Fisheries Journal, 15 (6), 3137-3147 (2025)
http://doi.org/10.29303/jp.v15i6.1983

ASSESSMENT OF ENVIRONMENTAL FRIENDLINESS LEVEL OF BOAT LIFT NET FISHING GEAR BASED ON CCRF CRITERIA AT PPN SIBOLGA, NORTH SUMATRA PROVINCE

Penilaian Tingkat Keramahan Lingkungan Alat Tangkap Bagan Perahu Berdasarkan Kriteria CCRF di Ppn Sibolga Provinsi Sumatera Utara

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(Received November 25th 2025; Accepted December 28th 2025)

ABSTRACT

Boat lift nets are one of the fishing gears used by fishermen at the Nusantara Fishing Port (PPN) Sibolga, North Sumatra. However, the level of their environmental friendliness needs to be evaluated because this gear often catches various non-target species (bycatch) and uses a relatively small mesh size of 0.5 inches. This study aimed to determine the environmental friendliness level of boat lift nets based on the Code of Conduct for Responsible Fisheries (CCRF) at PPN Sibolga. The research was conducted at Tangkahan Murni, one of the landing sites within the working area of PPN Sibolga, from April 30 to May 28, 2025. A descriptive method with a quantitative approach was used through surveys and interviews using questionnaires. Respondents were selected using a purposive sampling technique, involving 10 boat lift net units out of a total of 52 units operating at PPN Sibolga. The respondents included crew members, skippers, vessel managers, fish sorters, consumers, and local community members. The observed variables referred to the nine CCRF criteria. The results showed that the boat lift nets at PPN Sibolga obtained a score of 28, which falls into the very environmentally friendly category. According to the FAO (1995) guidelines, scores ranging from 28 to 36 are classified as very environmentally friendly fishing gear.

Keywords: Boat Lift Net, Catch Composition, CCRF, Environmental Friendliness

ABSTRAK

Bagan perahu merupakan salah satu alat tangkap yang digunakan oleh nelayan di Pelabuhan Perikanan Nusantara (PPN) Sibolga, Sumatera Utara. Namun, tingkat keramahan lingkungannya perlu dikaji karena alat tangkap ini sering menangkap berbagai spesies yang bukan merupakan target utama (by catch) dan memiliki ukuran mata jaring yang relatif kecil, yaitu 0,5 inci. Penelitian ini bertujuan untuk mengetahui tingkat keramahan lingkungan alat tangkap bagan perahu (boat lift nets) berdasarkan Code of Conduct for Responsible Fisheries (CCRF) di PPN Sibolga. Penelitian dilaksanakan di Tangkahan Murni, salah satu tangkahan

yang berada di wilayah kerja PPN Sibolga, pada tanggal 30 April hingga 28 Mei 2025. Penelitian ini menggunakan metode deskriptif dengan pendekatan kuantitatif melalui survei dan wawancara menggunakan kuesioner. Pemilihan responden dilakukan dengan teknik purposive sampling, dengan jumlah sampel sebanyak 10 unit kapal bagan perahu dari total 52 unit yang ada di PPN Sibolga. Responden terdiri atas anak buah kapal (ABK), nahkoda, pengurus kapal, petugas penyortir ikan, konsumen, dan masyarakat setempat. Peubah yang diamati mengacu pada sembilan kriteria CCRF. Hasil penelitian menunjukkan bahwa alat tangkap bagan perahu di PPN Sibolga memperoleh skor 28, yang termasuk dalam kategori sangat ramah lingkungan. Berdasarkan pedoman FAO (1995), skor 28–36 diklasifikasikan sebagai alat tangkap yang sangat ramah lingkungan

Kata Kunci: Bagan Perahu, CCRF, Hasil Tangkapan, Keramahan Lingkungan

INTRODUCTION

The waters off the west coast of Sumatra have high fishery resource potential, both in territorial waters and in the exclusive economic zone (EEZ) (Manik *et al.,* 2021). One of the ports in North Sumatra Province is the Sibolga Nusantara Fisheries Port (PPN), which boasts significant fish resource potential (Tampubolon, 2019). The Sibolga Nusantara Fisheries Port (PPN Sibolga) is located in Pondok Batu Village, Sarudik District, Central Tapanuli Regency, North Sumatra Province. Geographically, the port is located at coordinates 01-02'-15" South Latitude and 100-23'-34" East Longitude (Ariani & Heriyanto, 2020).

One of the fishing gears commonly used by fishermen in the Sibolga PPN is the boat lift net. The boat lift net is a fishing gear operated by lowering it into the water column and lifting it back up after catching a large number of fish. The process of operating a boat lift net begins with the helmsman determining the fishing ground, after which the boat lift net is towed by a delivery vessel to the desired fishing ground (Ramadhan *et al.,* 2016).

Fisheries management requires consideration of resources, ecosystems, the community's socio-economic status, and applicable policies. However, in current fisheries conditions, fisheries management focuses more on the community's socio-economic aspects, while paying less attention to ecosystem conditions. Therefore, the Sibolga PPN is expected to become a center for the growth and development of a capture fisheries-based fisheries economy and is expected to impact community welfare (Bangun *et al.,* 2015).

Identification of the catch and environmental friendliness of boat lift nets is necessary due to differences in research findings across locations regarding this fishing gear. According to research (Septian, 2019), the boat lift nets operated at the Karangantu PPN, Serang, Banten, are considered less environmentally friendly due to the use of very small mesh waring/nets (0.5 cm). In a study by Yuda *et al.,* (2012), the bagan fishing gear in Pelabuhan Ratu waters, Sukabumi Regency, was deemed less environmentally friendly because the fish caught were predominantly immature (56.44%) and non-target fish (45.33%). Conversely, a study by Surbakti and Sir (2019) in Oesapa waters, Kupang Bay, East Nusa Tenggara, showed that the bagan boat fishing gear in the area was highly environmentally friendly, with an indicator score of 28-36 according to FAO standards (1995).

This difference indicates that the environmental friendliness of bagan boat fishing gear can vary depending on several factors, such as differences in catch size, fish quality, the number of fish species caught, the impact of the fishing gear on the environment, and the fishing location. To date, based on available information, there is still little research specifically examining the environmental friendliness of bagan boat fishing gear in the Sibolga PPN. This research is important because environmentally unfriendly fishing gear can damage marine ecosystems and increase the risk of catching immature fish or non-target species. This is why

research is needed to determine the environmental friendliness of bagan boat fishing gear in the Sibolga National Fisheries System (PPN).

One reference for fishing gear currently practiced by many countries is the use of fishing gear using the CCRF criteria. The CCRF is a code of conduct containing international principles and standards regarding attitudes and behavior in responsible practices in national waters, the Exclusive Economic Zone (EEZ), and the high seas.

The CCRF explains that environmentally friendly fishing gear with high selectivity must be evaluated based on nine criteria: not damaging fish habitats, not endangering fishermen, producing good quality fish, not endangering consumers, low by-catch, low impact on biodiversity, not catching protected fish species, and social acceptance by the community (Marni *et al.,* 2020). These criteria can serve as a basis for evaluating the environmental friendliness of bagan boat fishing gear in the Sibolga National Fisheries System (PPN). So based on this background, this study aims to determine the level of environmental friendliness of the boat lift net fishing gear in accordance with the Code of Conduct for Responsible Fisheries (CCRF) at the Sibolga Archipelago Fisheries Port (PPN), North Sumatra.

RESEARCH METHODS

This research was conducted at the Sibolga Nusantara Fisheries Port (PPN) in Aek Habil Bay, Sarudik District, Central Tapanuli Regency, North Sumatra Province, specifically in one of the fishing vessels within the Sibolga PPN's working area, Tangkahan Murni, from April 30 to May 28, 2025. The materials used in this study were bagan boat catches. Furthermore, the equipment used included bagan boat fishing gear, boats, questionnaires, stationery, and documentation tools.

The method used in this study was a survey. In this research, questionnaires were used to obtain information from respondents. Data collection in this study used purposive sampling, selecting respondents who used bagan boat fishing gear at the Sibolga PPN. There are 52 bagan boat vessels at the Sibolga PPN, with a sample size of 10 bagan boat vessels. The respondents interviewed included crew members, captains, ship managers, fish sorters, consumers who purchased the catch, and local residents, totaling 60 respondents. The data collected from these respondents was analyzed according to their respective weighting criteria, based on the nine criteria for environmentally friendly fishing gear (CCRF) (FAO, 1995).

Data Analysis

The data analyzed included: catch composition, the proportion of fish caught as primary catch and bycatch, and an analysis of the environmental friendliness of the lift-net fishing gear.

1. Composition of Catch Results

The first step in the catch composition analysis is to identify the catch from the boat lift nets to determine their common and scientific names. After identification, the data obtained is processed, including the weight per species and the total weight of the catch to determine its composition.

According to Susaniati *et al.,* (2013), the formula for determining the catch composition in a given body of water is:

$$Pi=\frac{ni}{N}x100\ \%$$

Description: Pi : Species composition (%)
ni : weight of each type of fish species 1 (kg)
N : total weight of the catch

2. Proportion of Main Catch Fish (HTU) and Bycatch Fish (HTS)

The proportion of fish caught is grouped into two categories: main catch (HTU) and bycatch (HTS). According to Marliana *et al.,* (2015), fishing gear is considered environmentally friendly if it meets the specified criteria with a total score of more than 60%. In this case, the catch is grouped based on HTU (main catch) and HTS (bycatch). Then, the weight of the fish caught is added up and a comparison is made to determine which percentage is greater. Furthermore, according to Wulandari (2021), to calculate the proportion of main catch and bycatch, the following formula is used:

$$Main\ Catch = \frac{Main\ catch}{Total\ catch\ amount} x100\%$$

$$By\ catch = \frac{By\ catch}{Total\ catch\ amount} x100\%$$

3. Environmental Friendliness Level Analysis

The analysis of environmental friendliness levels is based on the FAO's weighting system, which includes nine criteria for environmentally friendly fishing gear according to the CCRF. These nine criteria will be analyzed, each with four weightings. Each of the four criteria has several values, ranging from the smallest to the largest, with 1 being the smallest and 4 being the largest. The environmental friendliness level can be analyzed using interviews with several respondents. This can be seen in Table 1.

Table 1. Environmental Friendliness Level Weighting

No	Criteria	Sub Criteria	Score
1	Has high selectivity	- Caught > 3 species of very different sizes	1
		-Caught 3 species of fish of different sizes far away	2
		- Catch < 3 species with relatively uniform size	3
		- Catching fish of one species with relatively uniform size	4
2	Does not damage the habitat	- Causes habitat destruction over large areas	1
		- Causes habitat destruction in a narrow area	2
		- Causes partial damage to a narrow area	3
		- Safe for habitat	4
3	Producing quality fish	- Dead and rotten fish	1
		- Dead, fresh and physically defective fish	2
		- Dead and fresh fish	3
		- Live fish	4
4	Does not endanger fishermen	- It can result in death for fishermen.	1
		- Can result in permanent disability for fishermen	2
		- It is only a temporary health problem	3
		- Safe for fishermen	4
5	Production does not harm consumers	- High risk of causing death to consumers	1
		- Potential to cause health problems in consumers	2
		- Relatively safe for consumers	3
		- Safe for consumers	4

6	Low by-catch	- By-catch is a type of product that is not sold in the market. - There are several types of by-catch and some are sold in the market. - By-catch < of 3 types and sold in the market - By-catch is less than three species and has a high price in the market	1 2 3 4
7	Impact on Biodiversity	- Causes the death of all living things that destroy the habitat - Causes the death of several species and destroys habitats - Causes the death of some species but does not damage habitats - Safe for biodiversity	1 2 3 4
8	Does not harm protected fish	- Protected fish are often caught - Protected fish caught several times - Protected fish have been caught - Protected fish are never caught	1 2 3 4
9	Socially acceptable	- Low investment costs - Economically profitable - Does not conflict with local culture - Does not conflict with existing regulations	1 2 3 4
	Total		

Sumber: Food and Agriculture Organization (1995)

The final result is determined using a formula, namely the total weighted value divided by the total number of respondents or calculated using the following formula:

$$X = \frac{\sum X1 + X2 + X3, \ldots Xn}{N}$$

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

Description:
X = Weight of Value
Xn = Total Amount of Weighted Values
N = Total Responden

For the value index is determined as follows:
1. X = 1-9 ; Very Unfriendly to the Environment
2. X = 10-18 ; Not Environmentally Friendly
3. X = 19-27 ; Environmentally friendly
4. X = 28-36 ; Very Environmentally Friendly

RESULT

Catch composition is a key indicator in assessing the effectiveness and selectivity of fishing gear. The catch was obtained from 10 vessels, each conducting one fishing trip over 12 days at sea. The following table shows the types of catch from the 10 vessels, as seen in Table 2.

Table 2. Types of Catch from Boat Bagan

No	Types of Catch	Latin Name	Heavy (kg)
1	Anchovy *	Stolephorus commersonnii	4823
2	Tembang Fish *	Sardinella gibbosa	8814
3	Squid *	Loligo sp	4220
4	Mackerel *	Rastrelliger kanagurta	1587
5	Selar Fish *	Selar boops	610,5
6	mackerel **	Scomberomorus commerson	400
7	mackarel tuna **	Auxis thazard	283
8	Kerong-kerong Fish **	Terapon jarbun	1
9	Barracuda Fish **	Sphyraena barracuda	807,5
10	Peperek Fish **	Gazza minuta	997,5
11	Siro Fish**	Amblygaster clupeoides	1119
12	Talang-talang Fish **	Scomberoides lysan	270
13	Pinang-pinang Fish**	Dipterygonotus balteatus	1047
14	Cuttlefish **	Sepia spp.	12,5
15	Todak Fish**	Ablennes hians	110,5
16	Ribbonfish **	Trichiurus lepturus	18
17	Flying Fish **	Decapterus mocrosoma	410,5
18	Tajak Fish **	Mene maculata	4836
19	Tetengkek Fish**	Megalaspis cordyla	50,5

Ket : * = HTU
** = HTS

The following presents the results of the fishing gear assessment based on the nine CCRF criteria. Each criterion has four rating levels (weighted from 1 to 4). A total of 60 respondents were interviewed in this study, so the numbers and percentages in the table indicate the number of respondents who rated the fishing gear at a specific weight. The following weightings for the nine CCRF criteria can be seen in Table 3.

Table 3: Weightings for the Nine CCRF Criteria

No	Criteria	Weight	Respondents	%
1	Has high selectivity	1	60	100
		2	0	0
		3	0	0
		4	0	0
2	Does not damage the habitat	1	0	0
		2	0	0
		3	60	100
		4	0	0
3	Producing quality fish	1	0	0
		2	1	2
		3	59	96
		4	0	0
4	Does not endanger fishermen	1	0	0
		2	0	0
		3	10	17
		4	50	83
5	Production does not harm consumers	1	0	0
		2	0	0
		3	0	0
		4	60	100
6	Low by-catch	1	0	0
		2	20	33
		3	40	67
		4	0	0
7	Impact of biodiversity	1	0	0
		2	0	0
		3	0	0
		4	60	100
8	Does not harm protected fish	1	0	0
		2	0	0
		3	13	22
		4	47	78
9	Socially acceptable	1	0	0
		2	33	55
		3	27	45
		4	0	0

Fishing Gear Selectivity

Based on interviews and observations, 100% of fishermen caught more than three species of fish of significantly different sizes, including anchovies, mackerel, mackerel, and tuna, all of which vary considerably in size. Selectivity in fishing operations plays a crucial role in ensuring the oceans consistently provide abundant seafood. Selectivity in certain catches prevents mis-fishing or catching seafood that is not yet suitable for fishing (Priambodho *et al.,* 2025).

The catch of lift nets in pure catches is divided into two types: main catch (HTU) and bycatch (HTS). Main catch is classified based on the fish's positive phototaxis characteristics, high economic value, or selling price, and stable catch yields (independent of the season).

Bycatch, on the other hand, is classified as undesirable fish because it has low economic value and unstable catch yields (depending on the season) (Septian, 2019).

The mesh size of a net will affect the catch (P. Ramadhan *et al.,* 2023). The smaller the net, the more fish are caught and the smaller the catch, allowing for a variety of fish of varying sizes. A typical catch per boat for a 12-day fishing trip is 7-13 fish species of varying sizes.

No Habitat Damage

Based on the interview results, 100% stated that fishing gear only causes partial damage to a small area. Habitat-safe fishing gear is fishing gear that does not have a significant impact on ecosystem function, maintaining the sustainability of fishing efforts and the preservation of fish resources (Ilan *et al.,* 2022). Boat lift net fishing gear is generally considered to have no significant impact on aquatic habitats, but it still has the potential to cause small-scale, limited disturbances. One source of this disturbance comes from the use of anchors lowered to stabilize the vessel's position during fishing operations.

Producing Quality Fish

Based on interviews and observations, 2% reported that the catch was dead, fresh, or physically defective during unloading. However, this was very rare, as only a small number of fish were caught during the catch, so they weren't picked up immediately, but waited until the catch was sufficient to avoid wasting fuel or other expenses. Meanwhile, 96% stated that the catch was dead and fresh during unloading. The bagan boat fishing gear is considered capable of producing good-quality fish, with the fish generally dead but still fresh during the unloading process.

The freshness of the catch is maintained using ice. During a single fishing trip, lasting approximately 12 days, the boat carries approximately 200 ice blocks. The ice is added to maintain the quality of the fish after catching. Chilling the fish means lowering its temperature as low as possible, but not freezing it. The colder the fish, the lower the bacterial and enzyme activity (Zulaihah *et al.,* 2018). Furthermore, to maintain the quality of the catch, the fish are routinely delivered or shipped using small boats, locally called "stempel".

No Harm to Fishermen

Based on interviews, 17% stated that operating fishing gear can cause temporary health problems. However, this only occurs among fishermen who are fishing for the first time. Accidents at work are unpredictable, although they can be anticipated, and they are common among younger fishermen, especially those with less experience due to lack of experience (Hasmidar *et al.,* 2024). Meanwhile, 83% stated that operating fishing gear is safe for fishermen and that there were no incidents of work-related accidents during the operation process.

Production Does Not Harm Consumers

Based on interviews and observations, the catch from the bagan boat fishing gear is considered 100% safe for consumers. This is because no harmful chemicals or preservatives are used in the entire handling process. For fish handling on board, only ice blocks are used to maintain the freshness of the catch. The catch is considered safe for consumers because only ice blocks are used to maintain freshness, and this handling process does not use harmful substances such as formaldehyde, borax, or other chemicals (Hasmidar *et al.,* 2024).

Low By-catch

Based on the interview results, 33% stated that by-catch consisted of several species and some species were marketable, while 67% stated that by-catch consisted of fewer than three species and was marketable. The bagan perahu fishing gear captures several types of by-catch but still has a selling price. The capture of these fish species in the fishing gear is due to the availability of food needed by these species (Surbakti & Sir, 2021), and one factor contributing to the diverse catch is the similarity of habitat between target and non-target fish (Rambun *et al.,* 2016). Another factor contributing to the high by-catch is the small mesh size of the net, so all fish that enter the net are caught.

Impact on Biodiversity

Interviews indicate that boat lift net fishing gear is 100% safe for marine biodiversity. This is based on its static operating method and the fact that it doesn't chase schools of fish, thus reducing the potential for disturbance to marine life. Furthermore, fishing locations are generally in muddy areas that are not sensitive habitats like coral reefs. Some fishing gear also uses fish aggregating devices (FADs) to help gather fish.

Does not harm protected fish

Based on the interview results, 22% stated that protected fish had been caught, but this happened accidentally, as the fish were caught in the net and caught in it. However, this is very rare, and if caught, the fish are immediately released back into the sea alive. Meanwhile, 78% stated that protected fish had never been caught, and the majority stated that they had never encountered protected species in the net during the operation process.

Socially Accepted

Based on the interview results, 55% stated that their fishing gear only met two of the four criteria: that the fishing gear does not conflict with local culture and that it does not conflict with existing regulations. Meanwhile, 45% stated that their fishing gear met three of the four criteria: that it is profitable, that it does not conflict with local culture, and that it does not conflict with existing regulations.

Table 3. Environmental Friendliness of Bagan Perahu

No	Criteria	Respondents (10 Ships)									
		1	2	3	4	5	6	7	8	9	10
1	Has high selectivity	1	1	1	1	1	1	1	1	1	1
2	Does not damage the habitatt	3	3	3	3	3	3	3	3	3	3
3	Producing quality fish	3	2,8	3	3	3	3	3	3	3	3
4	Does not endanger fishermen	3,8	3,8	3,8	4	3,7	3,7	3,7	4	4	3,8
5	Production does not harm consumers	4	4	4	4	4	4	4	4	4	4
6	Low by-catch	2,7	2,5	3	2,7	2,7	2,5	2,3	2,8	2,7	2,8
7	Impact of biodiversity	4	4	4	4	4	4	4	4	4	4
8	Does not harm protected fish	3,7	3,7	4	4	4	3,7	3,7	3,8	3,7	3,7
9	Socially Acceptable	2,5	2,5	2,3	2,7	2,7	2,5	2,3	2,3	2,3	2,3
Amount		28	27	28	28	27	27	27	27	28	27
Total Score						277,2/10 =28					

The assessment of 10 bagan perahu vessels at the Sibolga PPN (National Land Use Agency) was conducted, with each vessel assessed based on nine criteria using a scoring approach. The results are presented in Table 3 below.

Based on the results of the assessment of 10 bagan boat vessels, the level of environmental friendliness of the bagan boat fishing gear with a size of 28-30 GT is included in the environmentally friendly category with a score of 28. According to the FAO (Food Agriculture Organization) 1995 regarding the assessment of the CCRF (Code of Conduct for Responsible Fisheries) the value of category 28 - 36 is grouped in the category of very environmentally friendly fishing gear. By using environmentally friendly fishing gear, it will maintain the aquatic habitat and the number of fish caught has a high level of selectivity so that it has a high economic value with high quality and is suitable for consumption by consumers (Surbakti & Basri, 2024).

CONCLUSION

Based on the results of research on the level of environmental friendliness of the bagan boat fishing gear in Tangkahan Murni, PPN Sibolga, the results obtained that the bagan boat is categorized as a very environmentally friendly fishing gear with a score of 28. This assessment is based on the Code of Conduct for Responsible Fisheries (CCRF) guidelines which state that a score of 28-36 is included in the category of very environmentally friendly fishing gear. This score indicates that in general, the bagan boat fishing gear meets most of the CCRF assessment criteria for assessing environmentally friendly fishing gear.

ACKNOWLEDGEMENT

The authors would like to thank the Sibolga Nusantara Fisheries Port (PPN) for providing permission and facilities during the research. They also thank Tangkahan Murni, the fishermen, and all the workers at Tangkahan Murni who assisted in the data collection process and provided invaluable information for the success of this research. The support, cooperation, and time provided by all parties contributed significantly to the successful implementation of this research.

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