceptability	Low investment cost	1	1	0
		Economically profitable	2	12	10
		Not in conflict with local culture	3	27	27
		Not in conflict with existing regulations	4	36	44
	Subtotal			**76**	**81**
9	Low By-catch	By-catch consists of several species with no market value	1	3	3
		By-catch consists of several species with some market value	2	10	14
		By-catch consists of fewer than three species and can be sold in the market	3	15	15
		By-catch consists of fewer than three species with high market value	4	48	40
	Subtotal			**76**	**72**
		Total score		**730**	**709**
		Number of respondents		**25**	**25**
		Average Environmental Friendliness Score ($\bar{X}$)		**28.78**	

Source: Primary data

The percentage of compliance between handling practices in the field and standards is only 71%. This figure reflects that fish handling practices have not yet met the standards set by Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019). Therefore, improvements are needed in the implementation of fish handling procedures so that the quality of the catch can be maintained and meet the principles of sustainability and food safety.

Handling of Fish Catches at the Pier, the average standard handling value (CLh) is 4, while the current handling value (CLr) is 2.75, with an average gap of 1.25. The percentage of compliance between current and standard handling is 69%, indicating that fish handling at the dock does not yet meet the standards set by Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019). However, there is a gap in the handling of caught fish that needs to be improved to achieve optimal handling (Table 7).

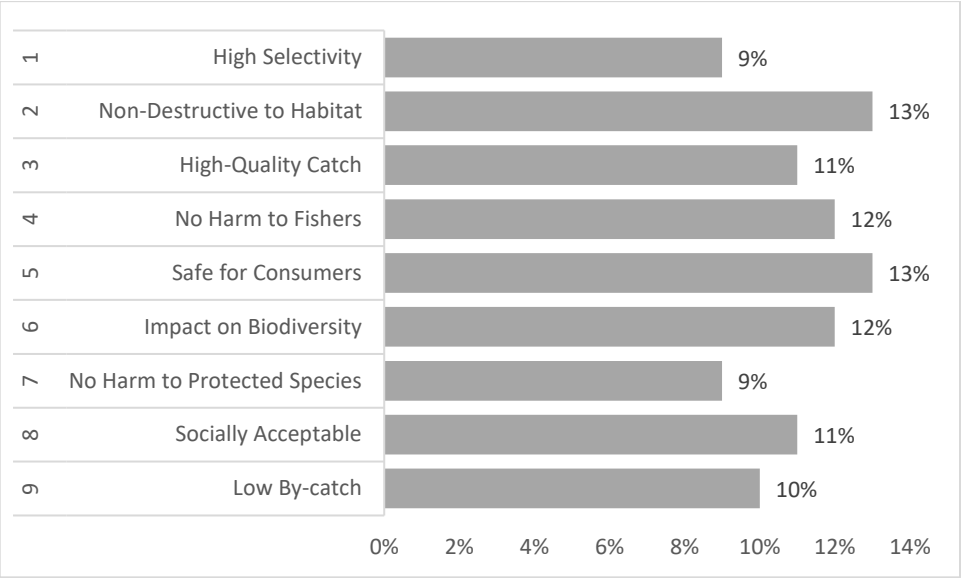

Figure 2 Proportional Contribution of Environmental Friendliness Indicators in Purse Seine Fishing Gear

Table 6 Handling practices on board and compliance level

No	Handling Practices on Board	CLh	CLr	Gap
1	Handling and storage of fish must be carried out properly to avoid physical damage.	4	3	1
2	Once brought on board, the catch must be immediately cooled.	4	3	1
3	Storage of catch at temperature (<0 °C).	4	4	0
4	When stored with ice, meltwater should not flood the fish.	4	3	1
5	No use of hazardous substances in accordance with legal regulations.	4	4	0
6	Arrangement of catch in the hold should consider species, size, and quality.	4	0	4
	Average Value	4	2.83	0.50
	Compliance (xCLr/xCLh) × 100%		71%	

Source: Primary data

Table 7 Handling practices at the landing site and compliance level

No	Handling Practices at the Landing Site	CLh	CLr	Gap
1	Loading and unloading of fish should be carried out quickly and not under direct sunlight.	4	4	0
2	Fish should not be in contact with the ground/floor during the transportation process.	4	3	2
3	Products/fish deemed unfit for consumption must be stored separately from the catch and working/handling area, or disposed of properly.	4	2	2
4	Proper and timely handling, with appropriate temperature, should be applied to products deemed fit for consumption.	4	3	1
	Average Value	4	2.75	1.25
	Compliance (xCLr/xCLh) × 100%		69%	

Source: Primary data

The percentage of compliance between handling practices in the field and standards is only 69%. This figure reflects that fish handling practices have not yet met the standards set by Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019). Therefore, improvements are needed in the implementation of fish handling procedures so that the quality of the catch can be maintained and meet the principles of sustainability and food safety.

Table 8 Handling practices at the fish auction site and compliance level

No	Handling Practices at the Fish Auction Site	CLh	CLr	Gap
1	Sorting should be conducted first to separate fish by species and size before cooling or storing in ice.	4	4	0
2	During transportation, the catch must not come into contact with the ground or floor.	4	4	0
3	Fish should be arranged in containers according to species, quality, and size.	4	3	1
	Average Value	4	3.67	0.33
	Compliance (CLr/CLh × 100%)		92%	

Source: Primary data

Handling of fish caught at fish auction sites with an average standard handling value (CLh) of 4, while the current handling value (CLr) is 3.67 with an average gap of 0.33. The percentage of conformity between current handling and standards is 92%, indicating that handling at fish auction sites already meets the standards set by the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019), as shown in the table of handling at the Fish Auction Site (Table 8).

Overall, it can be concluded that the percentage of compliance between the handling that occurs in the field and the value is 92%. This figure reflects that fish handling at the Fish Auction Site already meets the standards set by the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (2019). Therefore, maintaining and improving the implementation of fish handling procedures is crucial to ensuring good quality and safety for consumption, as well as enhancing market value.

DISCUSSION

The results of the analysis on the environmental friendliness assessment of purse seine fishing gear, based on scores obtained from respondents, indicate that purse seines are categorized as less environmentally friendly (Table 5). This is presumed to be related to the criterion of high selectivity, which recorded the lowest score among the nine criteria analyzed. The scores for this selectivity criterion were distributed more evenly across the weighting categories.

The capture of more than three fish species warrants particular attention, especially when the catch sizes are relatively uniform. Consistently harvesting fish of similar sizes over time may lead to the loss of an entire generation of potential broodstock, thereby reducing reproductive capacity for future generations. It is well established that fish exhibiting schooling behavior and migratory tendencies generally have relatively uniform body sizes.

These findings are consistent with previous studies on purse seine fisheries at fishing port or 'PPI' of Sawang Ba'u, Aceh Selatan Regency, which classified purse seines as less environmentally friendly, with a total score of 29 (Fadli *et al*., 2020), as well as research conducted in Pasongsongan, which recorded a score of 28.298 (Aisyaroh and Zainuri, 2021) .

The findings demonstrate that purse seine operations have not entirely complied with the principles of responsible fishing as compared to the code of conduct for responsible fisheries (CCRF), especially with regard to resource conservation, selectivity, and ecosystem sustainability. The relatively low score in selectivity reflects a lack of compliance with CCRF recommendations, which emphasize the need to minimize bycatch and avoid the capture of non-target species, juveniles, and potential spawners. Priambodho *et al*., (2025) also stated in his research that the use of fishing gear with high selectivity is very important to maintain ecosystem balance, as it can reduce negative impacts on non-target species. Therefore, improving the selectivity of purse seine gears through technical modifications, better spatial-temporal management, and stricter enforcement is crucial to align current practices with CCRF guidelines and to ensure long-term ecological sustainability.

The findings from the environmental friendliness assessment of purse seine fishing gear, particularly the low score on the selectivity criterion, are consistent with the catch composition data observed across three fishing trips, where more than three species were caught in relatively similar size ranges. Such patterns indicate that purse seines tend to capture mixed species and uniform size classes, which raises ecological concerns as it may lead to the removal of an entire cohort, including potential broodstock, thereby

threatening future recruitment. According to the Code of Conduct for Responsible Fisheries (CCRF), fishing practices should minimize bycatch, avoid juvenile and non-target species, and maintain ecosystem balance (Fauzany & Ningsih, 2024; Handayani *et al*., 2024; Tantowi *et al*., 2024). However, the results of both the scoring assessment and empirical catch observations suggest that purse seine operations in the study area are not yet fully aligned with CCRF principles. This highlights the urgent need for technical modifications to enhance gear selectivity, stricter spatial-temporal management, and stronger enforcement measures to ensure sustainability and compliance with responsible fisheries guidelines.

The analysis of handling practices on board indicates a compliance level of 71**%**, which reflects a moderate gap between the handling standard (CLh = 4) and the actual practices (CLr = 2.83) (Table 6). Several key aspects, such as immediate cooling of fish after capture, proper arrangement in the hold, and the prevention of fish contamination with meltwater, remain suboptimal. Notably, the largest gap was identified in the practice of segregating catches by species, size, and quality inside the hold, which was not adequately implemented. This shortcoming poses a risk to maintaining the freshness and quality of the fish, and it may also reduce the market value of the landed product.

This result highlights a moderate gap between the expected standards and actual implementation at sea. Practices related to fish handling and immediate cooling after capture were applied but not fully optimized, suggesting a risk of physical damage and deterioration in quality. Storage at temperatures below 0 °C was consistently maintained, reflecting good compliance with quality standards. Nevertheless, shortcomings were observed in ice management, particularly regarding meltwater control, which may negatively affect freshness. The cold chain is one of the special treatments that is important to apply for the handling of fishery products (Herawanty *et al*., 2021; Sahar *et al*., 2024; Sari & Hidayat, 2024). Furthermore, the most significant gap was identified in the arrangement of fish in the hold, where the absence of proper sorting by species, size, or quality increases the likelihood of physical damage and compromises product quality. When managing fish that have been caught on board, sorting is a crucial step (Sari & Nawafil, 2023; Tani *et al*., 2020). In general, handling practices on board can be considered adequate, but improvements are required in early handling, ice management, and fish arrangement to strengthen compliance and ensure the sustainability of fish quality until landing.

The assessment of fish handling practices at the landing site revealed an average compliance score of 69% (Table 7), with critical gaps primarily observed in preventing fish from coming into contact with the ground and in the proper separation of fish deemed unfit for consumption. Such shortcomings pose significant risks to both food safety and product quality. According to the FAO (1995) CCRF, Article 11 emphasizes the importance of post-harvest practices and trade, requiring that fish be landed, handled, and stored in ways that maintain nutritional value, quality, and safety for consumers (Thamrin *et al*., 2024). The low compliance rate suggests that current practices at the landing site remain below internationally recommended standards, potentially leading to increased post-harvest losses and food safety concerns. Improved infrastructure, training, and enforcement of regulations aligned with CCRF guidelines are therefore necessary to ensure safe and sustainable fish supply chains.

At the fish auction site, compliance was higher, averaging 92% (Table 8), indicating that most handling practices such as sorting by species and size, and preventing fish from touching unsanitary surfaces were well observed. However, minor gaps were still found in maintaining product segregation within containers, which could influence both hygiene and traceability. In line with CCRF Article 11.1, States and stakeholders are encouraged to promote responsible fish handling during processing and marketing to maintain quality and ensure consumer protection. The relatively high compliance rate at the auction site demonstrates progress toward these objectives, yet continuous monitoring and reinforcement of best practices remain essential. Such improvements will not only enhance market competitiveness but also contribute to reducing food waste and safeguarding consumer health. In addition, it is important to maintain hygienic conditions at fish auction sites, as indicated by the results of a study conducted by *(*Subhany *et al*., 2022).

In accordance with the Code of Practice for Fish and Fishery Products Codex Alimentarius & FAO/WHO (2020), fish handling must minimise physical damage and microbial contamination to ensure product safety and resource. However, recent assessments show that several fish handling practices at Prigi

Fishing Port still fall short of these standards, highlighting the need to strengthen technical capacity and improve on-board as well as on-shore facilities. This issue is particularly critical in the storage and preservation of catches, where infrastructure limitations reduce product quality. Strengthening facilities and technical skills is consistent with the vision of FAO's *State of World Fisheries and Aquaculture 2022*, which emphasises the "Blue Transformation" agenda to ensure high-quality and sustainable fishery products. The development of these facilities and infrastructure aims to ensure that fish products caught at PPN Prigi are of good quality, as indicated by previous research by Sayuti & Limbong (2019) .

The strengthening of facilities and technical skills is in line with FAO's *State of World Fisheries and Aquaculture 2022*, which introduces the concept of "Blue Transformation." This agenda highlights the urgent need for fisheries to adopt more efficient, resilient, and sustainable practices across the value chain—from harvesting to post-harvest handling. Within this framework, improving on-board and on-shore infrastructure, such as storage, cold chain systems, and handling procedures, becomes essential to ensure that fishery products maintain high quality and safety standards. The "Blue Transformation" further underlines that upgrading technical capacity not only safeguards product value but also supports long-term resource sustainability and the competitiveness of fishing communities.

Previous studies, have also shown that improper onboard handling especially delayed cooling and poor storage arrangements leads to rapid deterioration of fish quality and significant post-harvest losses (Handoko & Yuniarti, 2023; Litaay *et al.,* 2020; Rahayu and Herliani, 2025). These findings align with the present study, suggesting that similar challenges persist across small-scale purse seine operations in Indonesia. Therefore, interventions such as the provision of adequate ice, training for fishers on hygienic handling, and enforcement of fish handling regulations are critical to increase compliance levels. Strengthening these practices will not only improve product quality but also ensure conformity with national standards and international guidelines for responsible fisheries.

CONCLUSION

The implementation of the CCRF at Prigi Fishing Port indicates that small pelagic purse seine had an environmental friendliness score of less environmentally friendly, primarily due to low selectivity and its potential impact on fish populations. The methods of handling catch that demonstrated different degrees of conformance. These findings imply that there are still large gaps in aboard and landing site handling procedures, even though post-harvest treatment at the auction site is comparatively in line with CCRF rules. The infrastructure and facilities development for handling catch are important to guarantee the high quality of fish products obtained at Prigi Fishing Port.

RECOMMENDATION

Future research should focus on policy formulation and evaluation of the implementation of CCRF in the operation of purse seine fishing gear and the handling of fish landed at Prigi Fishing Port, as well as addressing the challenges of developing facilities and infrastructure for handling fish catches so that the quality of fish sold improves.

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