Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 29(3): 2755 – 2768 (2025)
www.ejabf.journals.ekb.eg

Analysis of the Level of Environmental Friendliness of Fishing Gear Perre-Perre in the Waters of Sinjai Regency

Karmila[1], Najamuddin[2], M. Abduh Ibnu Hajar[2]

[1]Master's Programs of Fisheries Science, Faculty of Marine Science and Fisheries, Hasanuddin University, Indonesia
[2]Capture Fishery Study Program, Faculty of Marine Science and Fisheries, Hasanuddin University, Indonesia

[*]**Corresponding Author: najamuddin@unhas.ac.id**

ARTICLE INFO

Article History:
Received: May 2, 2025
Accepted: June 8, 2025
Online: June 18, 2025

Keywords:
Environmental friendliness,
Perre-perre,
CCRF,
Selectivity,
Sustainable fisheries

ABSTRACT

Perre-perre is a traditional fishing gear that has relatively recently developed in South Sulawesi and is operated by fishermen in Sinjai Regency. This fishing gear uses high-pressure light, so the capture method has the potential to affect the level of environmental friendliness. This study aimed to assess the level of environmental friendliness based on the Code of Conduct for Responsible Fisheries (CCRF) using the census method. This study was conducted from September to December 2024 which showed that perre-perre obtained a total score of 29 based on 9 CCRF criteria which were categorized as extremely environmentally friendly fishing gear for the catch of black anchovies (*Stolephorus heterolobus*), white anchovies (*Stolephorus indicus*), grafted anchovies (*Thryssa baelama*), and the sardinella fish (*Sardinella* sp.). However, in terms of selectivity, perre-perre does not meet the requirements because there are still catches that do not meet the size of the catchability, namely sardinella fish (*Sardinella* sp.) with a percentage of 61% classified as unsuitable. However, these findings cannot be used as the only basis for stating that perre-perre is an environmentally unfriendly fishing gear. Therefore, further evaluation of perre-perre fishing gear is needed based on the criteria that have been set.

INTRODUCTION

The Sinjai Regency, South Sulawesi, has abundant fisheries potential. However, increasing fishing intensity raises concerns regarding the sustainability of aquatic ecosystems. The use of fishing gear that is not environmentally friendly can damage the marine ecosystem, threaten biodiversity, and hinder the conservation of marine resources by sustainable development goals (SDGs) 14 **(Drakeford *et al.*, 2023; Goritschnig, 2023; Habibie *et al.*, 2024)**.

Various analyses have been carried out to measure the level of environmental friendliness of fishing gear, one of which is the Code of Conduct for Responsible Fisheries (CCRF) analysis. This analysis has been applied to several types of fishing gear

such as Danish seine **(Hanafi *et al.*, 2019)**, guiding barrier fishing gear **(Patangngari *et al.*, 2022)**, and purse seine **(Ceballos-Santos *et al.*, 2023)**. Furthermore, a similar analysis will be applied to perre-perre fishing gear, which is still relatively new. Government Regulation Number 27 of 2021 Article 146 Paragraph (1) requires the use of environmentally friendly fishing gear to refer to fishing gear that is selective and does not damage the seabed habitat, which aims to maintain the sustainability of fish resources and preserve the aquatic environment. According to the CCRF standards, fishing gear must be selective, causing no damage for habitats, safe for fishermen, produce quality catches, and minimize non-target catches **(Sowunmin, 2020)**. The use of non-selective tools can damage ecosystems and increase catch waste; therefore, more selective fishing gear is needed to support sustainable fisheries **(Al Bayyinah & Nurkhasanah, 2021)**.

The target of perre-perre fishing gear is anchovies (*Stolephorus* sp). Anchovies are one of the main commodities in the Sinjai Regency, with a recorded production volume of 301.71 tons in 2023. Perre-perre is a fishing gear that is still relatively new and developing in the Sinjai Regency. This tool uses high-pressure light as a catching aid to attract the attention of target fish. The use of high-pressure light can affect the operating method of fishing gear and has the potential to affect marine ecosystems **(Barus & Septaria, 2023)**. In contrast, **Hasmidar and Wulandari (2024)** assessed perre-perre as environmentally friendly since it operates on the surface without damaging coral reefs, seagrasses and mangroves. However, this fishing gear is considered friendly to small fishermen owing to its low cost and ease of operation. On the other hand, there are several issues related to the environmental impact of this fishing gear, particularly regarding the selectivity and destruction of seabed habitats. Therefore, further research and supervision are needed to determine whether the perre-perre operation in the Fisheries Management Region (FMR) 713 fishing area contributes to sustainable fisheries or causes damage to the marine ecosystem.

MATERIALS AND METHODS

Research time and location

This study was conducted in Sinjai Regency, South Sulawesi, from September to December 2024 (Fig. 1).

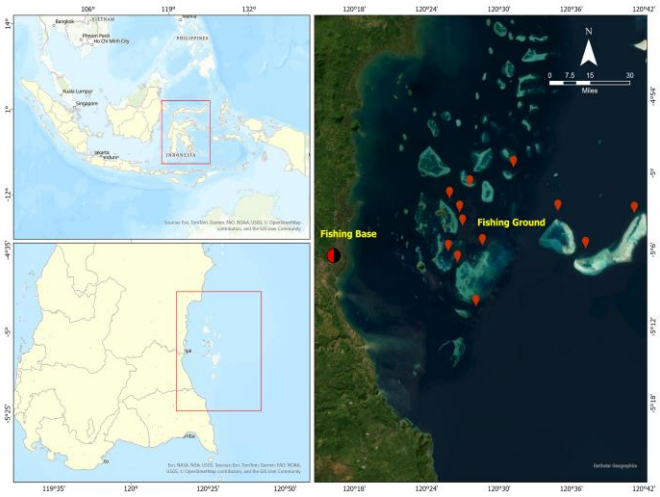

Fig. 1. Map of the research locations in Sinjai Regency's aquatic environment

Data collection

This study used a census method to identify nine fishermen who used perre-perre fishing gear in the Sinjai Regency. Catch data were obtained using purposive sampling techniques applied to 30 fishing trips. Furthermore, the type, number, and weight of fish were measured based on species to evaluate the level of selectivity of the fishing gear used.

Data were collected through questionnaires compiled based on CCRF principles and interviews with fishermen to explore the operational experience of perre-perre fishing gear. Following previous studies, dicret observations were conducted to evaluate the fishing gear operating process, fishing area, and its impact on the ecosystem **(Surbakti & Sir, 2019; Asni *et al*., 2022)**. In addition, catch analysis includes the evaluation of fishing gear selectivity against target species, and bycatch identification, including protected species, to support the sustainability of aquatic ecosystems **(Fenton *et al*., 2024)**.

Data analysis methods

The data analysis was based on the weighting of nine criteria for environmentally friendly fishing gear according to CCRF 1995, as shown in Table (1). The study population was perre-perre fishermen in Sinjai Regency, with nine respondents who had operated this fishing gear for at least one year. This limited number is due to the status of perre-perre as fishing gear that was only legalized last year. Data were collected through sampling, species identification, in addition to catch weight and size measurement. Bycatch analysis was conducted to evaluate the impact on non-target species, as well as observations of the physical condition of the fishing gear and its impact on sensitive habitats, such as coral reefs and seagrass meadows. Fishermen's interviews provide complete data related to the practice of using fishing gear. The results of the analysis were used to assess the selectivity, bycatch, and environmental impact of the CCRF principles in maintaining the sustainability of fisheries and marine ecosystems.

Analysis of the level of environmental degradation of perre-perre fishing gear, based on the criteria of the Code of Conduct for Responsible Fisheries, CCRF-FAO (**1995**), is shown in Table (1).

Table 1. Criteria for the level of environmental friendliness CCRF/FAO 1995

No	Criteria
1.	Has high selectivity
2.	Does not damage the habitat
3.	Does not harm fishermen
4.	Producing high-quality fish
5.	Production does not harm consumers
6.	Minimum wasted catch
7.	Impact on biodiversity
8.	Does not harm the protected fish
9.	Socially accepted 1. Low investment costs 2. Auspicious 3. Not against culture 4. Not against existing regulations

The category in determining the level of environmental friendliness refers to the provisions of **CCRF-FAO (1995)**.

Grade/Score 1-9 : Very unenvironmentally friendly
Grade/Score 10-18 : Not environmentally friendly
Grade/Score 19-27 : Eco-friendly
Score 28-36 : Very ecologically friendly

Weighting of respondents' answer scores on the assessment of the level of environmental friendliness was based on the CCRF criteria **(Sima *et al.*, 2013; Ilan *et al.*, 2022)**:

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

Notes:
X : Value weight
Xn : Total value weights
N : Total respondents

RESULTS AND DISCUSSION

Perre-perre fishing gear

Perre-perre fishing gear is passive fishing gear widely used by fishermen in the Sinjai Regency. Perre-Perre was initially introduced by fishermen in Barru Regency who entered the waters of Sinjai Regency. Perre-Perre then underwent various modifications to the fishing area in the Fisheries Management Region (FMR) 713 with the target of catching anchovies (*Stolephorus* sp.*)*. Some of the tools used include fish finders, lights,

and generators, as shown in Fig. (1). Perre-perres employ LED light sources to attract target species, thereby enhancing their fishing efficiency. Based on the results of the interviews, the average fishermen used LED lights with powers of 18 watts and 15 watts, with a total of 258 light bulbs. Perre-perre, as mentioned in Article 7 paragraph (1) letter e and a 6, is a passive fishing gear (PFG) operated with a ≥4 mm net, a ≤3 m frame, a ≤10 m net body, and a fishing gear auxiliary (FGA) in the form of a lamp with a total power of ≤2,000 watts and a boat (Ministry of Marine Affairs and Fisheries No. 36, 2023). This fishing aid increased the effectiveness and efficiency of the fishing process. The use of light with a brighter intensity can increase the effectiveness of fish capture but also has the potential to have ecological impacts **(Sudirman *et al.*, 2019)**. Therefore, this study recommends using LED lights as a more environmentally friendly alternative in fishing operations, as light can reduce energy consumption while maintaining fish catch efficiency.

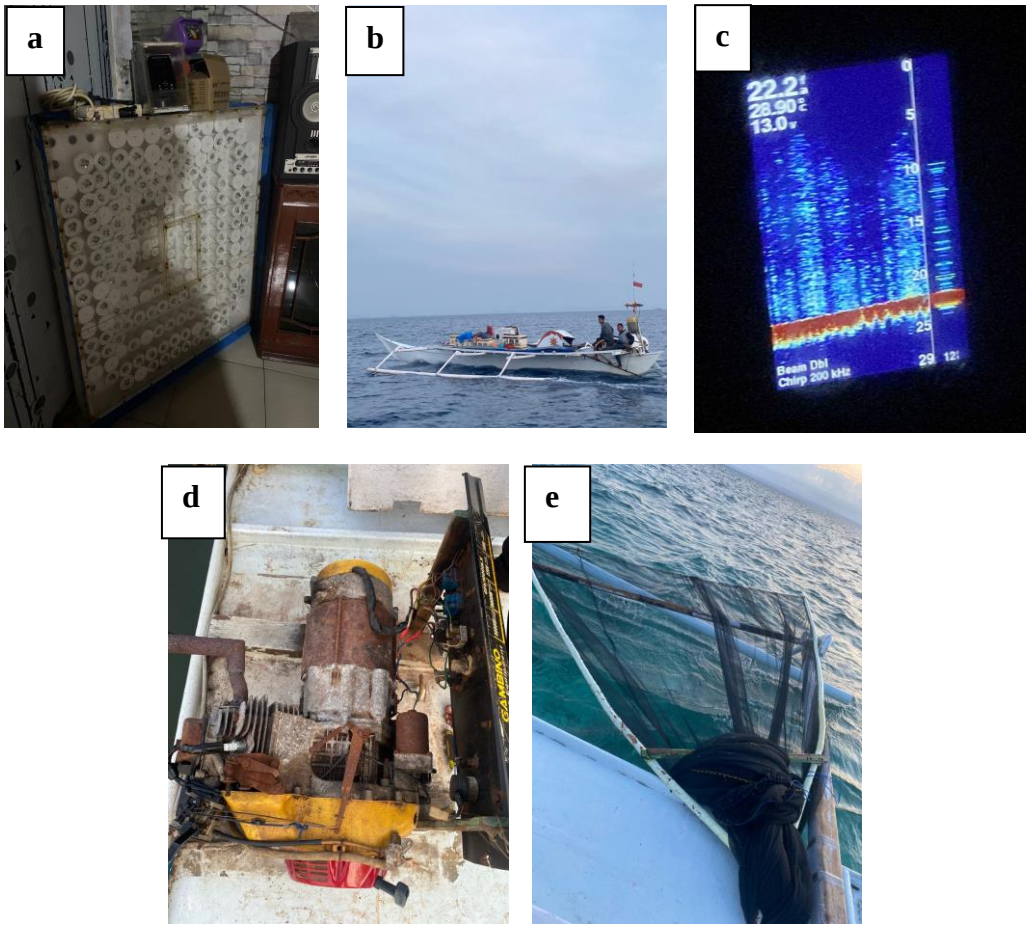

Fig. 1. (a) Lights, (b) Boat, (c) Fishfinder, (d) Genset, (e) Scoop net

Based on the study results, perre-perre fishermen carry out fishing activities within 20 miles from the fishing base to the fishing ground, and with the rule that the distance between perre-perre fishermen and other fishermen, such as charters, must be 1 mile. The operating method begins with the release of the anchor after the ship arrives at

the fishing site, which is suspected to have a high concentration of fish based on the results of fish finder detection. Next, the lights are turned on to attract the fish's attention, after which the fishing process is carried out using modified shovels, and then the catch is manually lifted onto the boat.

The results of the interviews show that fishermen who use perre-perre fishing gear are between 20 and 57 years old, with an average age of 34. Of the nine owners of these perre-perres, all are natives living in Sinjai Regency, with a minimum level of education in elementary school and a maximum in junior high school.

Types of perre-perre catch

Data on the type of catch of perre-perre fishing gear obtained by participating in fishing operations can be identified visually by direct observation. These observations allow for more accurate documentation of the dominant species caught as primary and by-catch. The analysis of catch can provide an overview of the effectiveness of perre-perre fishing gear and its impact on fishery resources in the waters where the research is located. The types of catch from perre-perre fishing gear are shown in Fig. (2).

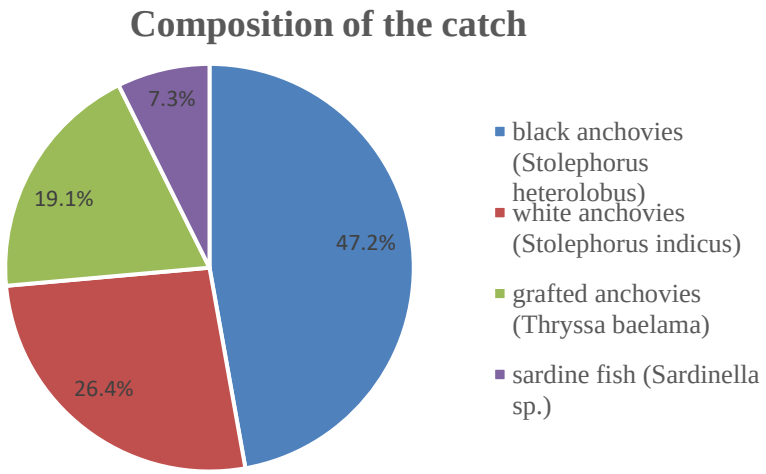

Fig. 2. Composition of fish catches

Fig. (2) illustrates the composition of perre-perre types caught during the study, comprising four fish species. The most frequently caught were black anchovies (*Stolephorus heterolobus*), accounting for 47.2% or 3890kg, followed by the white anchovies (*Stolephorus indicus*) at 26.4% or 2176kg, grafted anchovies (*Thryssa baelama*) at 19.1% or 1573 kg, and sardine fish (*Sardinella* sp.) at 7.3% or 605 kg. The sizes of the perre-perre catch are detailed in Table (2).

Table 2. Perre-perre fish catch size

Fish species	Samples	Length (cm)	Information
black anchovies (*Stolephorus heterolobus*)	900	4.3 - 8.2	29% Not suitable for capture 71% Worth catching
white anchovies (*Stolephorus indicus*)	810	5 - 8.5	10% Not suitable for capture 90% Worth catching
grafted anchovies (*Thryssa baelama*)	720	5-11.5	50% Not suitable for capture 50% Worth catching
sardine fish (*Sardinella sp.*)	630	9.5 - 15.4	61% Not suitable for capture 39% Worth catching

Source: 2024 primary data from 30 trip research results.

Based on the data in Table (2), among the four types of fish caught, black anchovies (*Stolephorus heterolobus*) are suitable for catching, and white anchovies (*Stolephorus indicus*) are suitable for catching. However, quantitatively, the number approached the criterion limit that is not environmentally friendly, based on the standard of < 30% of catches that are suitable for catching, can be said to be environmentally friendly **(Sunarto & Nurruhwati, 2016)**. However, for the catch of sardine fish (*Sardinella* sp.) with presentations, 61% were not fit to be captured, and 39% were arrestable. This shows that the caught sardinella fish are still juvenile in size or have not reached gonadal maturity; therefore, if done continuously, it can potentially damage the sustainability of the fish population. The size of the catch of black anchovies is 6cm, the size of the white anchovy is 5.4 -7cm, and 9.2cm **(Bandjar & Andamari, 1990; Pranggono, 2003; Mainassy, 2017)**. The catch size of anchovies varies depending on the species and area of the catch **(Saleh & Supriyadi, 2016)**. In addition, the length of the first mature gonad fish is 12.8cm, and that of the sardinella fish ranges from 13 to 16.7cm depending on the species and the location of the study **(Muafi, 2017; Tampubolon *et al.*, 2019)**. The study results showed that sardinella fish are not the main target of perre-perre fishing gear, which has the fewest catches. The fishing gear can be considered selective if it can only capture the species that are the main targets **(Mallawa, 2006)**.

Table 3. Assessment level of friendliness of perre–perre fishing gear

Parameter	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Has high selectivity	1	1	1	2	2	2	1	1	1	12
Does not damage habitat	4	4	4	4	4	4	4	4	4	36
Producing quality fish	3	3	3	3	3	3	3	3	3	27
Does not harm fishermen	3	3	3	4	4	3	3	3	4	30
Production does not harm consumers	4	4	4	4	4	4	4	4	4	36
By-catch	2	2	2	2	2	2	2	2	2	36
Impact on biodiversity	4	4	4	4	4	4	4	4	4	36
Does not harm the protected fish	4	4	4	4	4	4	4	4	4	32
Socially acceptable	1	2	3	2	2	3	2	2	3	20
Total	**26**	**27**	**28**	**29**	**29**	**29**	**27**	**27**	**25**	**269**
Rating Weights										**29**

Note: *1-9: Very unfriendly; 10-18: Unfriendly;*
19-27: Eco-friendly; and 28-36: Very eco-friendly

Source: 2024 primary research data.

The level of friendliness of perre-perre fishing gear in Sinjai Regency was obtained based on the results of interviews with nine fishermen as respondents in this study using nine criteria based on the **CCRF FAO (1995)**, who obtained an assessment score for perre-perre fishing gear as a total of 29, as shown in Table (3). The assessment results show that perre-perre fishing gear in the Sinjai Regency is classified as very environmentally friendly because it does not damage the ecosystem **(Dolman & Brakes, 2018; Ilan *et al*., 2022)**. This principle is in line with SDG 14, which emphasizes the protection of marine ecosystems and the responsible resource management **(Pellowe & Leslie, 2021)**. However, of the nine criteria assessed, some aspects were not included in the environmentally friendly category, namely selectivity, since catches with sizes unsuitable for catching were still found. Nevertheless, these findings cannot be used as the only basis for stating that perre-perre is environmentally unfriendly fishing gear. The location of the operation affects the size of the fish caught, as larger fish tend to be found in water farther from the coast **(Najamuddin *et al*., 2021)**. Management strategies, such as restricting fishing gear, setting operating areas, and monitoring overfishing, are needed for sustainability. Thus, all respondents' answers to the nine criteria for assessing the level of friendliness of fishing gear in the Sinjai Regency are shown in Table (3).

Selectivity catch of perre-perre fishing gear based on the type and size of fish caught, such as the black anchovies (*Stolephorus heterolobus*), white anchovies (*Stolephorus indicus*), grafted anchovies (*Thryssa baelama*), and bycatch of fish sardine (*Sardinella sp.*) from the results of the study, only the white anchovies (*Stolephorus indicus*), and black anchovies (*Stolephorus heterolobus*) are included in the category of size suitable for catching, as seen in Table (2). The selectivity of fishing gear plays an important role in maintaining fishery sustainability by regulating the type and size of fish caught and reducing overexploitation **(Yulisti *et al*., 2024)**. The net design and fast hauling technique allow the perre-perre to minimize bycatch and discard. The effectiveness of fishing gear in sorting target fish is greatly influenced by the size of the nets and their operational methods, which contributes to the sustainability of fish stocks and aquatic ecosystems **(Najamuddin *et al*., 2017; 2020; 2021)**. Therefore, optimizing perre-perre selectivity through adjustment of net size is needed so that only appropriately sized fish are caught, thereby supporting sustainable fisheries management and improving catch quality and economic value **(Dhany *et al*., 2023)**.

The impact of fishing gear on habitat from the results of the perre-perre fishing gear research obtained a value of 36, which is categorized as very environmentally friendly and is considered safe for the habitat since it is operated on the surface of the water to prevent damage to benthic ecosystems, such as coral reefs, seagrass beds, and

mangroves. Unlike fishing gear that comes into direct contact with the seafloor and risks disrupting benthic habitats **(Patangngari *et al.*, 2025)**, perre-perre supports the principle of sustainable fisheries by maintaining stocks of non-target species and reducing pressure on marine ecosystems. Using non-selective fishing gear can cause overfishing and ecosystem imbalances **(Tamrol *et al.*, 2012)**, perre-perre selectivity is an important factor in maintaining the sustainability of fishery resources.

The quality of fish caught in this criterion obtained a score of 27 environmentally friendly categories; the perre-perre catch is considered good with proper post-catch handling, namely, the provision of ice to maintain the freshness of fish for marketing. This method ensures that the fish remain in a fresh dead condition, which indicates the quality **(Nanga *et al.*, 2024)**. Good fish handling not only meets quality standards but also increases consumer confidence in the safety and freshness of fishery products.

Impact of fishing gear

The use of perre-perre fishing gear does not significantly impact fishermen. Based on the results of the interviews with nine respondents, no reports of fatal accidents or permanent disabilities were found. Six respondents reported experiencing temporary health problems due to manual operations during setting hauling, such as fatigue and wrist injuries. Meanwhile, three others assessed this fishing gear as safe, thus obtaining a score of 30, which included being very environmentally friendly. Even though the boat used is open, the risk of an accident is still anticipated when implementing fishing gear operations.

Product impact on consumers

The results of the study obtained a score of 36 categories that are very environmentally friendly because there is no negative impact on the catch of perre-perre fishing gear because it maintains its freshness by not using harmful materials such as formalin, borax, or other chemicals, and handling it by providing ice. Refrigeration, particularly with ice, is a common method of preserving fish by slowing down physical/chemical reactions, microorganisms, and enzymes and can extend the shelf life of fish **(Tavares *et al.*, 2021)**. All the respondents provided statements on this matter.

Bycatch results obtained a score of 36, included in the category of very environmentally friendly, and interviews showed that the bycatch of perre-perre fishing gear was sardine fish (*Sardinella* sp.*)* because of the four types of products caught; the catch is the least but has a selling price. According to the CCRF-FAO, the selectivity of fishing gear in terms of time and location of operation plays an important role in reducing bycatch and maintaining the ecosystem. Therefore, perre-perre is an environmentally

friendly fishing gear that supports sustainable fisheries **(Sari *et al*., 2024; Nugraha *et al*., 2026)**.

The impact of fishing gear on biodiversity

Perre-Perre fishing gear is declared safe for habitats by obtaining a score of 36 very environmentally friendly categories, because they do not hurt biodiversity and promote the sustainability of fish resources. The operational method does not disturb the bottom of the water; therefore, there is a minimal risk of damaging sensitive ecosystems. The impact of fishing gear on biodiversity depends on its type and use, and installation in sensitive ecosystems can potentially damage marine habitats **(Subehi *et al*., 2017; Karadurmus & Bilgili, 2024)**. The CCRF initiative, perre-perre operations carried out on the surface of the waters, supports sustainable fisheries by minimizing non-target biota catches and maintaining the balance of marine ecosystems.

Not catching protected fish

Fish species caught consisted of anchovies (*Stolephorus* sp.*)* and sardine fish (*Sardinella* sp.), a type of small pelagic fish that is common in coastal waters and plays an important role in exospecies and local fisheries. Thus, to obtain a score of 32 categories of very environmentally friendly, all respondents confirmed that these two species were not included in Indonesia's threatened or protected category. However, capture techniques still need to be considered. Anchovies and Sardinella have abundant stocks in Indonesian waters and are not at risk of extinction **(BKIPM, 2017)**.

Conformity of customs and local wisdom

Perre-perre fishing gear in Sinjai Regency obtained a score of 20, which is included in the environmentally friendly category but close to the limit of not being environmentally friendly based on the provisions of the CCRF; perre-perre fishing gear in Sinjai Regency is socially accepted since it is economically profitable and does not contradict local wisdom. Although initially, it caused a social conflict among the chart fishermen regarding the seizure of the fishing area, an agreement between the fishermen was finally reached by dividing the fishing area by one mile. Sustainability of fisheries depends on technical regulations, social justice, and community involvement in resource management **(Sari *et al*., 2024)**.

CONCLUSION

The results of this study showed that the perre-perre fishing gear is operated by fishermen in Sinjai Regency, with catches including the black anchovies (*Stolephorus heterolobus*), white anchovies (*Stolephorus indicus*), grafted anchovies (*Thryssa baelama*), and bycatch of sardine fish (*Sardinella* sp.). Based on the analysis using the

CCRF principle, the perre-perre fishing gear obtained a score of 29, including the category of very environmentally friendly. However, when reviewed more deeply based on selectivity criteria, it was found that there were indications of a lower environmentally friendly impact. These findings suggest that, while fishing gear generally meets sustainability standards, further evaluation of specific aspects is still needed to ensure more responsible fisheries management of the aquatic environment.

REFERENCES

Al Bayyinah, A. and Nurkhasanah, D. (2021). Analysis of Environmentally Semi Trammel Net based on Code of Conduct Responsibilities Fisheries (CCRF) in Cirebon Waters: Indonesia. *Jendela ASWAJA, 2*(02), 1-9.

Asni, A.; Kasmawati, K. and Sugianto, H. T. (2022). Studi Tingkat Keramahan Lingkungan Alat Tangkap Purse Seine Di Ppi Pontap Kota Palopo. Journal Of Indonesia Tropical Fisheries (Joint-Fish): *Jurnal Akuakultur, Teknologi Dan Manajemen Perikanan Tangkap Dan Ilmu Kelautan, 5*(2), 228-240

Badan Karantina Ikan Pengendalian Mutu dan Keamanan Hasil Perikanan (BKIPM). (2017). Peraturan Presiden Republik Indonesia Nomor 2 Tahun 2017 tentang Kebijakan Kelautan Indonesia.

Barus, S. I. and Septaria, E. (2023). Reposisi Kewenangan Daerah dalam Pelaksanaan Pengawasan Terhadap Penggunaan Alat Penangkan Ikan. *Jurnal Rechts Vinding: Media Pembinaan Hukum Nasional*, *12*(3).

Bandjar, H. and Andamari, R. (1990). Perbandingan Kelamin, Tingkat Kematangan Gonad dan Fekunditas Ikan Puri Putih (Stole. phorus deuisi) di Teluk Saparua. *Jurnal Penelitian Perikanan Laut*, (55).

Ceballos-Santos, S.; Laso, J.; Ulloa, L.; Salmón, I. R.; Margallo, M. and Aldaco, R. (2023). Environmental performance of Cantabrian (Northern Spain) pelagic fisheries: Assessment of purse seines and minor art fleets under a life cycle approach. *Science of the Total Environment*, *855*, 158884.

Dhany, A. F.; Prihantoko, K. E. and Setiyanto, I. (2023). Tingkat Keramahlingkungan Pukat Cincin Pelagis Kecil Berdasarkan Code of Conduct for Responsible Fisheries (Ccrf) Di Ppi Tanjungbalai Asahan, Sumatera Utara. *Jurnal Perikanan Tangkap: Indonesian Journal of Capture Fisheries*, *7*(1), 24-33.

Dolman, S. J. and Brakes, P. (2018). Sustainable fisheries management and welfare of bycaught and entangled cetaceans. *Frontiers in Veterinary Science 5*, 287.

Drakeford, B. M.; Forse, A. and Failler, P. (2023). The economic impact of introducing biodegradable fishing gear as ghost fishing mitigation in the English Channel static gear fishery. *Marine Pollution Bulletin*, *192*, 114918.

Fenton, M.; Szostek, C. L.; Delargy, A.; Johnson, A. F.; Kaiser, M. J.; Hinz, H. and

Sciberras, M. (2024). Catch yield and selectivity of modified scallop dredge to reduce seabed impact. *Plos one*, *19*(5), e0302225.

FAO] Food and Agriculture Organization. (1995). Code of Conduct For Responsible Fisheries. FAO. Rome, Italy. 41P.

Goritschnig, A. (2023). The impact of Illegal, Unreported, and Unregulated (IUU) fishing on Biodiversity and Societies in West Africa.

Habibie, D. A.; Sadjeli, S. S.; Sabilla, I. Z. and Tesalonika, B. (2024). Penanggulangan overfishing terhadap ekosistem Laut Guna Terwujudnya *Sustainable Development Gaoals 14.*

Hanafi, A.; Riniwati, H. and Afandhi, A. (2019). Fishing gear assessment was based on the Code of Conduct for Responsible Fisheries (CCRF) at Probolinggo. *Indonesian Journal of Environment and Sustainable Development*, *10*(2).

Hasmidar, N. L. and Wulandari, S. (2024). Tingkat Keramahan Lingkungan Alat Tangkap Perre-perre Berdasarkan *Code of Conduct for Responsible Fisheries*. Agrokompleks Vol. 24 No. 1 Januari 2024 p-ISSN: 1412-811x, e-ISSN: 2775-2321.

Ilan, M. V.; Paulus, C. A. and Sine, K. G. (2022). Tingkat Ramah Lingkungan Alat Tangkap Bagan Tancap dan Bagan Apung di Kelurahan Oesapa, Kecamatan Kelapa Lima, Kota Kupang. *Jurnal Bahari Papadak 3*(2), 28-40.

Karadurmuş, U. and Bilgili, L. (2024). Environmental impacts of synthetic fishing nets from manufacturing to disposal: A case study of Türkiye from a life cycle perspective. *Marine Pollution Bulletin*, *198*, 115889.

Kementerian Kelautan dan Perikanan Republik Indonesia. (2023). *Peraturan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 36 Tahun 2023 tentang rencana pengelolaan perikanan tuna, cakalang, dan tongkol di WPPNRI 713*. Jakarta: Kementerian Kelautan dan Perikanan. https://peraturan.kkp.go.id/

Mainassy, M. C. (2017). Pengaruh parameter fisika dan kimia terhadap kehadiran ikan lompa (Thryssa baelama Forsskal) di Perairan Pantai Apui Kabupaten Maluku Tengah. *Jurnal Perikanan Universitas Gadjah Mada*, *19*(2), 61-66.

Mallawa, A. (2006). Pengelolaan sumberdaya ikan berkelanjutan dan berbasis masyarakat. *Disajikan pada lokakarya agenda penelitian program COREMAP II Kabupaten Selayar*, 9-10.

Muafi. (2017). Ukuran pertama kali matang gonad ikan tembang (*Sardinella spp.*) di perairan Pantai Selatan Jawa. *Jurnal Perikanan dan Kelautan*, *8*(1), 33–40.

Najamuddin; Baso, A.; Musbir, M.; Akmaluddin, A.; Nelwan, A.; Sudirman, S. and Zainuddin, M. (2017). Performance of fishing gear on skipjack tuna Katsuwonus pelamis in South Sulawesi, Indonesia. AACl Bioflux Vol 10.

Najamuddin; Assir, A.; Palo, M. and Asni, A. (2020). Sustainable flying fish (*Hirundichthys oxycephalus*) fishing with a drift gillnet in Makassar Strait, Indonesia. In *IOP Conference Series: Earth and Environmental Science* (vol. 492, No. 1, p. 012157). IOP Publishing.

Najamuddin; Palo, M.; Assir, A. and Hardianti. (2021). Analysis of sustainable biological aspects of Scottish seine net in the waters of Majene, Indonesia. In *IOP Conference Series: Earth and Environmental Science* (vol 860 No. 1, p. 012105). IOP Publishing.

Nanga, S.; Tallo, I. and Al Ayubi, A. (2024). Tingkat Keramahan Lingkungan Alat Tangkap Jaring Insang (Gill net) yang dioperasikan oleh Nelayan di Desa Lamatokan Kecamatan Ile Ape Timur Kabupaten Lembata. *Jurnal Bahari Papadak*, *5*(1), 88-93.

Nugraha, B.; Turni, H. S. and Kamaluddin, K. (2021). Komposisi Hasil Tangkapan Perikanan Payang dan Bagan Tancap Pada Semester 1 2006. *Jurnal Riset Jakarta*, *14*(1), 1-8.

Patangngari, F.; Amir, F. and Jaya, I. (2022). Composition of fish catches, and environmental friendliness levels based on code of conduct for responsible fisheries (CCRF) using traditional set-net fishing gear with different depths in Malela waters, Awangpone district, Bone Regency. In *IOP Conference Series: Earth and Environmental Science* (vol. 1119, No. 1, p. 012028). IOP Publishing.

Patangngari, F.; Musbir. and Najamuddin. (2025). Fish diversity and associated physicochemical conditions in seaweed farming areas in the Bone Gulf Waters, South Sulawesi, Indonesia. *Biodiversitas Journal of Biological Diversity*, *26*(1).

Pellowe, K. E.; and Leslie, H. M. (2021). The ecosystem service lens revealed diverse community values for small-scale fisheries. *Ambio*, *50*(3), 586-600.

Pranggono, H. (2003). *Analisis Potensi dan Pengelolaan Perikanan Teri di Perairan Kabupaten Pekalongan* (Doctoral dissertation, Program Pendidikan Pasca sarjana Universitas Diponegoro).

Tampubolon, P. A.; Agustina, M. and Fahmi, Z. (2019). Aspek biologi ikan tembang (Sardinella gibbosa Bleeker, 1849) di di Perairan Prigi dan Sekitarnya. *BAWAL Widya Riset Perikanan Tangkap*, *11*(3), 151-159.

Tamrol, A.; Rahmawati, R. and Santosa, D. A. (2012). *Pengaruh alat tangkap tidak selektif terhadap kelestarian sumber daya ikan*. Jakarta: Penerbit Bahari Ilmu.

Tavares, J.; Martins, A.; Fidalgo, L. G.; Lima, V.; Amaral, R. A.; Pinto, C. A. and Saraiva, J. A. (2021). Degradation and preservation of fresh fish using emerging physical technologies. *Foods*, *10*(4), 780.

Sari, I.; Boli, P.; White, A.; Barclay, K.; Simatauw, F.; Tebay, S. and Rotinsulu, C. (2024). Integrating social equity as a new paradigm in managing fisheries: Case of

the flying fish roe fishery, West Papua Province, Indonesia. *Ocean & Coastal Management*, *249*, 106971.

Saleh, K. and Supriyadi, F. (2016). Distribusi Ukuran Ikan Teri (Stolephorus SP) Yang Ditangkap Pada Perikanan Bagan Tancap Di Muara Sungsang Sumatera Selatan (Size Distribution of Anchovy (Stolephorus SP.) Caught in Stationary Liftnets at Sungsang Estuary South Sumatera). *Marine Fisheries: Journal of Marine Fisheries Technology and Management*, *7*(2), 161-169.

Sima, A. M.; Djayus, Y. and Harahap, Z.A. (2014). *Identifikasi alat tangkap ikan ramah lingkungan di Desa bagan Asahan Kecamatan Tanjung Balai* (Doctoral dissertation, Universitas Sumatera Utara).

Sowunmi, F. A. (2020). Environmental and Economic Burden of Sand Dredging on Artisanal Fishing in Lagos State, Nigeria. *Inclusive Green Growth: Challenges and Opportunities for Green Business in Rural Africa*, 137-159.

Subehi, S.; Boesono, H. and Dewi, D. A. N. N. (2017). Analisis alat penangkap ikan ramah lingkungan berbasis code of conduct for responsible fisheries (CCRF) di TPI Kedung Malang Jepara. *Journal of Fisheries Resources Utilization Management and Technology*, *6*(4), 01-20.

Sudirman; Najamuddin; Palo, M.; Musbir; Kurnia, M. and Nelwan, A. (April 2019). Development of utilization of electrical lamp for fixed lift net (bagan) in Makassar Strait. In *IOP Conference Series: Earth and Environmental Science* (vol. 253, No. 1, p. 012026). IOP Publishing.

Sunarto, S., and Nurruhwati, I. (2016). Selektivitas alat tangkap purse seine di pangkalan pendaratan ikan (PPI) muara angke jakarta. *Jurnal Perikanan Kelautan*, *7*(2).

Surbakti, J. A. and Sir, R. W. (2019). Tingkat keramahan lingkungan alat tangkap bagan diperairan Oespa Teluk Kupang, Nusa Tenggara Timur. *Journal of Science and Technology 15*(1), 41-45.

Yulisti, M.; Hidayat, A. S.; Firdausy, C. M.; Mu'awanah, U.; Kurniasari, N. and Nurjati, E. (2024). Effects of eco-friendly fishing gear on fishermen's welfare and sustainable fisheries: Lessons learned from Indonesia. *Marine Pollution Bulletin*, *198*, 115888.