

FUNDAÇÃO APOLÔNIO SALLES
F A D U R P E

FINAL REPORT - ACTIVITY 1

Project Identification

Assessing quantities, causes, mitigation and prevention measures for abandoned, lost or otherwise discarded fishing gear (ALDFG) in Brazil.



**EQUIPAMENTOS DE PESCA, PERDIDOS,
ABANDONADOS, OU DESCARTADOS**

**ABANDONED, LOST OR OTHERWISE DISCARDED
FISHING GEAR (ALDFG)**



Summary

Summary.....	2
Summary of Figure	4
Summary of Tables	5
Executive Summary.....	6
1. Project Background and Objectives	7
1.1. Background and Rationale	7
1.2. Objectives.....	7
1.3 Summary Description of Activities and Deliverables	8
1.4 Key Performance Indicators and Means of Verification	10
1.5 Workplan and Calendar	12
2. Achieved Results.....	13
2.1. Results of Activity 1.9	13
Title	14
Abstract	14
Introduction and Rationale.....	14
Method	15
Definition of the sample size	17
Defining ALDFG magnitude	18
Analysis of causes and practices - Risk Screening Matrix.....	19
Results	19
Fisheries' Profile	23
Location of the survey	26
Seasonality of fishing activities.....	28
The Assessment of ALDFG Magnitude	29
Analysis of ALDFG Data Distribution	30
Direct Estimation of ALDFG Magnitude.....	31
Bootstrap estimation of ALDFG magnitude	33
The frequency of fishing gear loss.....	35
Causes and practices of ALDFG	36
The list of causes and practices	36
Relative results for causes and practices	37
ALDFG Risk Screening Matrix.....	37



End-of-Life Management	43
On board of vessels collections	43
Facilities for End-of-Life Gear Disposal.....	44
Marking fishing gear	46
Fishers' point of view	48
The importance of measures	49
Ideas, or examples of good practice	51
Discussion	52
Final Remarks	54
Acknowledgements	55
References.....	56

Summary of Figure

Figure 1. The workflow for implementing the FAO Global ALDFG Survey.....	16
Figure 2. A bar plot shows the age-class distribution of the respondents, by fishing gear.	23
Figure 3. Distribution of respondents' years of fishing experience by gear type.....	24
Figure 4. Where the survey was conducted and the country's Exclusive Economic Zone (EEZ): Brazil	26
Figure 5. Estimated ALDFG mass per year by gear type (combined from direct kg/year and units × mid-unit mass; log scale).	30
Figure 6. Median per-vessel ALDFG (kg per vessel per year) with percentile bounds, by gear type.	32
Figure 7. Fleet-level totals (tonnes per year), computed as per-vessel medians multiplied by vessel counts, with the same bounds.	33
Figure 8. Bootstrapped per-vessel ALDFG (kg per vessel per year) with 10th–90th percentile bounds, by gear type.....	34
Figure 9. Bootstrapped fleet-level totals (tonnes per year) with the same bounds.	35
Figure 10. Proportion of responses by question for respondents using trawl as the main fishing gear.	39
Figure 11. Proportion of responses by question for respondents using gillnets as the main fishing gear.	39
Figure 12. Proportion of responses by question for respondents using traps as the main fishing gear.	40
Figure 13. Analysis for each potential cause of ALDFG, based on the Risk Scoring Methodology, generated by pairing two answers (Cause Frequency X Avoidance Practice).....	40
Figure 14. Distribution of responses by gear type regarding fishing gear collection and storage on board.	43
Figure 15. Distribution of responses by gear type regarding the area on board for fishing gear storage to return to port facilities.	44
Figure 16. Existing facilities in or near the vessel's home port or landing sites.	45
Figure 17. There is a charge in using the facility in case of existence.	45
Figure 18. The treatment of end-of-life fishing gear materials.	46
Figure 19. Awareness of the law or regulations for marking fishing gear.	47
Figure 20. Share of responses if fishing gears in use is marked in any way.	47
Figure 21. Share of responses on the existence of marks traceable to the owner or vessel.	48
Figure 22. Fishers' responses to ALDFG and plastic pollution in the oceans.....	49
Figure 23. Trawl fishers' perception of the importance of measures to avoid/reduce ALDFG.....	50
Figure 24. Gillnet fishers' perception of the importance of measures to avoid/reduce ALDFG.	50
Figure 25. Trap fishers' perception of the importance of measures to avoid/reduce ALDFG.	51



Summary of Tables

Table 1. Sample sizes required for the number of surveys to be undertaken with Brazilian trawl, gillnet, and trap/pot fishers, based on the total number of vessels recorded nationally, and using Cochran's Equation	18
Table 2. Overview of surveyed fishing gear types, estimated number of vessels, and collected responder (fishers) count.	20
Table 3. Number of Interviews conducted by states and Brazilian macroregions.	21
Table 4. Number and percentage of interviews by fishing gear across states, macro-Brazilian regions, and nationally.....	22
Table 5. Respondents by job title (role on board) and gear type.	24
Table 6. Respondents by gear type and vessel length class.....	25
Table 7. Respondents by gear type and sub-gear category (ISSCFG	25
Table 8. Respondents by gear type and fishing ground (EEZ countries and FAO major areas).	26
Table 9. Summary by gear type: sample size (n), median, interquartile range (IQR) and 90th percentile of estimated ALDFG mass per year (kg).	30
Table 10. Per-vessel ALDFG estimates by gear type: median annual mass and percentile bounds (kg per vessel per year).	31
Table 11. Projected national ALDFG by gear type: per-vessel medians multiplied by fleet size (tonnes per year).....	31
Table 12. Bootstrap per-vessel ALDFG by gear type: sample size (n) and bootstrapped median with 10 th –90 th percentile bounds (kg per vessel per year).	33
Table 13. Bootstrap fleet totals by gear type: median and 10 th –90 th percentile bounds (tonnes per year).	34
Table 14. Paired survey items: 17 causes of ALDFG and the corresponding practices to avoid or mitigate them.	38
Table 15. Risk summary by cause–practice item (means over valid pairs), for the trawling fleet.	41
Table 16. Gillnets and entangling nets fleet risk summary by cause–practice item (means over valid pairs).....	41
Table 17. Traps and pots fleet risk summary by cause–practice item (means over valid pairs).....	42

Executive Summary

This project proposes to support the Food and Agriculture Organization of the United Nations (FAO) in implementing additional GloLitter Partnerships project activities to address Abandoned, Lost, or Otherwise Discarded Fishing Gear (ALDFG), a significant source of sea-based marine plastic litter originating from the fisheries sector. The GloLitter Partnerships Project Phase I is implemented by the International Maritime Organization (IMO) and the FAO, with initial funding from the Government of Norway via the Norwegian Agency for Development Cooperation (Norad). GloLitter assists developing countries in reducing Marine Plastic Litter (MPL) from the maritime transport and fisheries sectors.

The key objective of the project is to sustainably improve the livelihoods of members of coastal fishing communities in Brazil, particularly fishers using gillnets, trawl nets, and traps/pots as main fishing gears, through *“assessing quantities, causes, mitigation, and prevention measures for abandoned, lost, or otherwise discarded fishing gear (ALDFG) in Brazil”*: Two main outputs are planned: *FAO Global ALDFG Survey is conducted at the national scale, for three major fishing gear types in Brazil: gillnets and entangle nets, trawl nets, and traps and/or pots; with ALDFG quantities, causes and prevention measures assessed; and Key Brazilian fisheries stakeholders are convened in a national workshop to discuss findings and results from FAO ALDFG surveys and lobster trap modification trials to reduce ghost fishing.*

This Final ALDFG Survey Report completes the analysis of Activity 1 and supplements the earlier Progress Reports. The initial report addressed data quality issues, outlier identification, feedback on FAO's Brazil ALDFG Country Report draft, and an overview of the survey results. The objective was to review the survey and understand local factors influencing its implementation during the National Workshop, including fieldwork challenges, awareness efforts, and material distribution. Therefore, this report provides a concluding remark for the first phase, Activity 1.9, and is based on the analysis provided by the FAO Global ALDFG Survey, managed by the Fishing Technology and Operations Team (NFIFO). Data were entered into FAO's secure online portal for storage and analysis, where they undergo routine checks and verification before reporting.

To address critical gaps in understanding the scale and nature of abandoned, lost, or otherwise discarded fishing gear (ALDFG), the Food and Agriculture Organization (FAO), through the Fishing Technology and Operations Team (NFIFO), has established a global survey program. This initiative utilizes standardized questionnaires tailored to specific fishing gear types, which are administered directly to fishers during field interviews. The program's design ensures that data collection is consistent across all participating regions, enabling harmonized analyses at national, regional, and global levels.

Central to the survey program is the integration of field interview data with a secure, centralized data portal. This system allows for efficient storage, routine verification, and comprehensive analysis of collected information. By supporting evidence-informed interventions, the program helps pinpoint actionable strategies to address ALDFG based on the recognized hierarchy of response: prevention, mitigation, and remediation.

Insights gained from these standardized data sets empower stakeholders to implement practical measures that focus on three key approaches. First, prevention strategies are prioritized to avoid gear loss wherever possible. Second, mitigation measures aim to reduce environmental and socioeconomic impacts when loss does occur. Third, remediation efforts facilitate the retrieval of derelict gear when feasible, further minimizing the negative impacts associated with ALDFG.

1. Project Background and Objectives

1.1. Background and Rationale

Brazilian marine fisheries include some of the most disregarded economic activities in the country. Besides economic insecurity, social and environmental aspects hamper the implementation of public policies to alleviate poverty and improve livelihoods. While access to fishing resources is feasible, precautionary approaches to sustainability concerns are necessary. Amongst the most worrisome, yet readily accessible, are fishing resources targeted by fisheries using gillnets, trawl nets, and traps. These fisheries contribute to the subsistence of many people, often through the efforts of marginalized fishers.

This project proposed to assist the Food and Agriculture Organization of the United Nations (FAO) in implementing additional GloLitter Partnerships project (GloLitter) activities to support Brazil as the project's South American Lead Partnering Country (LPC) to address Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) as a key source of sea-based marine plastic litter from the fisheries sector. The GloLitter Partnerships Project Phase I is implemented by the International Maritime Organization (IMO) and the FAO, with initial funding from the Government of Norway via the Norwegian Agency for Development Cooperation (Norad). GloLitter assists developing countries in reducing Marine Plastic Litter (MPL) from the maritime transport and fisheries sectors. The project strengthens government and port management institutional capacities in addressing MPL issues and supports legal, policy, and institutional reforms at the country level. GloLitter is achieving its objectives by focusing on several areas identified in the IMO Action Plan to address MPL from Ships, as well as in complementary actions identified by FAO, including supporting the provisions of the Voluntary Guidelines on the Marking of Fishing Gear (VGMFG).

Although the long-term goal of the project is to assist developing countries in reducing marine plastic litter from the maritime transport and fisheries sectors, it also aims to sustainably improve the livelihoods of members of coastal fishing communities in Brazil, particularly fishers using gillnets, trawl nets, and traps as main fishing gears, through *“assessing quantities, causes, mitigation and prevention measures for abandoned, lost or otherwise discarded fishing gear (ALDFG) in Brazil”*.

1.2. Objectives

To carry out the FAO Global ALDFG Surveys for at least three major fishing gear types at the national scale in Brazil, to assess ALDFG quantities, causes, and prevention and reduction measures, and to conduct a national workshop with key fisheries.

Two main outputs are planned:

Output 1. *FAO Global ALDFG Survey is conducted at the national scale, for three major fishing gear types in Brazil: gillnets and entangling nets, trawl nets, and traps and/or pots with ALDFG quantities, causes, and prevention measures assessed.*

Output 2: *Key Brazilian fisheries stakeholders are convened in a national workshop to discuss findings and results from FAO Global ALDFG Surveys and lobster trap modification trials aimed at reducing ghostfishing.*

1.3 Summary Description of Activities and Deliverables

To reduce marine plastic litter in fisheries, the fishing sector must enhance its ability to manage ALDFG within its respective fisheries. The initial purpose of carrying out the FAO Global ALDFG Surveys for gillnet, trawl net, and trap fishing gears at the national scale in Brazil is to assess ALDFG quantities, causes, and prevention and reduction measures. The second phase will conduct a national workshop with key fisheries stakeholders to share findings and results from the FAO ALDFG surveys and lobster trap ghostfishing reduction trials under GloLitter Activity 4.2.1¹, to support GloLitter Activity 4.2.2².

Activity 1.1: Complete Pre-Survey Questionnaire to determine fisheries to be surveyed and corresponding sample sizes with FAO Global ALDFG Survey team. Liaise with FAO Global ALDFG Survey team to complete the “Pre-Survey Questionnaire.”

DELIVERABLE 1.1: Pre-Survey Questionnaire.

Date to be submitted to FAO: 31 October, 2024

Activity 1.2: Translate FAO Global ALDFG surveys into the local language that the surveys will be conducted in, with the FAO Global ALDFG Survey team support.

DELIVERABLE 1.2: Portuguese versions of FAO ALDFG surveys carried out.

Date to be submitted to FAO: 15 November, 2024

Activity 1.3: Develop staff capacity to implement the FAO Global ALDFG Survey and data entry portal, aiming at using the FAO online data entry portal, reviewing the FAO Global ALDFG Surveys undertaken, and participating in online training delivered by FAO staff.

Activity 1.4: Conduct fisher surveys according to the sampling plan using FAO’s Global ALDFG Survey forms.

Activity 1.5: Enter fisher survey data into the online FAO Global ALDFG Survey Application, as the surveys are conducted, from the start of the surveys through the survey conclusion.

¹ GloLitter Activity 4.2.1: Technically support the testing of gear modifications in selected small-scale fisheries to reduce ghost fishing

² GloLitter Activity 4.2.2: Analyse and discuss with key stakeholders the findings of the gear and gear marking tests and alternative options from other regions/fisheries

DELIVERABLE 1.3: Raw survey data.

Date to be submitted to FAO: 31 May 2025

Activity 1.6a: Produce a *first project progress report* summarizing challenges and results of the conducted interviews, using a “Google Form” applied in Portuguese and adapted from the FAO Global ALDFG questionnaire.

DELIVERABLE 1.4: First Progress report from the answers and results as outcomes produced by the “Google Form”, delivered to the staff members participating in data collection, and explained during the field visit.

Date to be submitted to FAO: 31 March 2025

Activity 1.6b: Produce a *second project progress report* summarizing how many interviews have been conducted to date for which fisheries/gear types, where/how interviews were conducted, any issues encountered, recommendations on how to improve future surveys, and recommendations (if any) for further surveys in Brazil.

DELIVERABLE 1.5: Second Progress report with the data and outcomes produced by the FAO Global ALDFG online data portal.

Date to be submitted to FAO: 15 May 2025

Activity 1.7: *Review and provide input on the results of FAO’s analyses of data quality to identify outlier values.*

DELIVERABLE 1.6: Validated survey data.

Date to be submitted to FAO: 15 June 2025

Activity 1.8: *Comment on an FAO auto-generated draft Brazil ALDFG Country Report.*

DELIVERABLE 1.7: Comments on data analysis done by the FAO Global ALDFG Survey team.

Date to be submitted to FAO: 30 June 2025

Activity 1.9: *Final ALDFG survey report.* Produce a final report of the ALDFG surveys. The final ALDFG survey report should include an abstract, introduction/background, methods, results, discussion, conclusion, acknowledgements and supplementary materials sections.

DELIVERABLE 1.8: Final ALDFG survey report.

Date to be submitted to FAO: 31 July 2025

Activity 2.1: *Conduct national workshop preparatory meetings with workshop organizers/conveners.*

Activity 2.2: *Prepare for the national workshop* by sharing relevant preparatory materials with FAO before the workshop.

DELIVERABLE 2.1: Submission of summary of national workshop preparatory materials.

Date to be submitted to FAO: 15 August 2025

Activity 2.3: *Host ALDFG national workshop*.

Date to be submitted to FAO: 31 August 2025

Activity 2.4: *National workshop report*. Summarizing workshop proceedings and discussions among stakeholders.

DELIVERABLE 2.2: Workshop report with all elements and materials described above.

Date to be submitted to FAO: 10 September 2025

Activity 3: *Final report*. Following the conclusion of Activities 1.1 – 1.7 (national ALDFG surveys) and 2.1 – 2.4 (national ALDFG workshop).

DELIVERABLE 3: Final report.

Date to be submitted to FAO: 30 September 2025

1.4 Key Performance Indicators and Means of Verification

Key performance indicator 1.1: *Submission of SP Pre Survey Questionnaire*, to determine the number and type of fisheries to be surveyed and associated sample sizes, in accordance with Activity 1.1.

Key performance indicator 1.2: *Submission of Portuguese versions of ALDFG surveys* to ensure surveys are conducted in the relevant local language, in accordance with Activity 1.2.

Key performance indicator 1.3: *Submission of SP interview staff information into FAO ALDFG portal* to ensure SP staff capacity to implement FAO ALDFG surveys, in accordance with Activity 1.3.

Key performance indicator 1.4: *Progress report submitted for FAO Global ALDFG surveys*, including a summary of the number conducted for which fisheries/gear types, staff/interviewer effort employed, locations of surveys, key findings and challenges to date, in accordance with Activity 1.6.

Key performance indicator 1.5: *All completed survey data entered in the FAO Global ALDFG online database*, in accordance with Activities 1.3 – 1.6.

Key performance indicator 1.6: *Input provided to FAO's data quality assessment and verification process to identify outlier values*, in accordance with Activity 1.7.

Key performance indicator 1.7: *Comments provided to FAO auto-generated draft Brazil ALDFG country report*, in accordance with Activity 1.8.



Key performance indicator 1.8: *Submission of final FAO Global ALDFG Survey report, in accordance with Activity 1.9.*

Key performance indicator 2.1: *Summary of national workshop preparatory materials submitted at least 2 weeks prior to national ALDFG workshop, in accordance with Activities 2.1 – 2.2.*

Key performance indicator 2.2: *National ALDFG workshop hosted, in accordance with Activity 2.3.*

Key performance indicator 2.3: *National ALDFG workshop report submitted, in accordance with Activity 2.4.*

Key performance indicator 3: *Final report submitted in accordance with Activity 3.*

1.5 Workplan and Calendar

Activity Number	Description	Month (2024)				Month (2025)																			
		November		December		January		February		March		April		May		June		July		August		September		October	
		1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd		
1.1	Submit Pre-Survey Questionnaire to FAO ALDFG Survey Team																								
1.2	Submit translated versions of FAO Global ALDFG surveys to the FAO Global ALDFG Survey Team.																								
1.3	Develop staff capacity to implement the FAO Global ALDFG Survey and data entry portal.																								
1.4	Conduct fisher surveys																								
1.5	Enter fisher survey data into the online FAO Global ALDFG Survey Application.																								
1.6a	First project progress report																								
1.6b	Second project progress report																								
1.7	Review and provide input on the results of FAO's analyses of data quality to identify outlier values.																								
1.8	Comment on an FAO auto-generated draft Brazil ALDFG Country Report																								
1.9	Final ALDFG survey report																								
2.1	Conduct national workshop preparatory meetings.																								
2.2	Prepare for the national workshop.																								
2.3	Host the ALDFG national workshop																								
2.4	National workshop report																								
3	Final report submitted																								

2. Achieved Results

This **Final Report** outlines the results obtained in conducting Activity 1. More specifically, the necessary adjustment, review, and analysis of the results under the conduct of sub-activity 1.9. It provides a concluding remark for the first phase, based on the analysis provided by the FAO Global ALDFG Survey, managed by the Fishing Technology and Operations Team (NFIFO). Data were entered into FAO's secure online portal for storage and analysis, where they undergo routine checks and verification prior to reporting.

The FAO Global ALDFG Survey Team highlighted that the provided analysis is not an official FAO publication. Partner organizations are encouraged to use text and graphics in their own outputs, with attribution. The report is produced in English; on request, selected figures or tables can be provided in other languages when local survey translations are available. Survey responses remain confidential, and the data collected are co-owned by FAO and the survey partner(s), as per the Survey collaboration framework. The report template and code are under active development. Re-running the script on the same dataset later may therefore yield updated figures or tables as methods improve.

2.1. Results of Activity 1.9

Activity 1.9: *Final ALDFG survey report*. Produce a final report of the ALDFG surveys. The final ALDFG survey report should include an abstract, introduction/background, methods, results, discussion, conclusion, acknowledgments, and supplementary materials sections.

Title

Assessing quantities, causes, mitigation, and prevention measures for abandoned, lost, or otherwise discarded fishing gear (ALDFG) in Brazil.

Abstract

Abandoned, lost, or discarded fishing gear (ALDFG) presents considerable environmental and socio-economic challenges. Documented consequences include degradation of benthic habitats, entanglement and ghost fishing, the spread of invasive species, increased microplastic pollution, and navigational hazards. Furthermore, ALDFG results in retrieval and disposal expenses, as well as indirect impacts on other economic sectors, such as tourism. Effectively mitigating these risks necessitates robust, fishery- and gear-specific data regarding the causes, frequency, and extent of gear loss. The analysis presented herein is the result of the data collected through the project “*assessing quantities, causes, mitigation and prevention measures for abandoned, lost or otherwise discarded fishing gear (ALDFG) in Brazil*”, which aims to help the Food and Agriculture Organization (FAO) expand GloLitter Partnerships activities targeting sea-based marine plastic litter from fisheries. Phase I of GloLitter is led by the International Maritime Organization and FAO, funded by Norway through Norad, and seeks to help developing countries cut marine plastic pollution from shipping and fishing. The project's main goal is to sustainably improve livelihoods in Brazilian coastal fishing communities, especially for those using gillnets, trawl nets, and traps/pots, by assessing and mitigating ALDFG, across the recognized hierarchy (prevention, mitigation, and remediation), so that gear loss is avoided where possible, impacts are reduced when loss occurs, and derelict gear is retrieved where feasible. Here, we present the conclusions and analysis of the ALDFG Survey in the form of a final study. This study includes the challenges and results of the fieldwork, awareness-raising activities, materials dissemination, and collaboration to better understand the local factors that affect the surveys. A total of 315 stakeholders linked to the fishing sector in Brazil were interviewed, with 18 researchers participating in the fieldwork activities as interviewers. These efforts aim to improve understanding of ALDFG dynamics and support partners in designing targeted, context-appropriate actions to reduce gear loss and its effects on people and ecosystems.

Introduction and Rationale

Brazilian marine fisheries are among the most disregarded economic activities in the country. Besides economic insecurity, social and environmental aspects hamper the implementation of public policies to alleviate poverty and improve livelihoods. While access to fishing resources is feasible, precautionary approaches to sustainability concerns are necessary. Amongst the most worrisome, yet readily accessible, are fishing resources targeted by fisheries using gillnets, trawl nets, and traps/pots. These fisheries contribute to the subsistence of many people, often through the efforts of marginalized fishers.

Over the past decade, there has been growing recognition of the need to address the adverse ecological and socio-economic effects of Abandoned, Lost, or otherwise Discarded Fishing Gear

(ALDFG). Substantial knowledge gaps remain regarding the life cycle and end-of-life management of fishing gear, the quantities of ALDFG entering aquatic environments, and the effectiveness of interventions to prevent, minimize, and remediate associated impacts. In response to recommendations of the Committee on Fisheries (COFI), FAO's Fishing Technology and Operations Team (NFIFO) has developed standardized, gear-specific questionnaires to collect information on the causes and rates of ALDFG, together with a central online portal to compile, store, and analyze survey responses.

To overcome these challenges, ALDFG's issues were included as additional activities implemented through the GloLitter Partnerships Project. This project aims to assist the Food and Agriculture Organization of the United Nations (FAO) in supporting Brazil as the South American Lead Partnering Country (LPC) to address ALDFG, a key source of sea-based marine plastic litter from the fisheries sector. The GloLitter Partnerships Project Phase I is implemented by the International Maritime Organization (IMO) and the FAO, with initial funding from the Government of Norway via the Norwegian Agency for Development Cooperation (Norad). GloLitter assists developing countries in reducing Marine Plastic Litter (MPL) from the maritime transport and fisheries sectors. The project strengthens government and port management institutional capacities in addressing MPL issues and supports legal, policy, and institutional reforms at the country level. GloLitter is achieving its objectives by focusing on several areas identified in the IMO Action Plan to address MPL from Ships, as well as in complementary actions identified by FAO, including supporting the provisions of the Voluntary Guidelines on the Marking of Fishing Gear (VGMFG).

Although the long-term goal of the project is to assist developing countries in reducing sea-based marine plastic litter, it also aims to sustainably improve the livelihoods of members of coastal fishing communities in Brazil, particularly fishers using gillnets, trawl nets, and traps/pots as main fishing gears, through *“assessing quantities, causes, mitigation and prevention measures for abandoned, lost, or otherwise discarded fishing gear (ALDFG) in Brazil”*.

The main aim is to prioritize prevention, mitigation, and clean-up efforts to avoid gear loss when possible, lessen its impact when it happens, and recover lost gear whenever feasible. This final report presents the findings and analysis from the ALDFG Survey, covering challenges and results from fieldwork, awareness campaigns, distribution of materials, and collaboration to better understand local factors influencing the surveys. These initiatives are designed to deepen our understanding of ALDFG patterns and to help partners create effective, context-specific strategies for reducing gear loss and its negative impacts on both people and ecosystems. These efforts aim to improve understanding of ALDFG dynamics and support partners in designing targeted, context-appropriate actions to reduce gear loss and its effects on people and ecosystems.

Method

To fill critical knowledge gaps, FAO (through NFIFO) coordinates a global survey program using standardized, gear-specific questionnaires administered to fishers. The program combines field interviews with a central data portal to enable harmonized national, regional, and global analyses

and supports evidence-informed interventions. The workflow for implementing the FAO Global ALDFG Survey is shown in the flowchart (Figure 1).

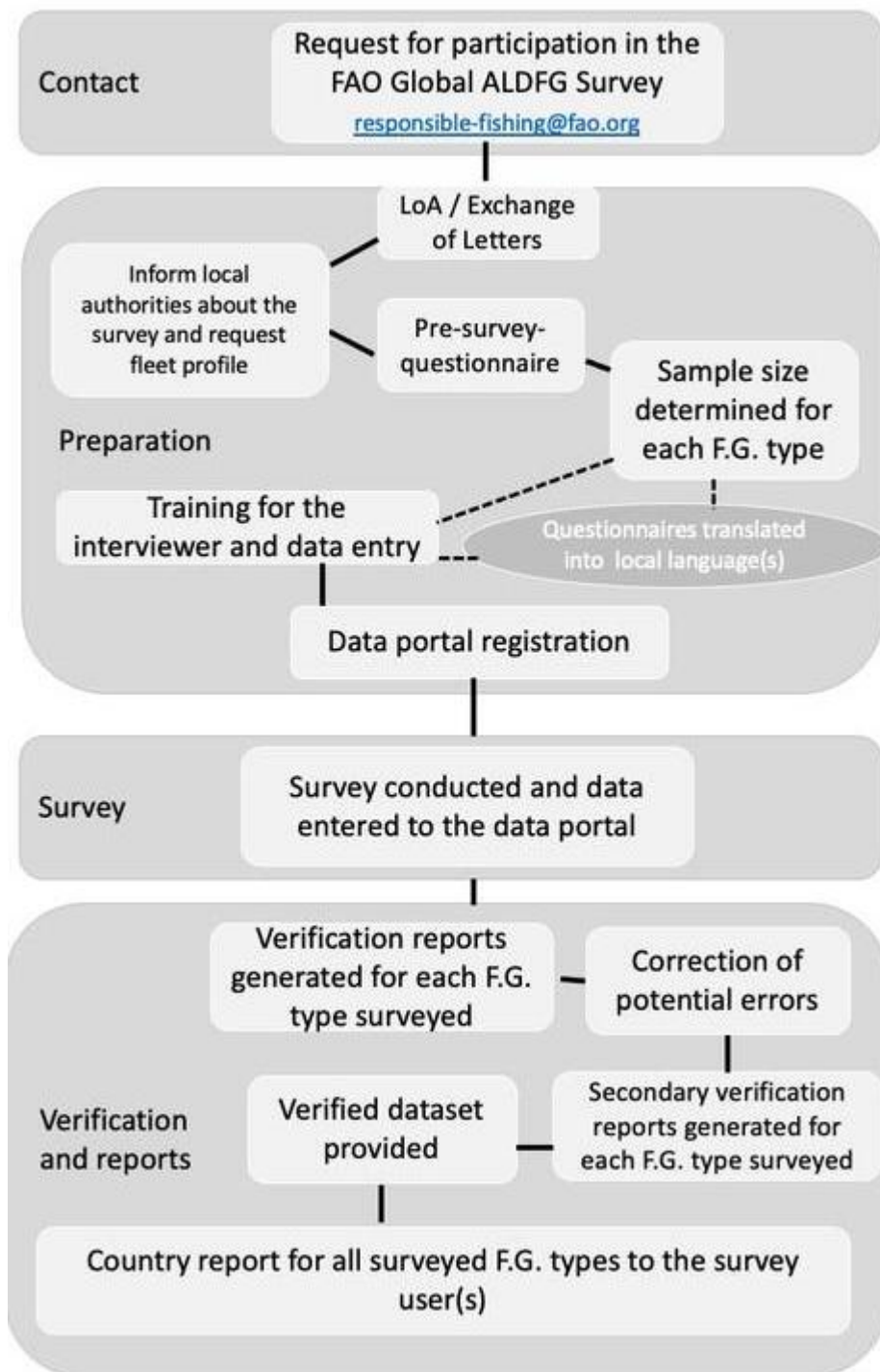


Figure 1. The workflow for implementing the FAO Global ALDFG Survey

To effectively carry out the FAO Global ALDFG Survey and gather comprehensive data, a pre-survey questionnaire on ALDFG was completed for at least three gear types: traps/pots, gillnets and entangling nets, and trawl nets. The selection of these gears was considered for specific reasons, and an extension study to other types of gears was not possible, mainly due to:



- ✓ These are the fishing gears most commonly used in Brazil;
- ✓ Brazilian coastline, more than 8,000km;
- ✓ Available financial resources from FAO;
- ✓ Difficulties in hiring a team of English speakers.

The method of investigation employed also considered:

- ✓ Challenges faced at the beginning of the project, meetings held, participants and stakeholders contacted, meeting agendas, and letters of invitation or introduction shared with stakeholders.
- ✓ Visiting sites across Brazil to introduce the FAO Global ALDFG Survey Project, promote collaboration, assess survey feasibility, and raise awareness about ALDFG.
- ✓ To gain stakeholder engagement and researchers' involvement along the Brazilian coast, which were chosen for their importance in local fisheries studies.
- ✓ To share project summaries in Portuguese using dissemination materials along the coast.

Definition of the sample size

The methodology was defined and advised by the FAO Global ALDFG Survey Team. Evaluation of the sample size needed for the survey of trawls, gillnets, and traps/pots in Brazil was conducted and established according to the number of fishing boats registered in the Ministry of Fisheries and Aquaculture of Brazil system, which included: 5,231 trawlers registered, 8,842 boats fishing with gillnets, and 3,159 using traps and/or pots. Cochran's Equation (1977) was used to determine sample size from the known population sizes (i.e., number of vessels):

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right)}$$

The goal was to maintain a 90% confidence level ($Z=1.65$) and a margin of error of 7.5% ($e=0.075$). The "sample size needed" is described in the table below, based on the criteria in red. Using Cochran's equation and the records of numbers of vessels from the Brazilian fishing boat registry system, it was determined that surveys should be conducted with 119 trawl fishers, 120 gillnet fishers, and 117 trap fishers (Table 1).

Next, the sample size was determined for the number of fishers to be surveyed to reach an 80% confidence level ($Z=1.28$) and a margin of error of 10% ($e=0.1$). Using the same sample size methodology described above, it was determined that 41 fishers are required to be interviewed for each of the three gear types (Table 1). If fewer than 41 responses are collected, the uncertainty for the fishery will be too high to make reliable estimates.

Finally, an upper limit sample size, titled "No need to exceed", was determined, which reflects the point where the confidence level reaches 95% ($Z=1.96$) with a margin of error of 5% ($e=0.05$). Collecting more responses than this upper limit (358 trawl fishers surveyed, 369 gillnet fishers

surveyed, and 343 trap/pot fishers surveyed) would not necessarily improve the data and would only use extra time and resources without significant gains (Table 1).

Table 1. Sample sizes required for the number of surveys to be undertaken with Brazilian trawl, gillnet, and trap/pot fishers, based on the total number of vessels recorded nationally, and using Cochran's Equation

Sample size	Total number of vessels	Sample size needed	Absolutely minimal Must be more	No need to exceed
Trawls	5231	119	41	358
Gillnets	8842	120	41	369
Traps/pots	3159	117	41	343

FAO vessel size is classified by length overall (LOA) in three categories: under 12 m, 12–24 m, and 24 m and over (LOA refers to the maximum length of a vessel measured from the two most distant points on the hull). Still, the fishing gear types and categories used in this survey follow the revised International Standard Statistical Classification of Fishing Gear (ISSCFG, Rev. 1, 2016), as elaborated by He et al. (2021).

Defining ALDFG magnitude

To estimate the magnitude of Abandoned, Lost or Discarded fishing gear (ALDFG), respondents were asked two complementary questions: (i) how much synthetic gear material they believe enters the environment from their fishery in a typical year, and (ii) how many complete units of gear are lost, together with the approximate mass of one gear unit (allowing conversion to an annual mass). These self-reported metrics are recognized as informative but inherently uncertain because fisheries, gear types, and operating conditions vary widely. As with any interview dataset, extreme values may arise from misinterpretation, recall bias, overestimation, or data-entry errors. The methods applied, therefore, examine the distribution of responses and summarize results using robust statistics to reduce the influence of outliers. For clarity and comparability, the results present a single, concise visual summary of the distribution, rather than multiple alternative plots.

These interview responses were summarized as an annual mass (kg per vessel per year) for each selected gear type, and the mean together with a 95% confidence interval was obtained by non-parametric bootstrap, which reduces, but does not remove, sensitivity to skewed data and outliers. Direct annual ALDFG for each selected gear type per vessel was estimated using percentile bounds to reduce the influence of outliers, then projected to the fleet by multiplying by the registered or estimated number of vessels using each gear type, yielding indicative national totals (tonnes per year).

To reduce the effect of outliers, a simple bootstrap method was applied. The data for each gear type are repeatedly resampled from the original survey responses. Each resample is made by randomly selecting answers one at a time from the original dataset, allowing the same answer to be selected more than once, a process called sampling with replacement. This resampling is performed 10 times, with each resample containing 100 observations. For each bootstrap

sample, the median was calculated, providing a stable estimate of the central tendency and the uncertainty range. These median values are then scaled up to the fleet level by multiplying by the total number of vessels using each gear type.

Analysis of causes and practices - Risk Screening Matrix

Gear loss in fisheries can occur for operational, environmental, or management reasons. To understand these causes, fishers were asked how frequently each occurs with their gear—choosing from Always, Sometimes, or Never. They also reported how often the crew tries to prevent or fix the problem, using the same scale. These answers are combined into a 3 X 3 matrix: risk is highest when gear loss happens often and crews rarely try to stop it, and lowest when loss is rare and prevention is common. This matrix serves as a practical tool for identifying where preventing or reducing gear loss could make a real difference. However, it's not a formal risk assessment and should be used together with local experience and context.

Risk Scoring Methodology

This method is intended as a pragmatic, first-pass screening tool rather than a full quantitative risk assessment. It highlights areas where prevention and mitigation efforts are likely to be most effective. For each potential cause of ALDFG, two related survey questions are paired:

- ✓ *Cause Frequency (Y-axis)*: This question assesses how often a specific cause of gear loss occurs. The responses are scored on a 3-point scale: **1** = Never; **2** = Sometimes; **3** = Always; and
- ✓ *Avoidance Practice (X-axis)*: This question evaluates how frequently the fishing crew actively works to prevent or mitigate that specific cause. To ensure that a lack of action corresponds to a higher risk score, the scoring for this question is reverse-scored: **1** = Always (The crew always tries to avoid the cause); **2** = Sometimes; and **3** = Never (The crew never tries to avoid the cause).

By multiplying the scores of these two answers (Cause Frequency X Avoidance Practice), we generate a simple screening score ranging from 1 to 9. A higher score indicates a greater risk, indicating a situation in which a cause of gear loss is common and the practices to avoid it are infrequent.

The 3 × 3 Risk Matrix (Heat Map)

Each paired response is plotted on a 3 X 3 matrix to visualize risk intensity:

- ✓ *Low Risk (Green)*: The cause rarely occurs, and avoidance practices are common.
- ✓ *Medium-Low Risk (Yellow)*: A moderate level of concern.
- ✓ *Medium Risk (Orange)*: A significant level of concern that requires attention.
- ✓ *Critical Risk (Purple)*: A critical issue demanding immediate attention and intervention.

Results

All survey data were entered into the FAO online Global ALDFG Survey database. Data quality assessments were conducted, and data entry processes were conducted from November/2024 to May/2025. A total of 315 interviews were conducted, being 91 with fishers from the trawling

fleet, 74 with fishers using pot/trap as the main fishing gear, and 150 with gillnetters (Table 2). Hence, 62 interviews were conducted in the North Region; 171 in the Northeast Region; 67 in the Southeast Region; and 15 in the South Region. Rio Grande do Norte State accounted for 55 interviews, followed by Pará State, with 44, and Pernambuco State, with 38 (Table 3).

Table 2. Overview of surveyed fishing gear types, estimated number of vessels, and collected responder (fishers) count.

Gear Type	Number of vessels	Respondents (Fishers)
Trawls	5,231	91
Gillnets	8,842	150
Traps/pots	3,159	74
Total	17,232	315

Table 4 displays the number and percentage of interviews by fishing gear across states, macro-Brazilian regions, and nationally. At a national level, the situation was as follows:

- ✓ In the North Region, 62 interviews were conducted, representing 19.7%. Of the total fishers interviewed in Brazil, this region accounted for 12.5% (10) who used traps/pots as their main fishing gear, 1.1% (1) who used trawling gear, and 34.9% (52) who used gillnets.
- ✓ In the Northeast Region, 171 interviews were conducted, representing 54.2%. Of the total fishers interviewed in Brazil, this region accounted for 78.75% (73) of those who used traps/pots as their main fishing gear, 57.8% (52) used trawling gear, and 38.9% (58) used gillnets.
- ✓ In the Southeast Region, 66 interviews were conducted, representing 21.3%. Of the total fishers interviewed in Brazil, this region accounted for 8.75% (7) who used traps/pots as their main fishing gear, 41.1% (37) who used trawling gear, and 16.1% (24) who used gillnets.
- ✓ In the South Region, 15 interviews were conducted, representing 4.7%. Of the total fishers interviewed in Brazil, this region accounted for 10% (15) who used gillnets as their main fishing gear.
- ✓ 91 surveys have been conducted with fishers using trawl nets as the main fishing gear. Eighty nine of the interviews were done in-person (98.8%), and, from these, 23.3% (20) were conducted with fishers from Rio Grande do Norte State – Northeast Region of Brazil; 20% (18) from Sergipe State – Northeast Region; 18.9% (16) from Rio de Janeiro State, Southeast Region; 13.3% (12) from São Paulo State, Southeast Region; and 8.9% (8) from Espírito Santo State, Southeast Region. The Northeast Region accounted for 57.7% (51) of the interviews, the Southeast Region for 41.2% (36), and the North Region for only 1.1% (1).
- ✓ 74 surveys of trap-using fishers were completed—95% in-person and the rest by cell phone. Of these, 77.7% were from Brazil’s Northeast Region: Ceará (25%), Rio Grande do Norte (17.5%), Pernambuco (16.25%), Piauí (16.25%), and Sergipe (3.7%). Pará (North) accounted for 12.5%, while Espírito Santo and Rio de Janeiro (Southeast) made up 8.7%.
- ✓ 151 surveys were administered to fishers whose primary fishing gear was gillnets. Of these, 97.3% (146) were conducted in person, while 2.7% (5) were completed via cell phone call. The Northeast Region accounted for the largest proportion of interviews at 38.9% (58), the State of Rio Grande do Norte reported the highest number, with 13.4% (20), followed by



the State of Pernambuco with 12.8% (19). In the North Region, 53 questionnaires (34.9%) were collected, primarily from Pará State (22.1%; 33) and Amapá State (12.8%; 20). The Southeast Region contributed 16.1% (24) of the interviews, including 8.7% (13) from the State of São Paulo and 6.7% (10) from the State of Rio de Janeiro. Additionally, 10.1% (15) of the interviews were conducted with fishers from Santa Catarina, located in the South Region of Brazil.

Table 3. Number of Interviews conducted by states and Brazilian macroregions.

Amapá – (AP)	19
Pará – (PA)	43
Total North Region	62
Alagoas – (AL)	9
Bahia – (BA)	-
Ceará – (CE)	24
Maranhão – (MA)	8
Paraíba – (PB)	-
Pernambuco – (PE)	38
Piauí – (PI)	18
Rio Grande do Norte – (RN)	53
Sergipe – (SE)	21
Total Northeast Region	171
Espírito Santo – (ES)	14
Rio de Janeiro – (RJ)	28
São Paulo – (SP)	25
Total Southeast Region	67
Paraná – (PR)	-
Santa Catarina – (SC)	15
Rio Grande do Sul – (RS)	-
Total South Region	15
TOTAL NATIONAL	319

Table 4. Number and percentage of interviews by fishing gear across states, macro-Brazilian regions, and nationally.

Fishing Gear/State	Trap/Pot			Trawl net			Gillnet			Total per Region
	Number	% in the Region	% National Total	Number	% in the Region	% National Total	Number	% in the Region	% National Total	
Amapá (AP)		0	0		0	0	20	36,5	13	62 (19.7%)
Pará (PA)	8	100	12,5	1	100	1,1	33	63,5	22,1	
North Region	8	100	12,5	1	100	1,1	53	100	34,9	
Maranhão (MA)	0	0	0	1	0	1,1	7	0	4,7	171 (54.2%)
Piauí (PI)	13	20,6	16,25	3	5,8	3,3	2	3,4	1,3	
Ceará (CE)	20	31,7	25		0,0	0	4	6,9	3	
Rio Grande do Norte (RN)	13	22,2	17,5	20	40,4	23,3	20	34,5	13,4	
Pernambuco (PE)	13	20,6	16,25	6	11,5	6,7	19	32,8	12,8	
Alagoas (AL)		0	0	3	6	3,3	6	10	4,0	
Sergipe (SE)	3	4,8	3,75	18	34,6	20,0		0,0	0,0	
Northeast Region	62	100	78,75	51	100	57,8	58	100	38,9	
Espírito Santo (ES)	5	86	7,5	8	22	8,9	1	4	0,7	66 (21.3%)
Rio de Janeiro (RJ)	1	14	1,25	16	46	18,9	10	42	6,7	
São Paulo (SP)	0	0	0	12	32	13,3	13	54	8,7	
Southjeast Region	6	100	8,75	36	100	41,1	24	100	16,1	
Santa Catarina (SC)	0	0	0		0	0	15	0	10	15 (4.7%)
South Region	0	0	0	0	0	0	15	0	10	
Brazil Total	80	100	100	90	100	100	149	100	100	319

Fisheries' Profile

Fishers' ages ranged from less than 20 to over 70, predominantly between 40 and 49 years old (41.1% - 37) for bottom trawling fishers, as well as for those using traps and/or pots as their main fishing gear (28.7% - 23), while it was predominantly between 50 and 59 years (35.6% - 53) among gillnetters (Figure 2).

Among trawlers, most of them were skippers (63.3% - 57), and only 8.9% (8) were deckhands, though 18.9% (17) answered having "others" fishing responsibilities; similarly with those using traps and/or pots, were skippers represented 56.3% (45), 26.3% (21) were deckhand fishers, 15% (12) indicated other positions, and 1.2% (1) were chief deckhand and first mate, for each; and usually skippers represented 73.8% (95) amid those using gillnets, but only 8.7% (13) were deckhand fishers, and 27.5% (41) had other functions on board (Figure 3).

The majority have more than 21 years of experience (81.1% - 73), while 16.7% (15) in between 5 and 20 years of experience, and only 2 (2.2%) have less than 5 years, among trawlers; again similarly for those using traps/pots, with the majority having more than 21 years of experience (71.3% - 57), 26.3% (21) between 5 and 20 years of experience, and 2.5% (2) less than 5 years; and among gillnetters again the majority have more than 21 years of experience (79.9% - 119), 27.5% (41) between 5 and 20 years; and just 1 has less than 5 years of experience (Table 5). Generally speaking, almost all of the fishers – 96.4% (304) – had never heard about the FAO Global ALDFG Surveys project. Interestingly, 11 answered YES, saying they had heard of the project.

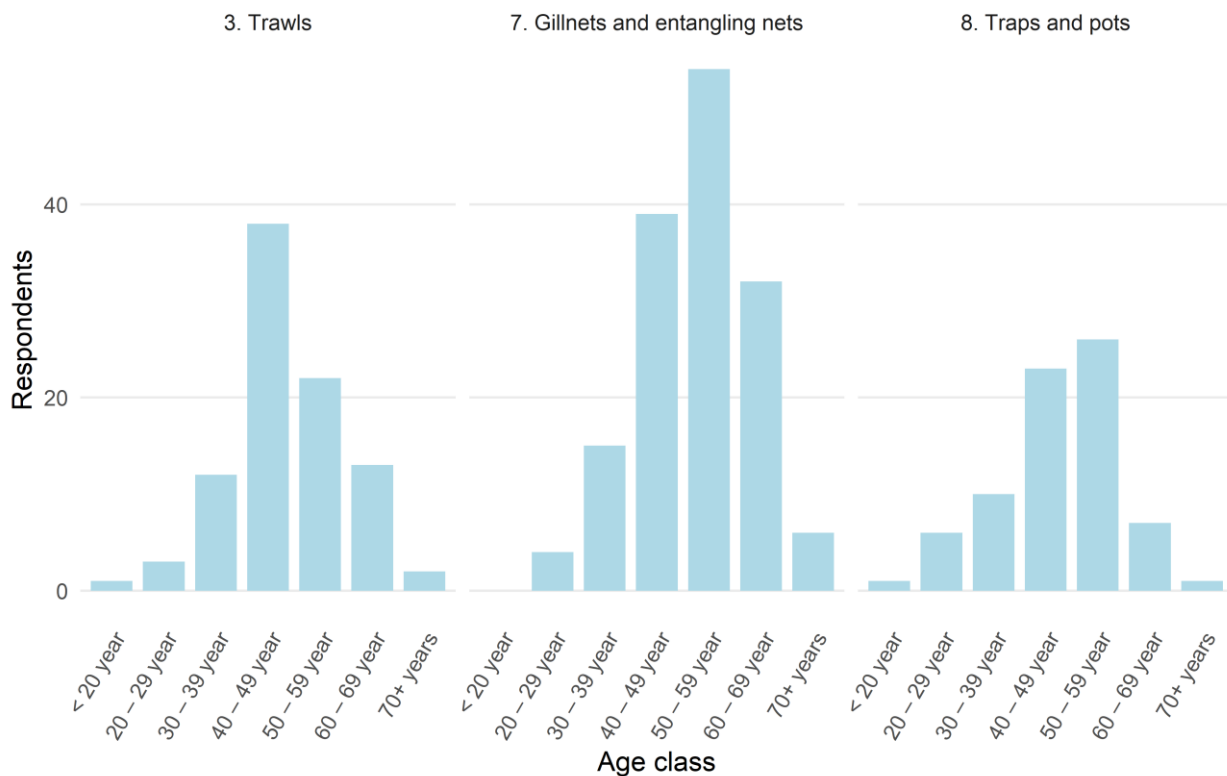


Figure 2. A bar plot shows the age-class distribution of the respondents, by fishing gear.



Table 5. Respondents by job title (role on board) and gear type.

GearType	Captain/ skipper	Chief deckhand	Deckhand	First mate	Other
Trawls	58	1	8	7	17
Gillnets and entangling nets	95	0	14	0	41
Traps and pots	41	1	20	1	11

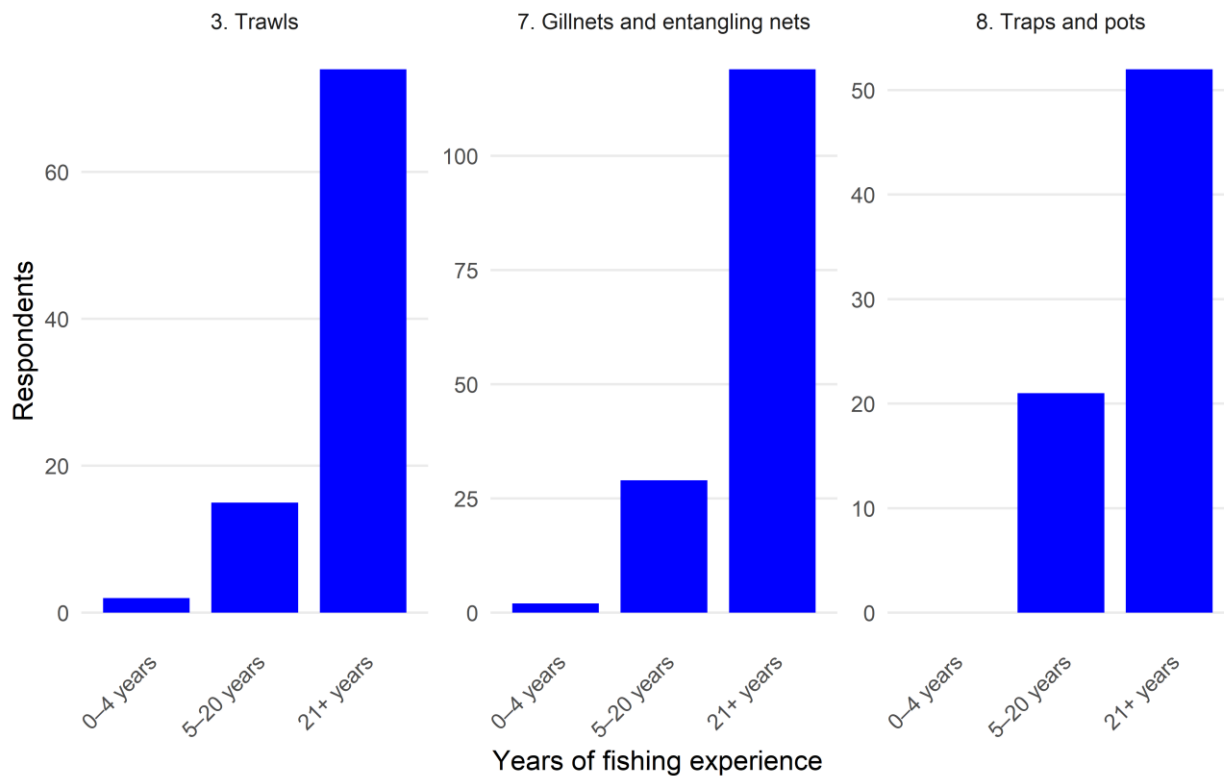


Figure 3. Distribution of respondents' years of fishing experience by gear type.

Still, 73% (230) of the fishing vessels were smaller than 12m; 25.7% (81) between 12m and 24m; and only 4 (1.3%) were greater than 24m, all operating in the North Brazilian Shelf from Ceará to Pará, where larger boats are required due to rough sea conditions. Table 6 summarizes the distribution of respondents, by gear type, across the LOA classes. Two boats fishing in Rio de Janeiro State's waters land their production in the neighboring State of Espírito Santo, heading north, and it was not possible to track the other boats' lading sites. Most fishers (91.3%, 73) use traps for lobsters in the North and Northeast, with landing sites matching boat registrations. For 77.25 (115) of those fishers using gillnets as main fishing gear reported that their fishing vessels were smaller than 12m, mainly located in the Northeast Region; with 20.8% (31) of fishers reporting vessel lengths between 12m and 24m, mainly in the South and Southeast Regions; and 2.0% (3) of fishers reporting vessel lengths greater than 24m, for vessels fishing in the North Region.

Table 6. Respondents by gear type and vessel length class.

GearType	Under 12 m	12–24 m	24 m and over
Trawls	65	25	1
Gillnets and entangling nets	116	31	3
Traps and pots	49	25	0

Respondents were asked to indicate the sub-type of fishing gear they used and for which they completed the survey. The Table 7 below shows the number of responses for each sub-group within each gear type. Although not displayed here, respondents could also optionally provide the local gear name, enabling finer, locally relevant categorization within sub-groups.

Table 7. Respondents by gear type and sub-gear category (ISSCFG)

GearType	Sub-gear category	Abbreviation	Number of fishers
Trawls	Single boat bottom otter trawls	OTB	91
Gillnets and entangling nets	Combined gillnets-trammel nets	GTN	2
Gillnets and entangling nets	Drift gillnets	GND	78
Gillnets and entangling nets	Encircling gillnets	GNC	9
Gillnets and entangling nets	Fixed gillnets (on stakes)	GNF	4
Gillnets and entangling nets	Set gillnets (anchored)	GNS	75
Gillnets and entangling nets	Trammel nets	GTR	1
Traps and pots	Pots	FPO	9
Traps and pots	Traps (nei)	FIX	66

The most common trawl nets used are twin-bottom otter trawls, representing 37.8%, followed by single-bottom otter trawls (23.3%) and bottom trawls (22.2%). Multiple bottom otter trawls are used in what in Brazil is considered the industrial fishery, towed by larger boats 24m or longer. Nevertheless, fishing gears were all categorized as single-boat bottom otter trawls (OTB), as it is common to have many local names for the same “gear category”, although this might not be the case if the same local name is given to a different “gear category”. Small boats, less than 12m, mainly use just one trawling net with approximately 8m (headrope). Medium-sized boats (12m – 24m) also mainly use 1 trawling net, with approximately 12m (headrope). Bigger boats, 24m or larger, use 2 trawling nets with “outriggers”, each with around 15m (headrope).

The most common gillnets used are “drift gillnets”, reported by 53% (79) of fishers interviewed, followed by “set gillnets (anchored)”, reported by 50.3% (75) of fishers interviewed, with the remaining 6.7% of fishers interviewed reported using other types of gillnets, such as encircling gillnets, fixed gillnets (on stakes), trammel nets, and gillnets and entangling nets. The diversity of gillnet types used is likely related to species seasonality, requiring different fishery strategies for

different target species at different times of year. 88% (66) of fishers reported using traps targeting lobsters, while 12% (9) reported using pots targeting octopus.

Location of the survey

The report presented by the FAO Global ALDFG Team forms part of a global survey, and therefore, a transboundary view was taken when assessing patterns and solutions: one planet, one ocean. Respondents reported operating within the national Exclusive Economic Zone (EEZ) (Table 8). Some fisheries also extend into neighboring States' EEZs or into international waters; in those cases, respondents identified the relevant FAO major fishing area(s). The map illustrates the spatial context of the Brazilian EEZ where the ALDFG Survey occurred (Figure 4), while the table summarizes the number of interviews by gear type across EEZs and FAO major areas. Fishing location choices depend on both water depth and boat size.



*Figure 4. Where the survey was conducted and the country's Exclusive Economic Zone (EEZ):
Brazil*

Table 8. Respondents by gear type and fishing ground (EEZ countries and FAO major areas).

Gear type	Respondent (Brazil's EEZ)
Trawls	89
Gillnets and entangling nets	146
Traps and pots	74



Trawling primarily occurs in a specific fishing zone (63.2%). Additionally, 22.4% of interviewees reported that their fishing activity is equally divided (50%) between two main fishing areas, and another 14.5% indicated that 75% of their activity occurs in one main fishing area and 25% in another. Most trawl vessels (92.2%, or 83 boats) operate at depths of less than or up to 50m, 4.4% (4) sometimes, and 3.3% (3) never operate in such a depth. In the depth zone between 51m and 200m, 13 (14.4%) indicated they always operate, 12.2% (11) sometimes operate, and 68.8% (62) never operate. In the depth zone between 201m and 1,000m, 2.2% (2) always operate, 5.5% (5) sometimes operate, and 86.7% (62) never operate. Interestingly, although unlikely, 1 boat always operates at depths beyond 1,000m, 1 boat sometimes operates, and 83 (92.2%) never operate. These three boats, which operate beyond 200m depth, appear to have never operated in shallow waters below 50m. A similar pattern emerges when we consider the number of fishing days, which ranged from 1 to 45.

Most gillnet fishers (86.6%) operate primarily within a single fishing zone. 8% spend about 75% of their time in one zone, 6% split activity evenly between two zones, and 1.5% fish about a quarter of the time in a dedicated zone. Choice of zone is influenced by fishing depth and boat size, similar to trawl and trap fishers. Nearly all fishers (95.3%) always work between 0–50m depth, with 3.4% sometimes doing so. Approximately 10.1% operate, and another 10.1% operate occasionally, in depths ranging from 51–200m. Two fishers reported sometimes fishing at depths over 200m. A similar pattern appears when considering the number of days fishing, which varied mainly from 1 to 25 days, although one respondent said a fishing trip may last 50 days and another one up to 60 days. The results generally show that smaller boats fish close to shore, often in a specific, dedicated fishing zone, using a daily-based strategy, making up to 300 trips in a typical fishing year. On the other hand, larger boats can choose more than one fishing zone, mostly based on depth, and can spend more days (up to 60 days) fishing in a single trip, meaning taking 1 to 6 trips in a year.

Fishers primarily using traps as their main fishing gear indicated that fishing activities are concentrated within a specific fishing zone (87.5%). A small proportion (3.8%, three respondents) reported an even distribution of fishing effort across two main areas (50% each). Additionally, 2.5% (two respondents) indicated that 75% of their activity occurs in one main area, with the remaining 25% in another; 1.2% (one respondent) fishes in four different areas, allocating 25% of activity to each, and may occasionally operate in additional locations depending on fishing strategy. Lobster fishing season lasts from May to December, with peak catches in May, June, and July following a five-month closure. After September, fewer fishers are active, and many rarely fish in November due to lower lobster abundance and higher costs. There are no closed seasons for reef or demersal fish because fisher data is limited. Regarding fishing depth, 77.5% of interviewees consistently fish at depths of 0–50 m, while 12.5% do so intermittently. For the 51–200 m depth range, 20% always fish at these depths, 22.5% sometimes do, and 51.25% never fish there. Experience in deeper waters is limited: one individual fishes at 201–1,000 m, two sometimes operate in this range, and one occasionally exceeds 1,000 m.

Other aspects must be related to the weather, especially in the northern region near the Amazon River Mouth, where rough seas and strong winds hamper fishing activity. Trap units may range from 10 to 625 per vessel, with total trap numbers related to boat size and the license specifying the

number of units, and sets may range from 10 to 30. It's not clear whether Fisher's understanding of setting traps as a unit or in a set was accurate; this misunderstanding probably affected the answers provided, as seen in the outliers, and would have interfered with the results. This Figure presents the real number of traps and/or sets. When it is in sets, the number of traps is multiplied by the sets and by the number in each set. Once, smaller boats may set 1 to 3 traps at a time; a unit of traps could be considered a set; otherwise, the total number of trap units cannot be calculated. On the other hand, bigger boats set up to 20 units at a time, and may have 30 sets, which means setting around 600 traps. The real data is added as green dots, and the black dots are outliers. The blue dot shows the mean, with a line up and down representing the confidence interval.

Seasonality of fishing activities

Primarily, trawling occurs year-round, with an average of 50 fishing trips per typical fishing year. A fishing trip typically lasts 1 to 45 days, depending on the boat's size. Small fishing boats operate throughout the year, almost every day, very close to the shore, and once their tiny catches become too numerous, they resort to trawling just a few hours per day – up to 300, as mentioned by one fisher, and 5 answered over 200 days a year. More hours and/or days mean additional expenditures, such as food and ice, which small- and medium-sized boats often try to avoid. On the other hand, longer trips further from shore at greater depths are possibly undertaken by bigger boats.

Some interviewees noted that certain months are more important than others, and that in some months, fishing never occurs; 43% reported spending 18 hours mostly on trawling. These aspects are related to weather, especially in the North Region near the Amazon River Mouth, and to the closure of the fishing season for certain target species, when trawling is not allowed in specific regions and/or areas. The closure of the fishing activity implies moving to other regions or changing fishing gear. Crustaceans, particularly shrimp, are the primary target species, followed by mid-water pelagic fish, bottom fish, and benthic mollusks. Along almost the entire coast of Brazil, fisheries regulations establish a closed fishing season for shrimp, which may explain why some responses indicated that fishing never occurs in a specific month. Trawl net headline length mainly ranged from 10m to 12m.

Smaller boats targeting lobsters using traps fish close to the shore in one specific zone for 1-2 days, while larger boats can fish in multiple zones for up to 45 days. Medium-sized boats (12m to 24m) fish for 6 to 13 days, depending on their production. It is not feasible to illustrate the wide range of responses in a single graph. Therefore, the responses have been grouped into multiples of 25. Three main groups emerged:

- ✓ 19% reported taking up to 25 trips.
- ✓ 45% reported taking from 26 to 50 trips in a typical year.
- ✓ 10% reported taking 126 to 150 trips.
- ✓ 26% others.

As mentioned for trawling, smaller gillnet boats fish close to shore in one specific fishing zone, while bigger boats can choose more than one fishing zone, mostly related to the depth. A similar pattern seems to occur around the number of days fishing, which ranged from 1 to 60 days, and

the number of trips in a typical year of fishing, which ranged from 2 to 180. illustrates the wide range of responses, likely indicating strategies for fishing that must be kept secret to prevent escalating disputes over a resource already overexploited. Nevertheless, responses have been grouped in multiples of 15, indicating that 67.5% of fishers go fishing for up to 60 days in a typical year. Three main groups emerged:

- ✓ 26 fishers (32.5%) reported taking from 2 to 15 trips in a typical year.
- ✓ 16 fishers (20%) reported taking from 16 to 30 trips.
- ✓ 12 fishers (15%) reported taking from 46 to 60 trips.

Gillnet fishing happens year-round. Small boats fish near shore for a few hours due to limited catches and costs, while larger boats stay out longer. Some months are more productive, and some vessels avoid fishing at certain times. Soak times vary from 1 hour to 3 days; smaller boats often seek longer soaks, while larger ones set nets when fish shoals are found. Weather, closures for recruitment or reproduction, and heritage influence practices. The number of gillnets ranges from 1 to 160, shaped by tradition, technique, and target species.

The Assessment of ALDFG Magnitude

The estimation of the magnitude of abandoned, lost, or otherwise discarded fishing gear (ALDFG) was based on two complementary questions, grounded in self-reported metrics recognized as informative but inherently uncertain, given that fisheries, gear types, and operating conditions vary widely. As with any interview dataset, extreme values may arise from misinterpretation, recall bias, overestimation, or data-entry errors. Applied robust statistics allowed a single, concise visual summary of the distribution, rather than multiple alternative plots. The resulting figures should be interpreted as indicative, rather than precise totals. Estimates pertain to synthetic components of fishing gear unless stated otherwise.

Interviewees reported that the plastic components in trawl nets can weigh anywhere from less than 5kg up to 500kg, depending closely on the vessel and net size. Most respondents (39.7%) estimated weights between 10kg and 50kg, with 34.6% suggesting 5kg or 10kg. Two groups (9% each) cited weights of less than 5kg or within the 100kg–500kg range—the latter likely reflects some confusion during interviews.

Fishers reported that the plastic weight in their gillnets ranges from under 5 kg to over 5,000 kg. However, our assessment suggests this range is likely inaccurate due to miscommunication; it appears fishers included the entire net set (including sinkers and buoys) rather than just synthetic materials, leading to an overestimation.

When estimating the weight of plastic components in lobster traps, discrepancies emerged between interviewees and fishers, with reported weights higher than typical Brazilian trap weights. Some fishers may have included all traps used by a vessel rather than only individual plastic parts. Survey data were adjusted in the FAO ALDFG application for accuracy, with most component weights ranging from 5kg to 50kg; one fisher reported 50-100kg (reasonable based on total traps), while another cited 100-500kg, considered an outlier.

Analysis of ALDFG Data Distribution

To summarize respondent estimates of ALDFG, a single, compact distribution plot is presented for each selected gear type. The figure combines a violin (showing the full response density) with an overlaid boxplot (median and interquartile range), displayed on a logarithmic mass scale to accommodate long, right-tailed data (Figure 5). This approach retains visibility of extreme values while reducing their influence on summary statistics. Reported values should be interpreted as indicative, providing an order-of-magnitude view of potential ALDFG per year, rather than exact, reflecting variation in fisheries, gears, and operating conditions, as well as typical sources of uncertainty in interview data (e.g. recall and interpretation). For transparency, a small summary (sample size, median, IQR, 90th percentile) accompanies the plot (Table 6).

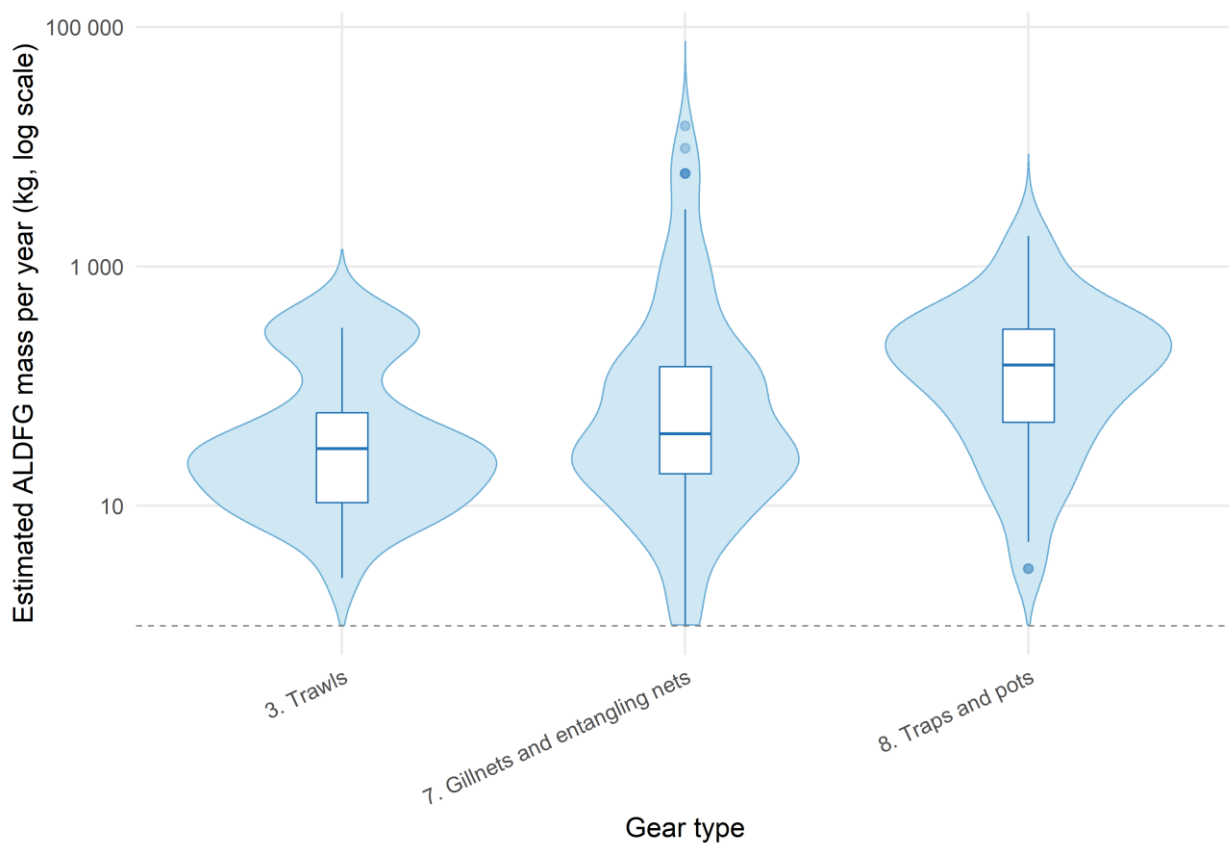


Figure 5. Estimated ALDFG mass per year by gear type (combined from direct kg/year and units \times mid-unit mass; log scale).

Table 9. Summary by gear type: sample size (n), median, interquartile range (IQR) and 90th percentile of estimated ALDFG mass per year (kg).

GearType	n	median_kg	iqr_kg	p90_kg
Trawls	66	30	49	300
Gillnets and entangling nets	112	40	128	885
Traps and pots	64	150	250	570



GearType	n	median_kg	iqr_kg	p90_kg
Total	242	210	427	1,755

Median (kg) – the “middle” value. If you line up all responses from smallest to largest, the median is the one in the middle. About half the fishers reported less than this amount and half reported more. Unlike an average, the median isn’t pulled up or down by a few very large or very small answers.

IQR (kg) – the interquartile range, i.e. the spread of the middle 50% of responses. It’s the difference between the 75th percentile (upper quartile) and the 25th percentile (lower quartile). A small IQR means most answers cluster tightly; a large IQR means responses vary a lot.

P90 (kg) – the 90th percentile. Ninety percent of responses are at or below this value, and 10% are above it. It gives a sense of the upper end of typical responses without being dominated by the very highest outliers.

In short: median = typical value, IQR = how tightly grouped the typical values are, P90 = a high-but-still-typical value near the upper tail.

Direct Estimation of ALDFG Magnitude

Results of the direct estimation of ALDFG magnitude are presented as annual mass (kg per vessel per year) for each selected gear type, with 95% confidence intervals obtained via nonparametric bootstrap (Table 10). This reduces, but does not remove, sensitivity to skewed data and outliers, using percentile bounds to reduce the influence of outliers, and projecting to the fleet, yielding indicative national totals (tonnes per year) (Table 11). As noted earlier, extreme values can affect both central estimates and bounds, so results should be interpreted with appropriate caution.

Table 10. Per-vessel ALDFG estimates by gear type: median annual mass and percentile bounds (kg per vessel per year).

Gear Type	Median (kg/vessel-yr)	Lower bound (kg)	Upper bound (kg)
Trawls	30	7.5	300
Gillnets and entangling nets	40	5.3	885
Traps and pots	150	13.3	570

Table 11. Projected national ALDFG by gear type: per-vessel medians multiplied by fleet size (tonnes per year).

Gear Type	Vessels (n)	Median (t/yr)	Lower (t/yr)	Upper (t/yr)
Trawls	5,231	156.93	39.23	1,569.30
Gillnets and entangling nets	8,842	353.68	46.42	7,825.17
Traps and pots	3,159	473.85	41.86	1,800.63
Total	17,232	984.46	127.51	11,195.10

The figures below present the results graphically. Figure 6 shows the median per-vessel ALDFG (kg per vessel per year) with percentile bounds, indicating that the total annual mass of ALDFG for trawling boats is 30 kg/year, ranging from 7.5 kg/year to 300 kg/year; for gillnet boats is 40 kg/year, ranging from 5.3 kg/year to 885 kg/year; and for trap boats is 150 kg/year, ranging from 13.3 kg/year to 570 kg/year (Table 9). As shown in the fleet projection, which multiplies the per-vessel figures by the number of vessels to give fleet-level amount (tonnes per year), the total annual mass of ALDFG across the selected gear types in Brazil is 984.5 tonnes, with an indicative range of 127.5 to 11195.1 tonnes per year (Figure 7), indicating that the total annual mass of ALDFG for the trawling fleet of 156.93 kg/year, ranging from 39.23 kg/year to 1,569.30 kg/year; for gillnet fleet is 353.68 kg/year, ranging from 46.42 kg/year to 7,825.17 kg/year; and for trap fleet is 473.85 kg/year, ranging from 41.86 kg/year to 1,800.63 kg/year (Table 9). Because interview data can contain extreme values, we use medians and percentile bounds to reduce the influence of outliers; nonetheless, the results should be interpreted as indicative.

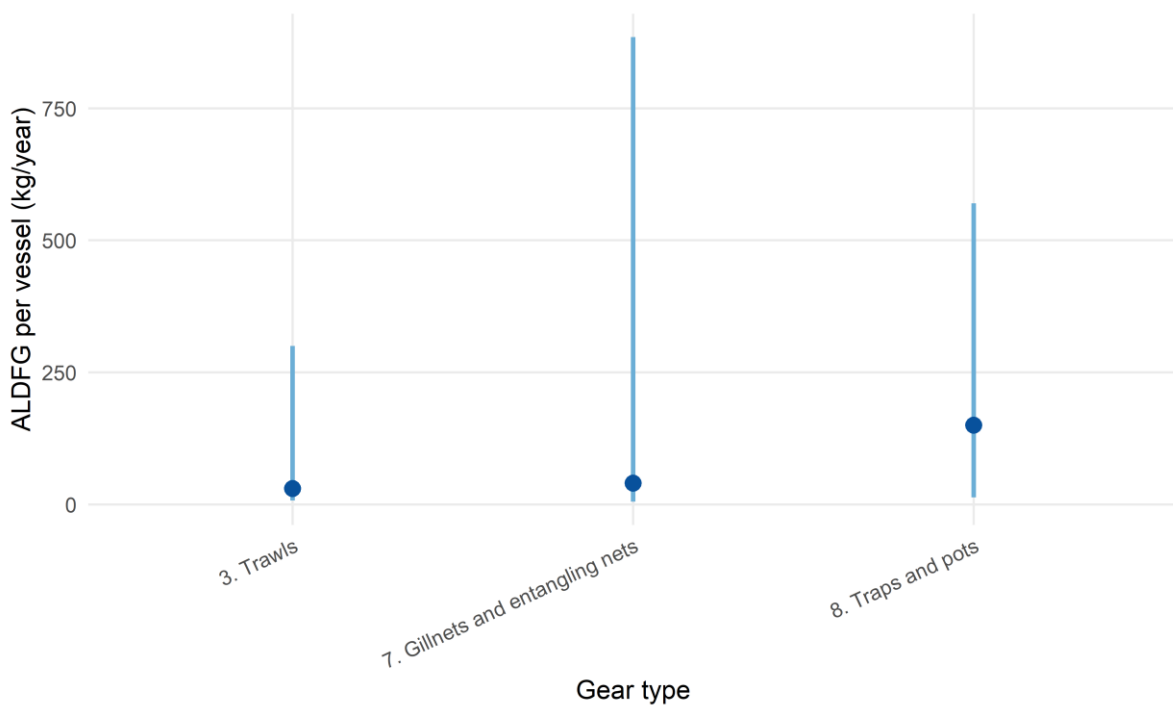


Figure 6. Median per-vessel ALDFG (kg per vessel per year) with percentile bounds, by gear type.

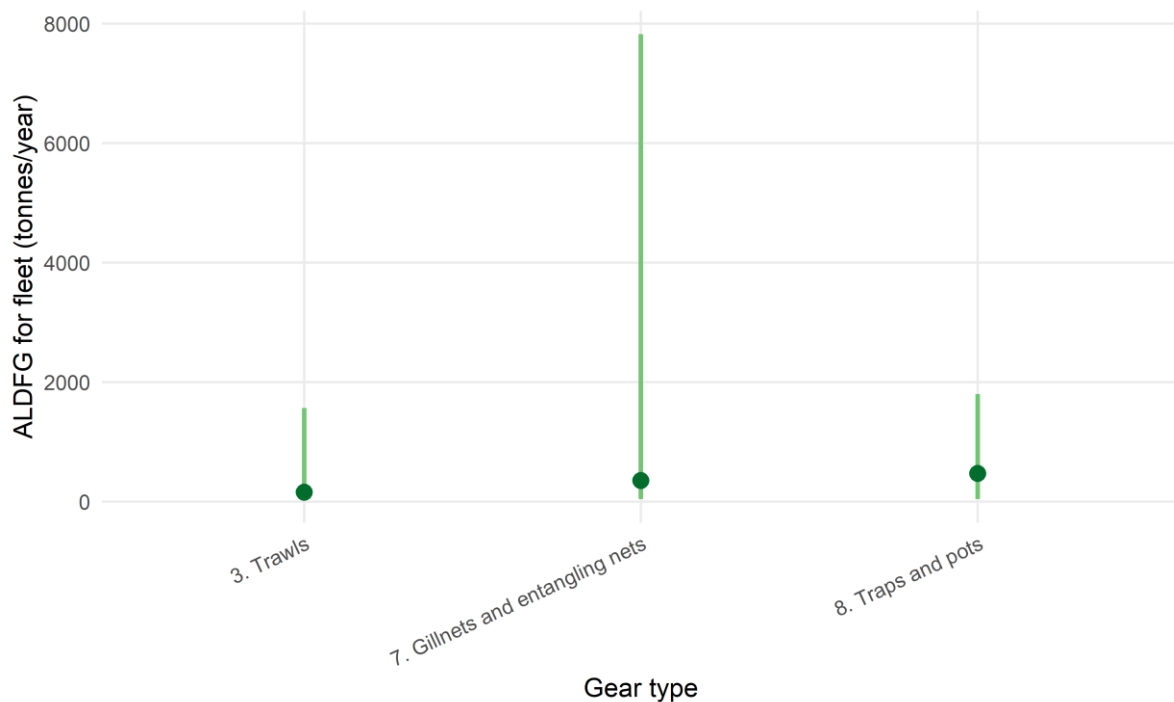


Figure 7. Fleet-level totals (tonnes per year), computed as per-vessel medians multiplied by vessel counts, with the same bounds.

Bootstrap estimation of ALDFG magnitude

Outliers, with unusually high or low values, can strongly influence direct estimates, even when they represent real but uncommon events. To reduce this effect, a simple bootstrap method was applied. The data for each gear type were repeatedly resampled 10 times from the original survey responses, with each resample containing 100 observations. Think of this as creating ten new “mini-surveys,” each with 100 respondents randomly selected from the original responses. Since common answers are more likely to be chosen repeatedly, they have more influence on the final result, while rare or extreme answers contribute less. The resulting figures should be interpreted as approximate, order-of-magnitude indicators of ALDFG levels rather than precise totals.

Bootstrap estimates are presented for the selected gear types and these medians are then scale by the number of vessels using each gear type to give fleet-level totals (tonnes per year). The reports the per-vessel annual ALDFG (median with 10th–90th percentile bounds, in kg per vessel per year) indicate that the total annual mass of ALDFG for trawling boats is 30 kg/year, ranging from 21.2 kg/year to 30 kg/year; for gillnet boats is 40 kg/year, ranging from 30 kg/year to 50 kg/year; and for trap boats is 150 kg/year, ranging from 118.8 kg/year to 183.8 kg/year (Table 12 and Figure 8). For Brazil, the bootstrap projection indicates 984.5 tonnes per year (10th–90th percentile 751.5 – 1179.5 t/yr), and indicate that the total annual mass of ALDFG for trawling fleet is 156.83 kg/year, ranging from 111.16 kg/year to 156.93 kg/year; for gillnet fleet is 353.68 kg/year, ranging from 265.26 kg/year to 442.10 kg/year; and for trap fleet is 473.85 kg/year, ranging from 375.13 kg/year to 580.47 kg/year (Table 13 and Figure 9). Results should be read as order-of-magnitude indicators rather than precise totals.

Table 12. Bootstrap per-vessel ALDFG by gear type: sample size (n) and bootstrapped median with 10th–90th percentile bounds (kg per vessel per year).

Gear Type	n	Median (kg/vessel-yr)	Lower (kg)	Upper (kg)
Trawls	66	30	21.2	30.0
Gillnets and entangling nets	112	40	30.0	50.0
Traps and pots	64	150	118.8	183.8

Table 13. Bootstrap fleet totals by gear type: median and 10th–90th percentile bounds (tonnes per year).

Gear Type	Vessels (n)	Median (t/yr)	Lower (t/yr)	Upper (t/yr)
Trawls	5,231	156.93	111.16	156.93
Gillnets and entangling nets	8,842	353.68	265.26	442.10
Traps and pots	3,159	473.85	375.13	580.47
Total	17,232	984.46	751.55	1,179.50

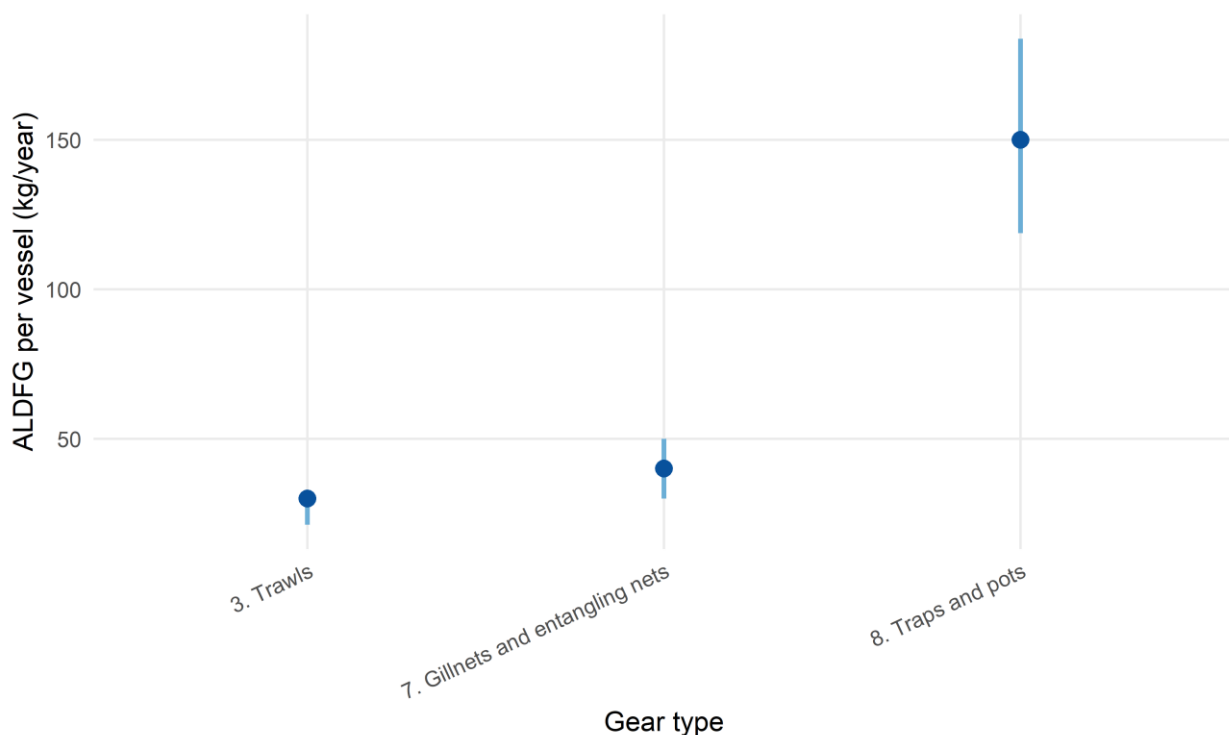


Figure 8. Bootstrapped per-vessel ALDFG (kg per vessel per year) with 10th–90th percentile bounds, by gear type.

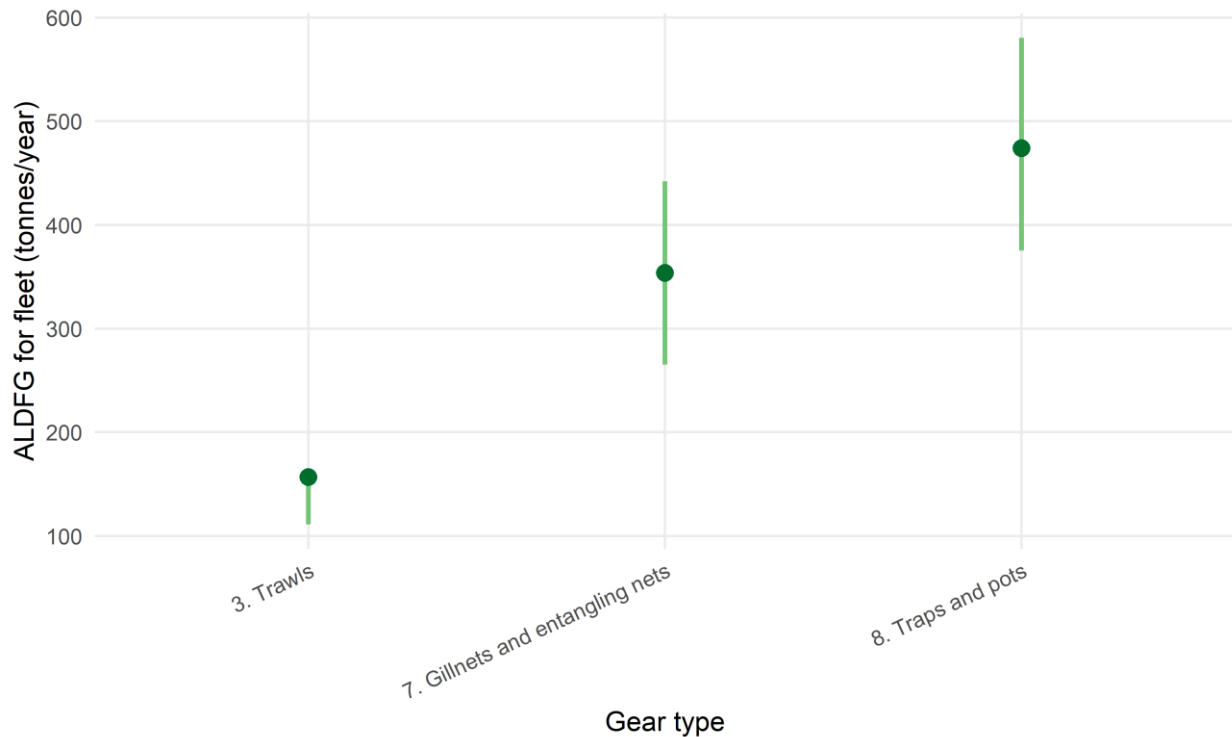


Figure 9. Bootstrapped fleet-level totals (tonnes per year) with the same bounds.

The frequency of fishing gear loss

Trawl net components are occasionally lost during fishing, with most fishers reporting rare losses, especially of cod ends and sometimes whole nets. Most respondents selected "rarely" for annual gear loss, but some selected "sometimes" or "never." Reports vary by month and are influenced by weather conditions. Data show 92.7% of fishers have experienced net loss, while 7.3%—mainly owners—report no losses. Losses are reported primarily to boat owners (52.5%), then nearby boats (30.5%), and rarely to authorities (9.7%). Losses are less common at depths of 0–50m but increase in deeper waters due to hazards.

Gillnet components are seldom lost during fishing, while buoys and net cut-offs are often or sometimes lost—occasionally even parts of the whole net. Annually, fishers estimate losing up to 100kg of trap elements, with a range from 0 to 500kg (or 0 to 45 traps). Losses occur most frequently between May and September due to rough sea conditions like strong winds and currents. Most fishers report that gillnet losses happen "sometimes" or "rarely," though some say they can occur at any time.

Trap-loss frequency includes components that are part of or attached to traps lost during fishing. Traps are usually lost in sets, placed in groups of 3 on small boats and up to 20 on larger boats. This makes losing a single trap uncommon. Individual trap attachments or gear components are also sometimes, rarely, or never lost, such as "sanga" (trap entrance) and buoys. Trap losses vary by target species and time of year, with most fishers indicating they occur "sometimes." During the January–May lobster fishing closure, trap losses are linked to bottom reef fishing. Notably, 40%

of fishers said losses always happen in August due to bad weather. Overall, 41% reported frequent losses, 39.7% occasional losses, 14.1% rare losses, and 5.1% no losses.

Causes and practices of ALDFG

Unintended gear loss can arise from operational, environmental, and governance factors. The results of combining causes and practice responses are shown in a simple 3 X 3 screening matrix: risk is highest where loss is reported to occur often and avoidance is rarely practiced, and lowest where loss is rare and avoidance is consistently practiced. This matrix, as already mentioned, is intended as a practical prioritization tool to highlight where prevention and mitigation may yield the greatest benefit; it does not replace a formal risk assessment and should be interpreted alongside local knowledge and context.

The list of causes and practices

Losses may be due to many causes. When this happens, “reefs and rocky areas” are the most common causes, followed by “poor weather conditions”, “vandalism (stolen or destroyed)”, “strong currents”, and “faulty, old or damaged gear”. Considering the practices used to prevent loss or damage to fishing gear, all items were selected by interviewees, with varying degrees of importance. However, the most common practice used is to “replace or repairs worn fishing gear or parts”, followed by “avoid losing drifting gear out of reach”, “avoid setting the fishing gear in areas known for snagging”, “securely stow fishing gear on board to withstand bad weather/sea conditions”, “avoid using the fishing gear in areas with strong currents”, “know fishing depth and rig accordingly”, and “make sure all equipment used with fishing gear is in good condition”. For 44% of fishers interviewed, the areas where trawl nets are lost are known and may be well identified, 31% don’t know, and 25% said they know the area but can’t identify it.

Fishers rated how often various factors cause ALDFG (Always, Sometimes, Never) and how often crews try to prevent or reduce these issues using the same scale. The paired items are shown below (Relative results for causes and practices)

The bar charts below show the proportions of responses across three ordered levels, plus a ‘Don’t know/Not relevant’ category. Reported causes are shown on the left and practices intended to avoid them on the right, for each fishing gear: trawl (Figure 10); gillnet (Figure 11); and Traps/pots (Figure 12). The numeric label on each bar refers to the corresponding question listed in the Table 14.

ALDFG Risk Screening Matrix

To identify and prioritize key factors contributing to gear loss, a simple risk-screening matrix was developed based on fishers’ survey responses. The same underlying data used in the relative bar charts are applied here, excluding responses of “Don’t know / Not relevant.” This method is intended as a pragmatic, first-pass screening tool rather than a full quantitative risk assessment. It highlights areas where prevention and mitigation efforts are likely to be most effective. The results should always be interpreted in light of local knowledge of each fishery’s operational context.

Table 14). Some gear types, like Surrounding nets and Trawls, have a shorter list because not all questions apply.

Relative results for causes and practices

The bar charts below show the proportions of responses across three ordered levels, plus a ‘Don’t know/Not relevant’ category. Reported causes are shown on the left and practices intended to avoid them on the right, for each fishing gear: trawl (Figure 10); gillnet (Figure 11); and Traps/pots (Figure 12). The numeric label on each bar refers to the corresponding question listed in the Table 14.

ALDFG Risk Screening Matrix

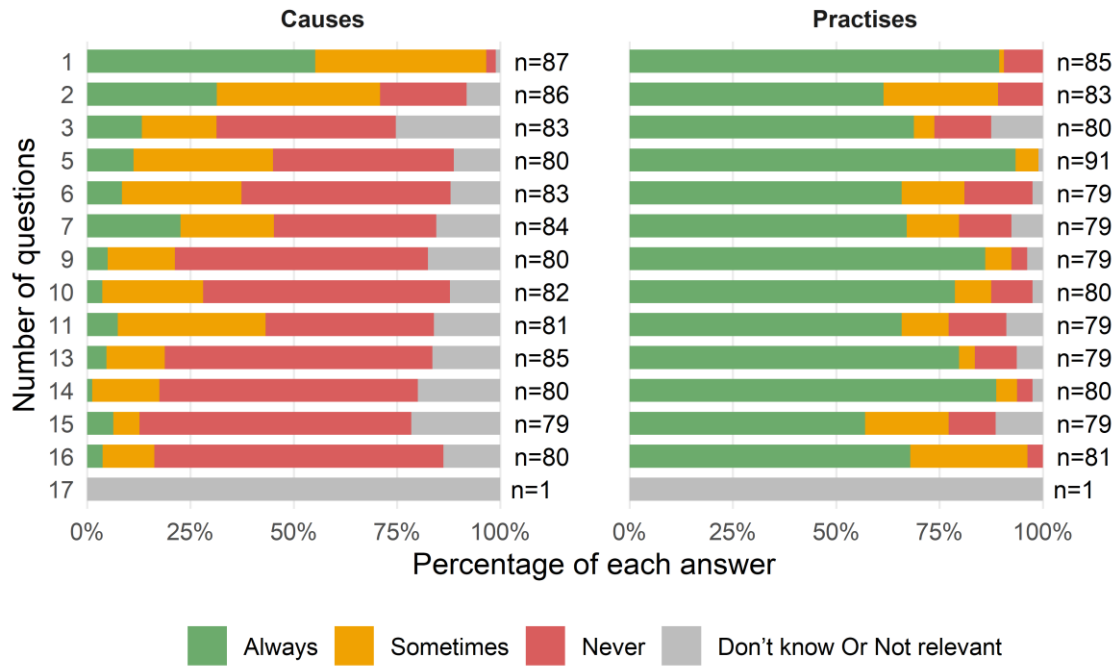
To identify and prioritize key factors contributing to gear loss, a simple risk-screening matrix was developed based on fishers’ survey responses. The same underlying data used in the relative bar charts are applied here, excluding responses of “Don’t know / Not relevant.” This method is intended as a pragmatic, first-pass screening tool rather than a full quantitative risk assessment. It highlights areas where prevention and mitigation efforts are likely to be most effective. The results should always be interpreted in light of local knowledge of each fishery’s operational context.

Table 14. Paired survey items: 17 causes of ALDFG and the corresponding practices to avoid or mitigate them.

Number	Causes	Practices
1	Net snagged on an obstruction, such as reef, rocky area or shipwreck	Avoid setting the fishing gear in areas known for snagging
2	Poor weather conditions	Avoid fishing in poor weather conditions
3	Damage or towed away by large animals	Avoid areas where animals likely to damage the gear
4	Drifted out of area that cannot be accessed by the vessel	Avoid losing drifting gear out of reach
5	Faulty, old or damaged gear	Repair or replace worn fishing gear or parts
6	Operator error	Training of crew on gear handling and operation
7	Strong currents	Avoid using the fishing gear in areas with strong currents
8	Deep water (e.g. line to buoy too short)	Know fishing depth and rig accordingly
9	Gear not properly stored on-board	Securely stow fishing gear on board to withstand bad weather/sea conditions
10	Conflict with other gear, e.g. trawls towing away nets	Communicate with nearby fishing vessels to avoid conflict
11	Vandalism, (stolen or destroyed)	Implement measures to avoid vandalism of gear by others
12	The surface marking is lost, sunk or malfunctioned	Use good surface marking or electronic devices
13	Gear intentionally discarded overboard	Instruct crew members not to discard fishing gear overboard
14	Equipment failure (i.e. hauler or location equipment)	Make sure all equipment used with fishing gear is in good condition
15	High traffic of other vessels	Avoid areas of high vessel traffic/shipping lanes
16	Lack of communication between fishing vessels	Cooperation with other fishers
17	Others	Others

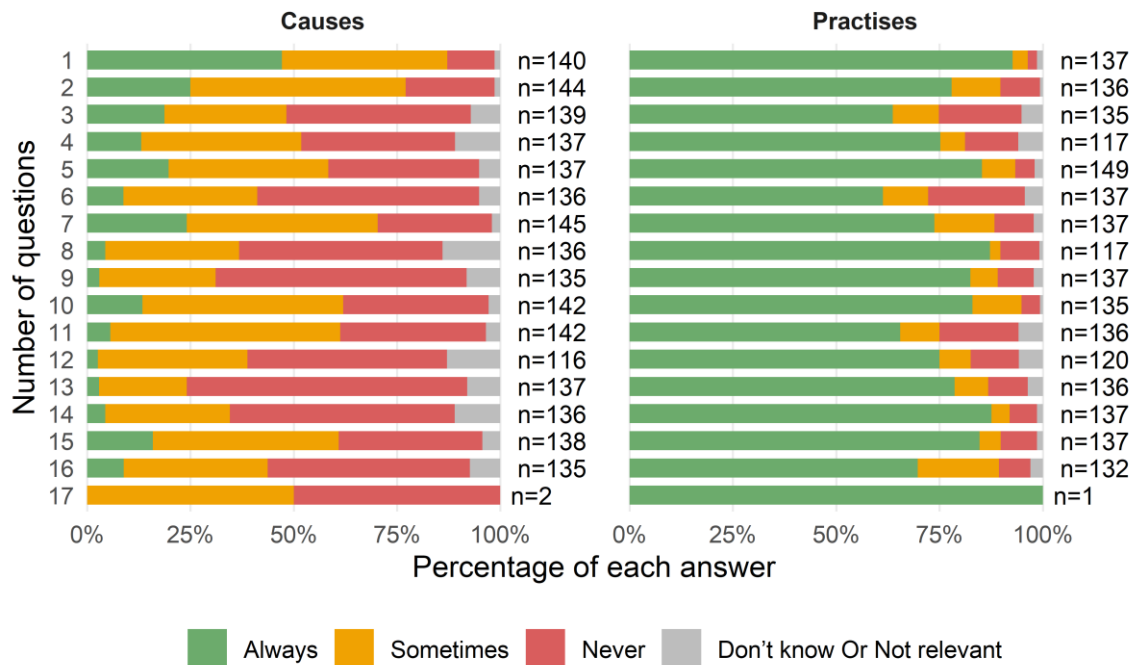
The analysis for each potential cause of ALDFG, based on the Risk Scoring Methodology, is generated by multiplying the scores for these two answers (Cause Frequency X Avoidance Practice), yielding a simple screening score ranging from 1 to 9 (Figure 13). A higher score indicates a greater risk, indicating a situation in which a cause of gear loss is common and the practices to avoid it are infrequent. Each paired response is plotted on a 3 × 3 Risk Matrix to visualize risk intensity. Color shading helps quickly identify critical areas:

- ✓ *Low Risk* (Green): The cause rarely occurs, and avoidance practices are common.
- ✓ *Medium-Low Risk* (Yellow): A moderate level of concern.
- ✓ *Medium Risk* (Orange): A significant level of concern that requires attention.
- ✓ *Critical Risk* (Purple): A critical issue demanding immediate attention and intervention.



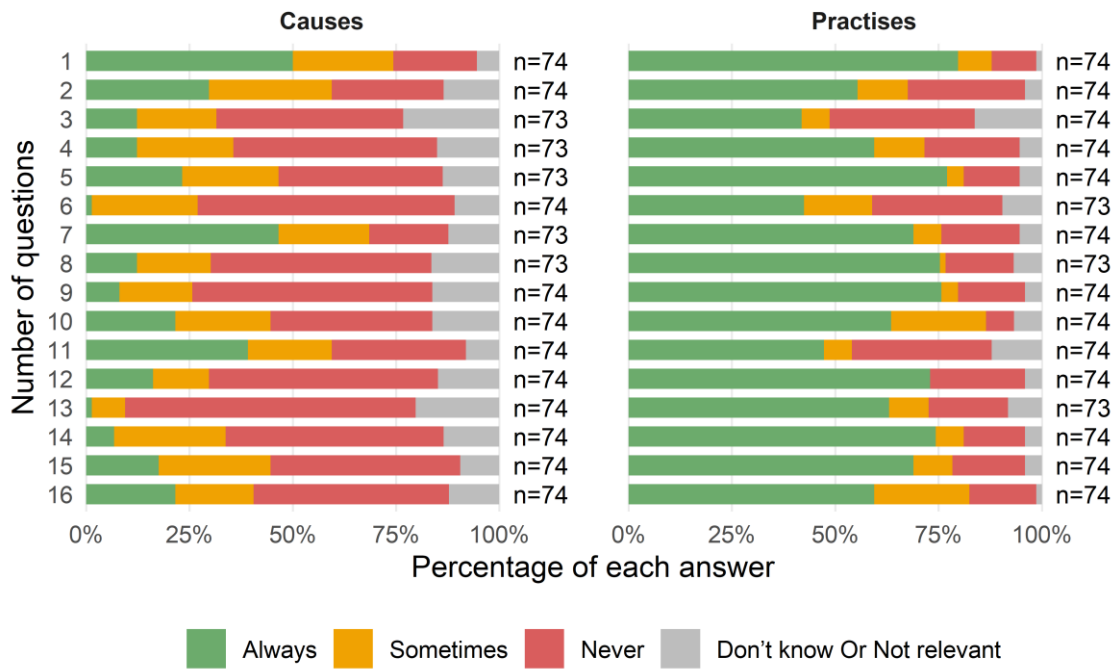
Proportion of each answer by question for respondents using 3. Trawls

Figure 10. Proportion of responses by question for respondents using trawl as the main fishing gear.



Proportion of each answer by question for respondents using 7. Gillnets and entangling nets

Figure 11. Proportion of responses by question for respondents using gillnets as the main fishing gear.



Proportion of each answer by question for respondents using 8. Traps and pots

Figure 12. Proportion of responses by question for respondents using traps as the main fishing gear.

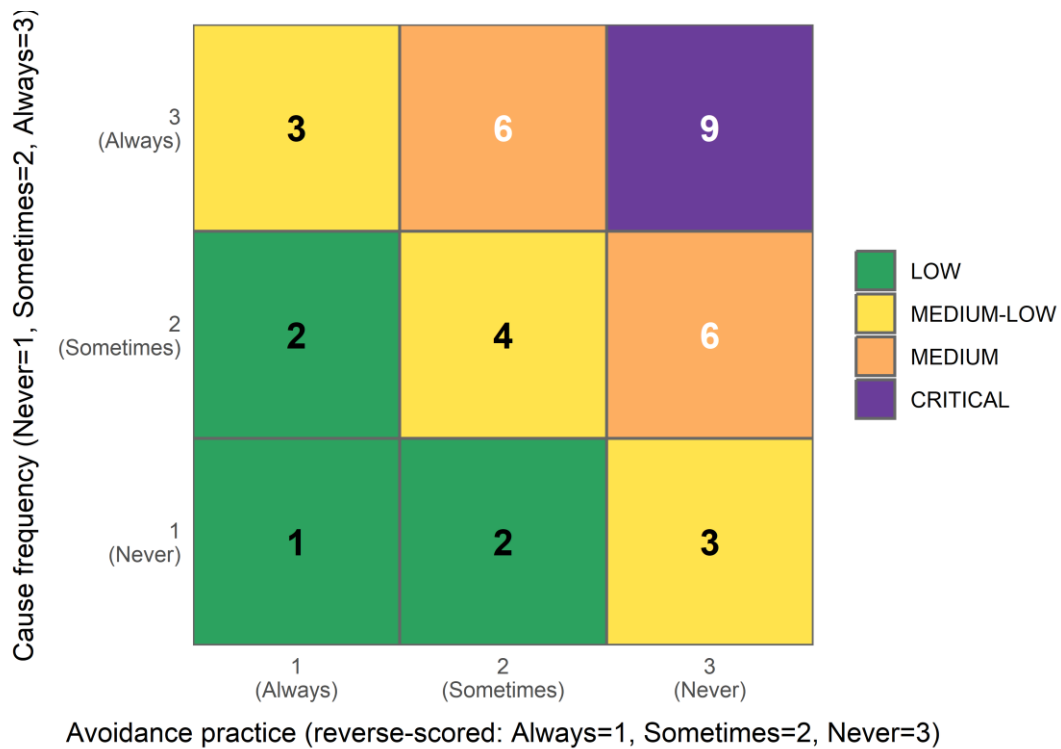


Figure 13. Analysis for each potential cause of ALDFG, based on the Risk Scoring Methodology, generated by pairing two answers (Cause Frequency X Avoidance Practice)

This visualization helps prioritize efforts and resources toward the main factors causing ALDFG for each gear type. As a preliminary screening tool, it enables fisheries managers, researchers,

and industry members to quickly identify and address significant gear-loss risks. Results should be interpreted using local expertise and knowledge of fishery operations. This method targets prevention and mitigation where it matters most, supporting a sustainable fishing industry and healthier marine ecosystems.

The results for each surveyed gear type and each question addressing the causes of Abandoned, Lost or Discarded Fishing Gear (ALDFG): trawl (Table 15); gillnet and entangling nets (Table 16); and traps/pots (Table 17). A score of 1 indicates that the cause was reported as never occurring, 2 that it sometimes occurs, and 3 that it always or frequently occurs. A corresponding set of questions examined practices undertaken by respondents or crew members to prevent or reduce such losses. Because these questions were framed in the opposite way, their scoring is reversed: 1 represents always taking preventive action, 2 represents sometimes taking action, and 3 represents never taking action. Only respondents who provided valid answers to both the cause and the avoidance questions, using one of the three scoring options, were included in the analysis. Responses marked “Don’t know / Not relevant” or left blank for either question were excluded.

Table 15. Risk summary by cause–practice item (means over valid pairs), for the trawling fleet.

Cause and Practices	Mean of Cause	Mean of Practice	Mean Risk	Valid pairs (n)
1 Net snagged	2.54	1.21	3.06	82
2 Poor weather conditions	2.10	1.48	2.95	77
3 Damage by animals	1.60	1.36	2.08	53
5 Faulty	1.63	1.06	1.73	70
6 Operator error	1.49	1.51	2.19	68
7 Strong currents	1.78	1.43	2.41	63
9 Gear not properly stored	1.33	1.17	1.53	64
10 Conflict with others	1.29	1.29	1.71	68
11 Vandalism	1.61	1.41	2.17	64
13 Intentionally discarded	1.22	1.26	1.52	65
14 Equipment failure	1.24	1.08	1.33	63
15 High traffic	1.26	1.47	1.82	57
16 Communication lack	1.23	1.35	1.61	69

Table 16. Gillnets and entangling nets fleet risk summary by cause–practice item (means over valid pairs).

Cause and Practices	Mean of Cause	Mean of Practice	Mean Risk	Valid pairs (n)
1 Net snagged	2.36	1.07	2.50	133
2 Poor weather conditions	2.02	1.30	2.52	131
3 Damage by animals	1.71	1.54	2.45	119



Cause and Practices	Mean of Cause	Mean of Practice	Mean Risk	Valid pairs (n)
4 Cannot access area	1.70	1.32	2.07	98
5 Faulty	1.83	1.19	2.20	128
6 Operator error	1.52	1.60	2.41	122
7 Strong currents	1.92	1.34	2.46	130
8 Deep water	1.37	1.25	1.68	99
9 Gear not properly stored	1.37	1.26	1.68	121
10 Conflict with others	1.74	1.21	2.21	129
11 Vandalism	1.67	1.52	2.58	123
12 Surface marking out of order	1.48	1.30	1.83	98
13 Intentionally discarded	1.28	1.28	1.62	120
14 Equipment failure	1.44	1.19	1.64	119
15 High traffic	1.81	1.24	2.16	129
16 Communication lack	1.55	1.38	2.18	116

Table 17. Traps and pots fleet risk summary by cause–practice item (means over valid pairs).

Cause and Practices	Mean of Cause	Mean of Practice	Mean Risk	Valid pairs (n)
1 Net snagged	2.32	1.32	3.07	69
2 Poor weather conditions	2.03	1.73	3.11	64
3 Damage by animals	1.57	1.87	2.83	54
4 Cannot access area	1.58	1.67	2.42	60
5 Faulty	1.80	1.36	2.57	61
6 Operator error	1.32	1.89	2.46	63
7 Strong currents	2.31	1.50	3.64	64
8 Deep water	1.47	1.44	1.91	57
9 Gear not properly stored	1.40	1.44	2.02	62
10 Conflict with others	1.78	1.43	2.57	60
11 Vandalism	2.05	1.86	3.61	64
12 Surface marking out of order	1.56	1.52	2.11	61
13 Intentionally discarded	1.14	1.56	1.79	57
14 Equipment failure	1.47	1.41	1.98	64
15 High traffic	1.68	1.50	2.29	66
16 Communication lack	1.71	1.60	3.08	65

End-of-Life Management

End-of-life management of fishing gear is key to advancing a circular economy in fisheries. As outlined by FAO (2023) and Einarsson et al. (2025), effective systems retain material value and prevent waste by using port facilities to collect and recycle old or discarded gear. Designing gear for easy disassembly, using fewer polymers, and clearly labeling components enhances recyclability. Financial incentives like Extended Producer Responsibility, deposit–refund, and buy-back schemes support recovery and recycling efforts.

Respondents did not report losing entire pieces of equipment, though gear-loss estimates may be inflated or misunderstood. Most fishers estimated monthly trawl or fragment losses. About 2/3 said damaged fishing gears were stored onboard for repair; ¾ collected plastic waste to bring ashore, but only 2/5 noted free disposal facilities at ports. The majority disposed of plastic in general waste, citing a few recycling options. Only 16.7% reported recycling returned plastic, 18.9% said it's discarded with general garbage due to limited recycling options, and 64.4% were unsure.

On board of vessels collections

Respondents' answers on whether damaged or unwanted plastic parts of fishing gear are collected and stored on board (Figure 14) and returned to the port or landing site (Figure 15) show how concerned most fishers are regarding fishing gear waste management.

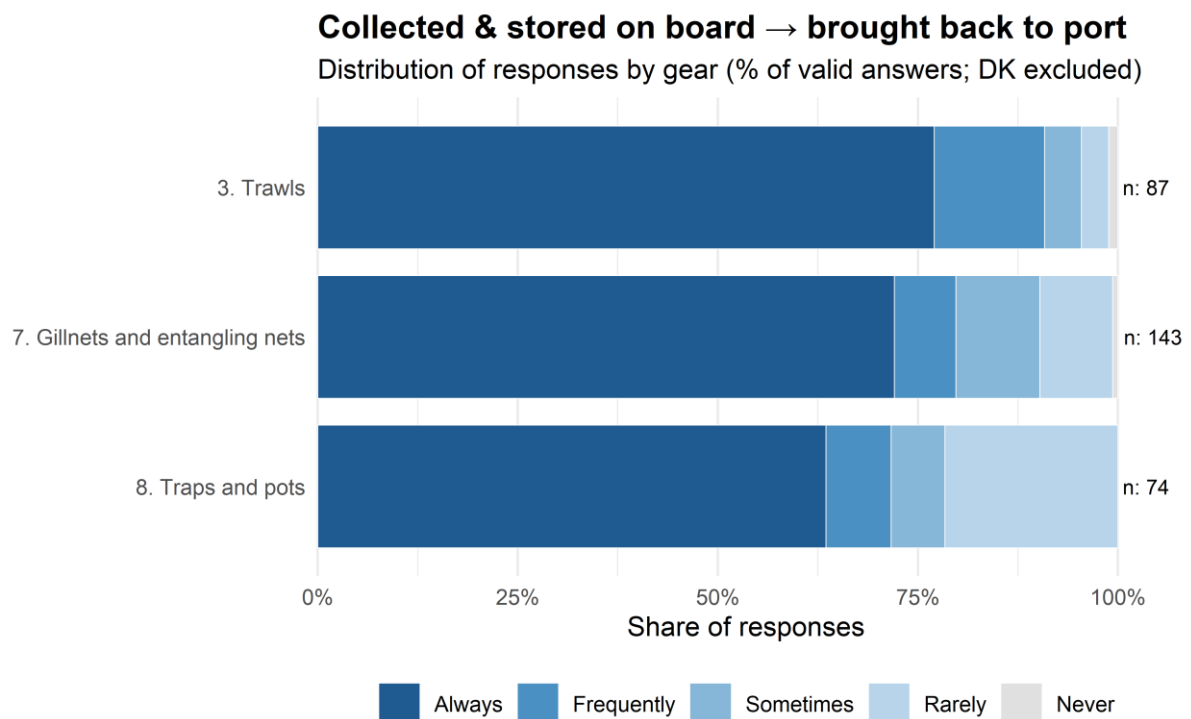


Figure 14. Distribution of responses by gear type regarding fishing gear collection and storage on board.

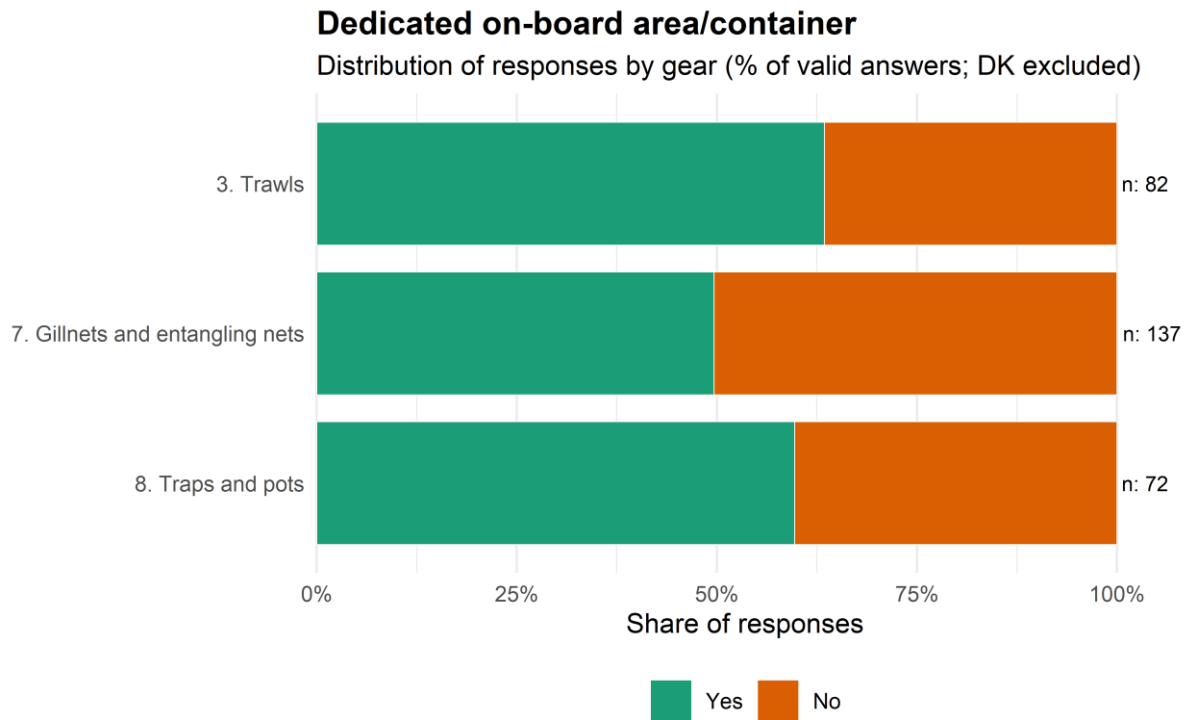


Figure 15. Distribution of responses by gear type regarding the area on board for fishing gear storage to return to port facilities.

Facilities for End-of-Life Gear Disposal

Harbors and nearby facilities for collecting and disposing of old fishing gear are vital to maintaining a clean marine environment and preventing ALDFG buildup. These sites allow fishers to return damaged gear safely and promote recycling, repair, or proper disposal. Many ports and landing sites still lack proper facilities for gear disposal, leading to informal practices that risk marine pollution.

Fishers' responses on whether suitable facilities were available at their main harbor or landing site are provided below, showing an existing negative infrastructure. The results provide insight into how well existing port infrastructure supports end-of-life management and ALDFG prevention, regarding the existing facilities in or near the vessel's home port or landing sites (Figure 16); if there is a charge in using the facility in case of existence (Figure 17); and the treatment of end-of-life fishing gear materials (Figure 18).



Facilities in or near the vessel's home port or landing site

Distribution of responses by gear (% of valid answers; Don't know excluded)

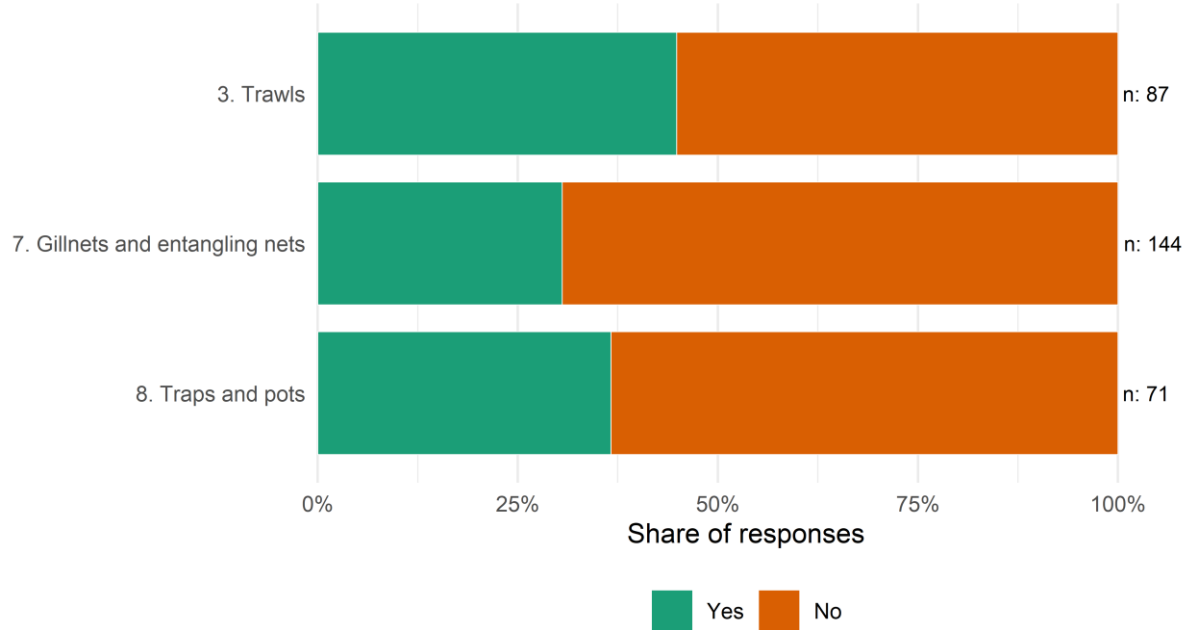


Figure 16. Existing facilities in or near the vessel's home port or landing sites.

If Yes, is there a charge to use the facilities?

Distribution of responses by gear (only 'Yes' respondents from previous que

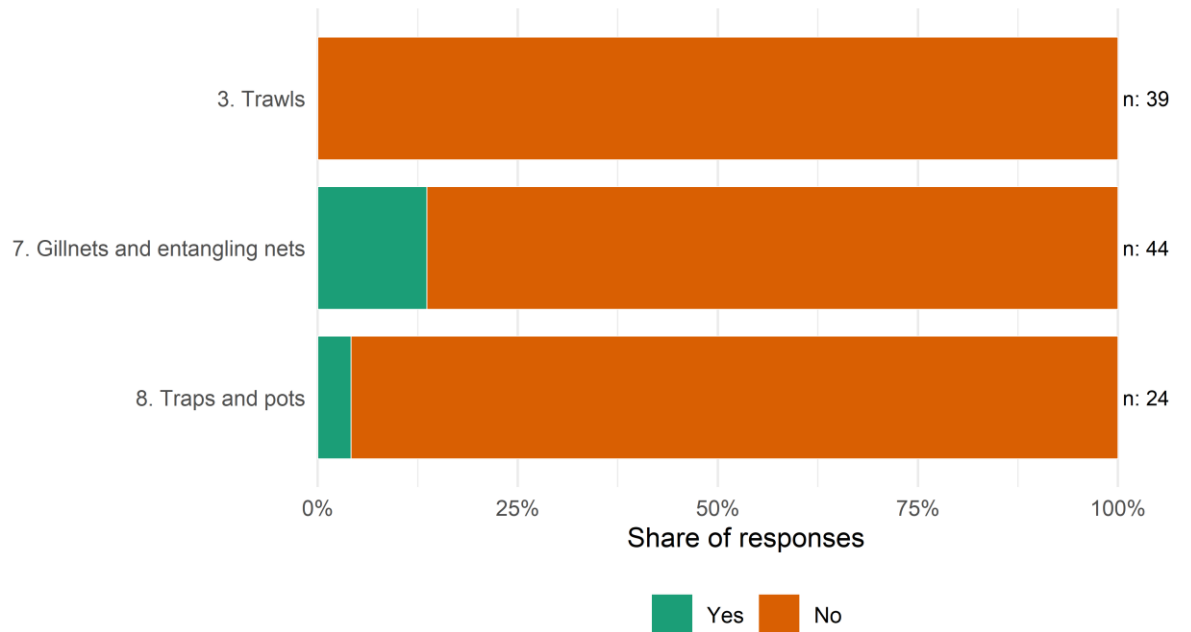


Figure 17. There is a charge in using the facility in case of existence.



Treatment of end-of-life fishing gear materials

Distribution of responses by gear (% of valid answers; Don't know excluded)

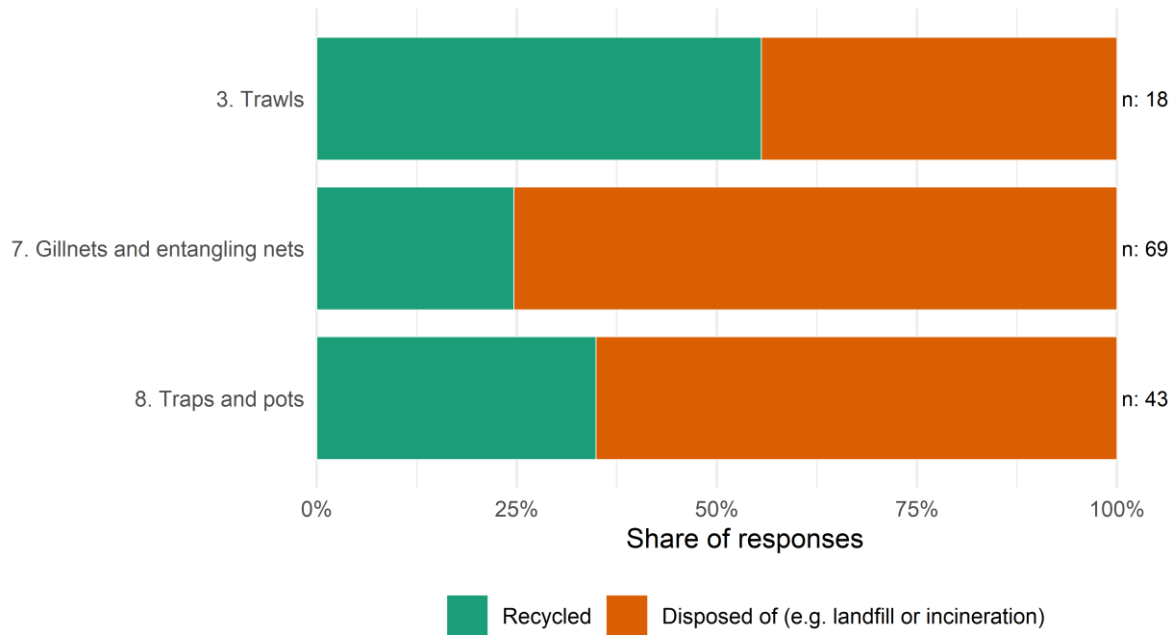


Figure 18. The treatment of end-of-life fishing gear materials.

Marking fishing gear

Using traceable, tamper-proof identifiers on fishing gear helps establish ownership, promotes compliance with regulations, and enhances accountability. Gear marking has long been recognized as a key measure to prevent marine litter and promote sustainable fisheries, such as ALDFG, and helps prevent and mitigate ghost fishing, improves safety at sea, and aids in detecting illegal, unreported, and unregulated (IUU) fishing. FAO continues to advance this work through technical guidance, pilot studies, and the development of a forthcoming Manual for the Marking of Fishing Gear. Stakeholders are encouraged to contribute information on existing marking systems, field trials, and technological developments that can support the global uptake of effective gear-marking practices.

It should be noted that Brazil has not yet enacted regulations to implement the FAO Voluntary Guidelines on the Marking of Fishing Gear (VGMFG). Among respondents, 14.1% reported awareness of existing regulations on fishing gear, and 68.1% stated that no regulations exist for marking their fishing gear (Figure 19). However, 17.8% reported uncertainty regarding such regulations. Additionally, 57.1% of fishers surveyed indicated that they use markings on their fishing gear to facilitate identification in the event of loss (Figure 20). Conversely, 76.7% affirmed that these markings are both identifiable and traceable (Figure 21), excluding those that answered “don't know” to the question of marking or not that fishing gear.

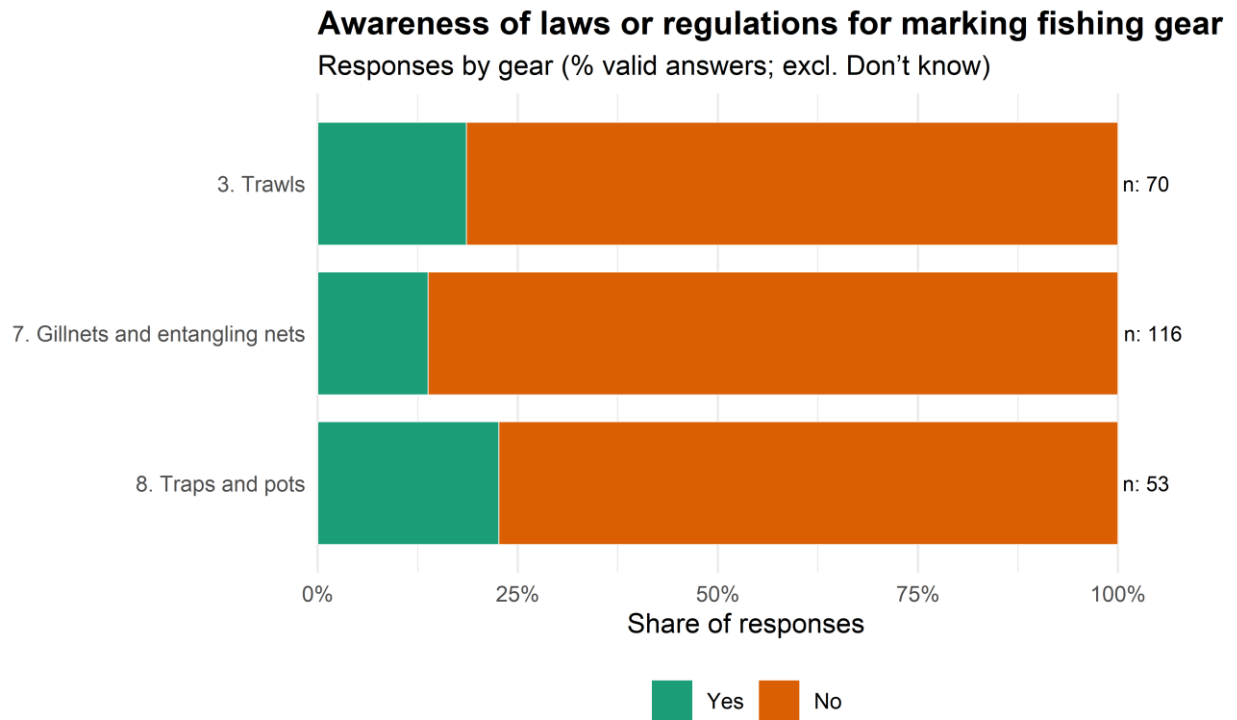


Figure 19. Awareness of the law or regulations for marking fishing gear.

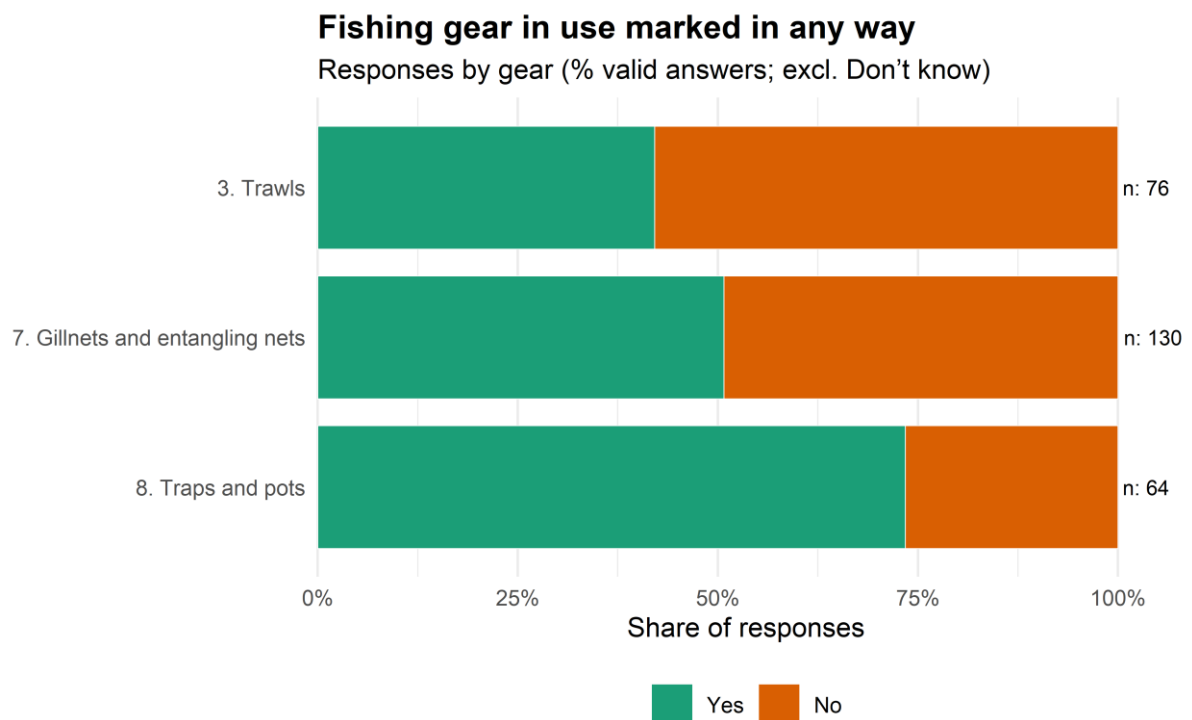


Figure 20. Share of responses if fishing gears in use is marked in any way.



Are marks traceable to owner or vessel?

Responses by gear (Yes to previous question only; excl. Don't know)

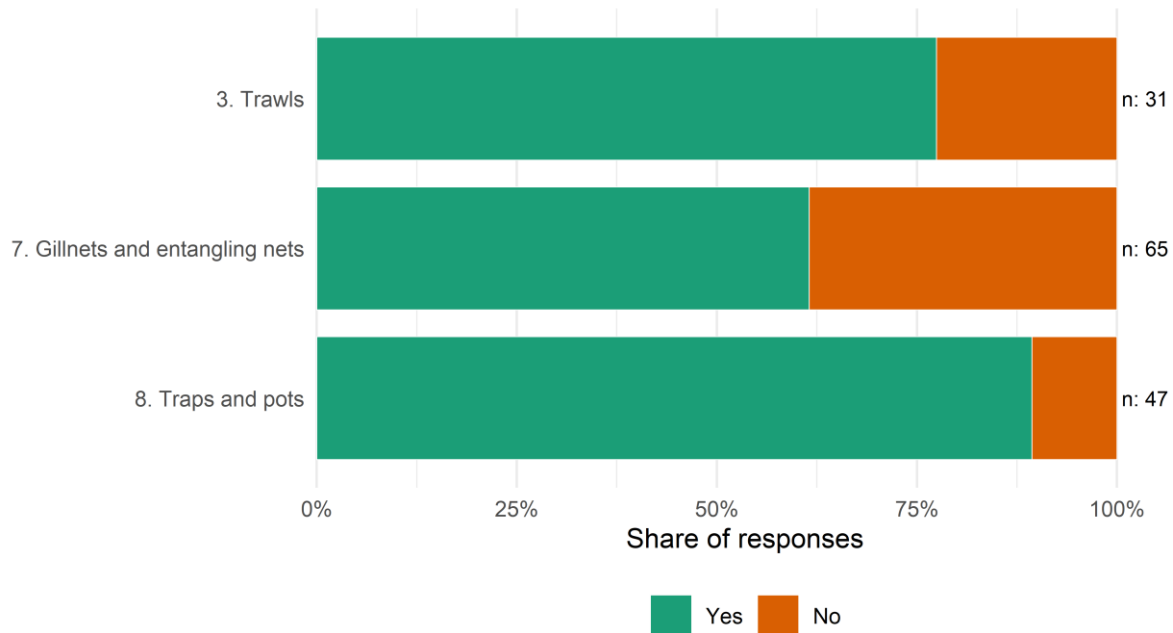


Figure 21. Share of responses on the existence of marks traceable to the owner or vessel.

Fishers' point of view

Respondents were asked a series of questions to express their own views on the potential problems associated with Abandoned, Lost, or otherwise Discarded Fishing Gear (ALDFG). The following section presents their responses. The final question in this part of the survey was open-ended, inviting participants to share their personal observations, opinions, or recommendations related to ALDFG and its prevention. These written comments have been summarized and are presented below.

Most fishers - a total of 285 fishers (89.1%) - answered that ALDFG, as well as plastic pollution, is of great concern and may be considered a wicked real problem; 6% answered "NO"; and 4.9% mentioned it is a problem in some places (Figure 22). Approximately half of the fishers interviewed (53.6%) shared that they think that this problem has increased over the last 10 years, while for approximately a third (30.7%) said that they think the problem of ALDFG has decreased, and 12.9% of fishers shared that they do not think any change has occurred, with the ALDFG issue being the same over the last 10 years. 35.3% of fishers answered that they think the issue of ALDFG will remain the same over the next five years, 35.3% answered that they think ALDFG will decrease over the next five years, and 43.9% of the fishers shared that they think the problem of ALDFG and plastic in the oceans will increase over the next five years. A proximate number of interviewed fishers held different opinions on the magnitude of ALDFG, with one group indicating it would increase (38.2%) and the other indicating it would decrease (37.3%). Additionally, 25.5% indicated that the problem of ALDFG and plastic in the oceans will remain unchanged over the next 5 years.



Do you think ALDFG and plastics at sea are a real problem?

Responses by gear (%; excl. Don't know)

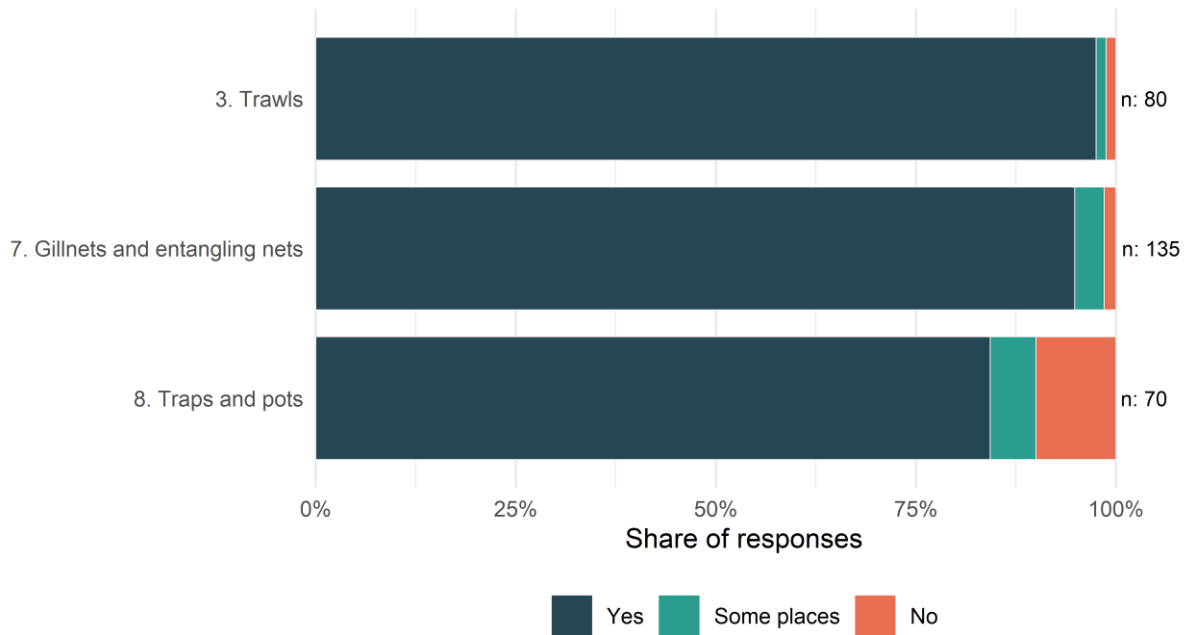


Figure 22. Fishers' responses to ALDFG and plastic pollution in the oceans.

The importance of measures

The survey sought to understand how fishers evaluate the importance of different measures to help prevent or reduce Abandoned, Lost, or otherwise Discarded Fishing Gear (ALDFG). Respondents were asked to rate the significance of factors such as gear design, marking, material quality, communication at sea, and training. The figures below illustrate the relative importance assigned to each element by gear type, offering insight into which practices are viewed as most critical for preventing gear loss and improving sustainability.

Fishers identified specific elements as important for preventing or reducing ALDFG levels. All elements, although in different levels of perception, were mentioned as an action "very important" or "important" to be taken. Only three elements were considered "not relevant": "fishing gear marking", "vessel design", and "accuracy and access to weather forecasting". all with different levels of perception. Still, "vessel design" was considered the least important factor for reducing ALDFG and plastic pollution; while "gear location technology the most important for the trawl fisheries (Figure 23); "communication between vessels" for the gillnet fisheries (Figure 24); and "quality of fishing gear materials" for the trap fisheries (Figure 25).



3. Trawls

Importance of measures to avoid/reduce ALDFG (Q8.4)

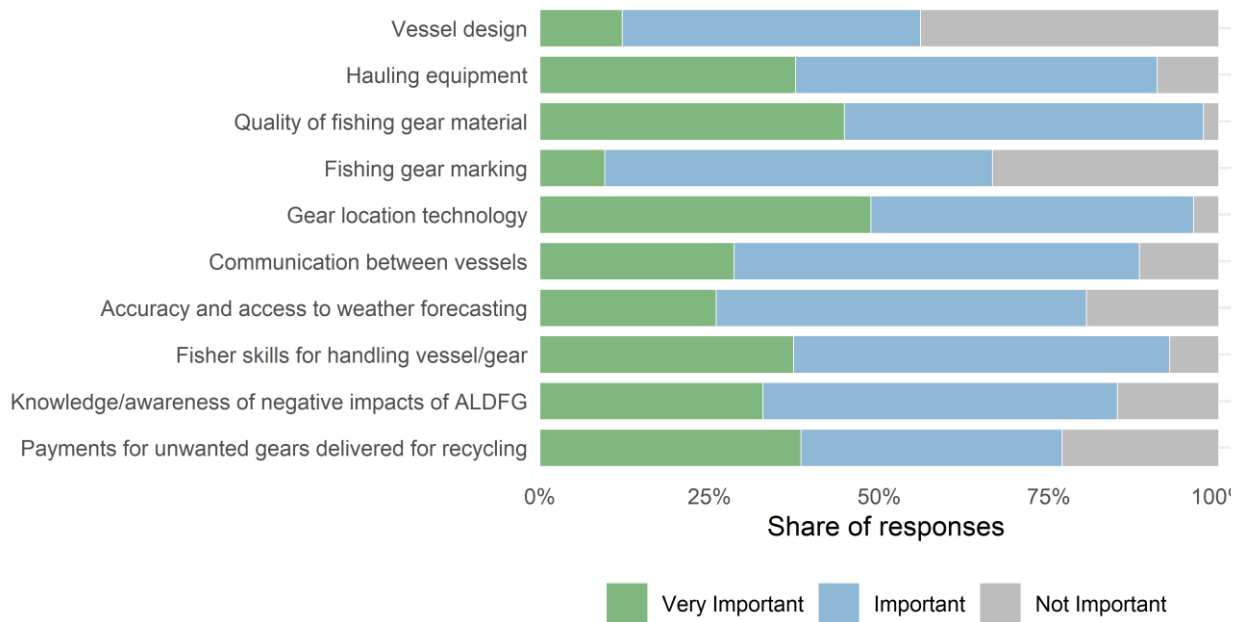


Figure 23. Trawl fishers' perception of the importance of measures to avoid/reduce ALDFG.

7. Gillnets and entangling nets

Importance of measures to avoid/reduce ALDFG (Q8.4)

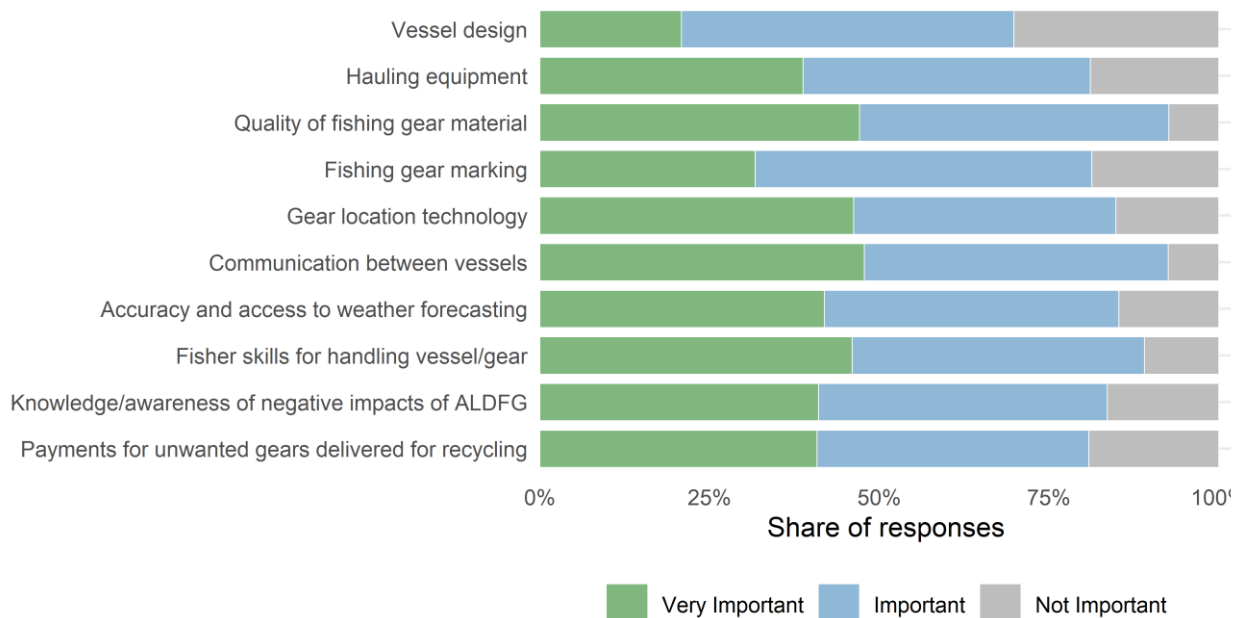


Figure 24. Gillnet fishers' perception of the importance of measures to avoid/reduce ALDFG.



8. Traps and pots

Importance of measures to avoid/reduce ALDFG (Q8.4)

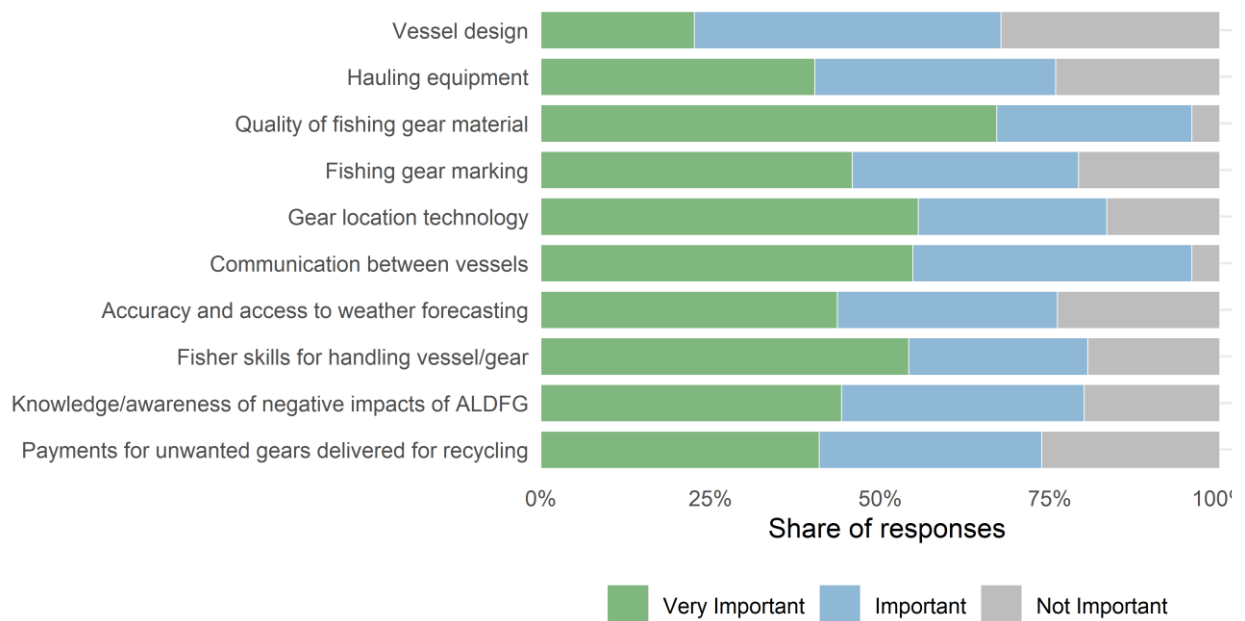


Figure 25. Trap fishers' perception of the importance of measures to avoid/reduce ALDFG.

Ideas, or examples of good practice

The last survey question allowed respondents to share thoughts, ideas, or experiences about ALDFG in their own words. These open-ended responses provided useful insights into local challenges and practical solutions from fishers' perspectives. The following summaries highlight the main themes for each gear type, based on common survey viewpoints.

Fishers operating trawls expressed mixed awareness of the ALDFG issue. Overall, comments suggest that practical awareness and infrastructure for handling old gear remain limited, and fishers would welcome better communication and port-based collection options. Nevertheless, several respondents provided short or negative replies ("No"), while others highlighted a lack of structured information or local coordination. Key points mentioned:

- ✓ Improve access to reliable information about ALDFG and its impacts.
- ✓ Increase communication within ports regarding lost equipment and how to report it.
- ✓ Establish suitable facilities for the disposal of old or damaged fishing materials.

Responses from gillnet fishers emphasized the importance of responsible handling and maintenance of gear. Although some gave brief answers, others noted the need for awareness campaigns and incentives for recycling damaged nets. These views show growing interest among gillnet users in taking practical steps to prevent ALDFG through collaboration and improved local systems. Main ideas included:

- ✓ Promote education and training on the prevention of gear loss.
- ✓ Provide clear port-based collection points for damaged or discarded nets.
- ✓ Encourage cooperative initiatives to repair or recycle fishing gear.

Respondents using traps and pots frequently mentioned the lack of suitable facilities for returning or recycling old traps. They recommended greater coordination with authorities to recover lost gear and to introduce incentive schemes to promote proper disposal. In summary, fishers recognize the issue but need clearer systems and support to manage traps responsibly and avoid unintentional loss. Highlighted themes are:

- ✓ Create organized recovery programs for lost traps.
- ✓ Develop recycling or buy-back systems for end-of-life gear.
- ✓ Provide training and awareness about ALDFG prevention and reporting mechanisms.

Discussion

During project implementation, it was consistently emphasized that the expected results should include knowledge partnerships focused on addressing issues related to Abandoned, Lost, or Otherwise Discarded Fishing Gear (ALDFG). This involves supporting Brazilian academic and research institutions in conducting FAO surveys to assess quantities, causes, and prevention measures for the three main types of fishing gear used in Brazil at the national level. Additionally, it includes engaging key national stakeholders to discuss the findings of FAO's ALDFG surveys and gear-modification studies aimed at reducing ghost fishing in small-scale lobster trap fisheries, such as representatives of fishers, researchers, fisheries authorities, and NGOs, to raise awareness of the scale and causes of ALDFG at the national level, as well as of available prevention and mitigation measures..

These actions should also enhance gear modification trials and obtain agreement and/or buy-in for the introduction of gear modifications as available technologies to mitigate the impacts of ALDFG ghost fishing, and the importance of sharing information with local communities about the impact of ghost fishing to upgrade equipment, reducing fishing gear loss, as higher-quality gear lessens environmental harm. It should be anticipated that technological improvements in fishing gear, as much as possible, using biodegradable materials in its construction, are feasible to boost the quality of fishing equipment and promote robust recycling initiatives.

Meanwhile, essential government actions such as lectures on preservation and responsibility – primarily focused on managing material and plastic waste – are necessary to better train and qualify people in this area. This should involve environmental education for fishers and in schools, training in boat maintenance, equipping coastal sites, encouraging the use of electronic equipment to better locate fishing gear, collaborating with fisher associations on marine waste, and promoting awareness at beaches and river areas. Although GPS is frequently used to position fishing gear, fishers must closely monitor sea conditions and weather forecasts before fishing, thoroughly understand their fishing areas, and use common sense when choosing fishing spots. Technicians must monitor the departures and arrivals of fishing boats to ensure compliance with environmental regulations. Constant monitoring is non-negotiable, and trawling practices should be immediately removed from coastal areas.

Awareness-raising programs for the public about marine trash and improvements to monitoring efforts are essential, as are campaigns that educate fishers about their responsibilities. Increasing awareness of environmental issues and the proper management of fishing waste to

prevent anything from being left in the sea should be a top priority. Additionally, a proactive approach is needed to conduct promotional work and raise awareness of best practices for handling fishing material waste, through responsive campaigns in fishing communities to foster understanding and commitment to environmental preservation. Everyone must be instructed to store waste properly to ensure its safe disposal onshore.

End-of-life management (EOLM) of fishing gear plays a crucial role in the transition of the fisheries sector toward a circular economy. As emphasized by FAO (2023) and Einarsson et al. (2025), effective EOLM systems are essential for retaining material value and preventing fishing gear from becoming waste or contributing to marine litter.

Key Components of Effective EOLM Systems

- ✓ **Dedicated Port Reception Facilities:** These facilities are established to enable the separate collection of end-of-life fishing gear (EOLFG) and recovered abandoned, lost, or otherwise discarded fishing gear (ALDFG). They are supported by logistics that facilitate sorting, cleaning, and recycling processes.
- ✓ **Design for Circularity:** To maximize circularity, fishing gears should be designed for ease of disassembly, minimize the diversity of polymers used, and include clear material labeling. Such design measures make it easier to recycle and repurpose gear materials, enhancing their value retention within the production cycle.
- ✓ **Financial Incentives:** Extended Producer Responsibility (EPR) schemes and other market-based instruments—such as deposit–refund or buy-back systems—can provide financial incentives for the recovery and recycling of fishing gear, encouraging stakeholders to participate actively in EOLM initiatives.

Recycling or reusing this fishing gear material is essential. Every fisherman must bring back the trash from their boat and any waste found in the ocean. Local fisher associations should promote the collection and recycling of materials. Everyone must be trained to store waste properly to ensure safe land disposal. Laws should be enacted to penalize littering in nature and encourage responsible waste management. Circular economy principles focus on recycling, reducing waste through better design, repair, and reuse. Implementing eco-design standards and traceability improves recyclability and keeps materials useful in production. Collaboration among stakeholders is key for developing sustainable end-of-life material systems.

Facilities at harbors or nearby sites for the collection and disposal of end-of-life fishing gear are widely recognized as one of the most important measures for maintaining a clean marine environment and preventing the accumulation of Abandoned, Lost, or Discarded Fishing Gear (ALDFG). Such infrastructure enables fishers to return damaged or obsolete gear safely and supports recycling, repair, or proper waste handling.

However, many ports and landing sites worldwide still lack accessible or dedicated facilities for gear disposal. The absence of these options often leads to informal or *ad hoc* disposal practices, increasing the risk that materials enter the marine environment. Availability depends not only on national policy but also on local waste-management capacity, the size of the fishing community, and the presence of circular-economy initiatives.

Final Remarks

It seems common sense that we must conduct ongoing research to ensure continuous improvements, particularly in small-scale fisheries along the Brazilian coast. The research is vital to ocean preservation, benefiting artisanal fishing and the fishers who depend on the ocean. It highlights the importance of collecting ALDFG and its harmful effects on marine life and fishing. This effort is crucial for reducing sea pollution and preserving vital fish species, offering tangible benefits to local fishers. The potential outcomes of this FAO project are promising.

The surveys conducted were thorough and covered a wide range of topics relevant to ALDFG management. However, their extensive length and the large number of questions posed a challenge. Many fishers found the surveys to be too time-consuming, which resulted in decreased willingness to participate fully. In some cases, respondents chose to withdraw after completing only the first interview. This behavior may reflect a general sense of distrust toward surveys that do not offer immediate, tangible benefits to participants.

To effectively assess the impacts of fishing activities and address the issue of marine pollution, it is essential that surveys distinguish between artisanal and industrial fishing operations. Identifying whether fishers operate on artisanal or industrial vessels is strongly recommended. This distinction is important because the environmental impacts associated with each type of fishery are not proportional, and analyzing their data collectively may lead to misinterpretation of the results. By separating data based on the type of fishing activity, researchers and policymakers can achieve a clearer understanding of each sector's unique contributions and challenges regarding pollution and ALDFG management.

Although Brazil has not established specific national regulations to implement the FAO Voluntary Guidelines on the Marking of Fishing Gear (VGMFG), there is a general awareness of gear marking requirements among stakeholders. In practice, marking of fishing gear is a common procedure, which plays a significant role in enabling the identification of fishing gear in cases where it becomes lost. This practice supports traceability and accountability within the sector, even in the absence of formalized internal regulations.

Acknowledgements

We would like to thank all 315 respondents, fishers who recognized the importance of the ALDFG project.

We would also like to thank the 18 researchers who accepted our invitation to conduct fieldwork activities.

Additionally, we would like to thank the FAO Global ALDFG Survey Team for providing guidance on project coordination for implementing and analyzing the methodology.

Finally, we would like to thank the FAO and IMO for financing the project implementation in Brazil, supported by the Government of Norway, through NORAD.

References

Einarsson, S. et al. (2025). The Circular Economy of Fishing Gear in Nordic Fisheries. Nordic Council of Ministers, TemaNord 2025:544. <https://doi.org/10.6027/temanord2025-544>

FAO (2023). Fishing Gear Recycling Technologies and Practices. Rome, FAO. <https://openknowledge.fao.org/handle/20.500.14283/cc8317en>

FAO. 1993. Report of the Expert Consultation on the Marking of Fishing Gear. FAO Fisheries Report No. 485. Rome. <https://openknowledge.fao.org/handle/20.500.14283/ca3546t>

He, P. & Lansley, J. 2023. Voluntary Guidelines on the Marking of Fishing Gear – A framework for conducting a risk assessment for a system on the marking of fishing gear (Suppl. 1). Rome, FAO. <https://doi.org/10.4060/cc4084en>

Einarsson, H., He, P. & Lansley, J. 2023. Voluntary Guidelines on the Marking of Fishing Gear – Manual for the Marking of Fishing Gear (Suppl. 2). Rome, FAO. <https://doi.org/10.4060/cc4251en>